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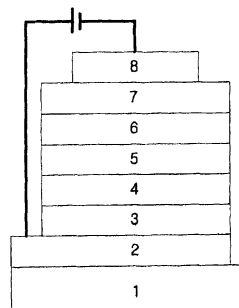
权利要求书 10 页 说明书 165 页 附图 1 页

[54] 发明名称

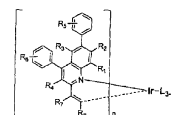
新的电致发光化合物及使用该化合物的电致发光装置

[57] 摘要

本发明涉及表现出高发光效率的新的有机电致发光化合物，以及含有该化合物的有机电致发光装置。根据本发明的有机电致发光化合物由化学式(1)表示。

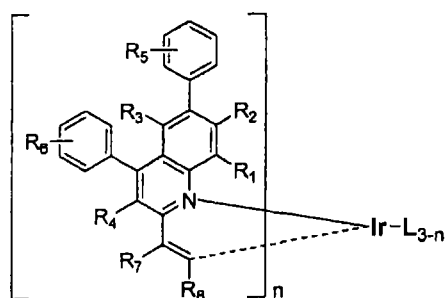


化学式 (1)



1、一种化学式(1)表示的有机电致发光化合物:

化学式(1)



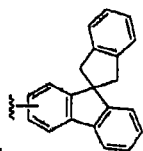
其中, L 是有机配体;

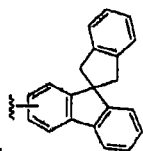
$R_1$  到  $R_4$  独立地表示氢、(C1-C60)烷基、(C1-C60)烷氧基、(C3-C60)环烷基、卤素、三(C1-C60)烷基甲硅烷基或三(C6-C60)芳基甲硅烷基;

$R_5$  表示氢、(C1-C60)烷基、卤素、或(C6-C60)芳基;

$R_6$  和  $R_7$  独立地表示氢、具有或不具有卤素取代基的(C1-C60)烷基、(C6-C60)芳基、卤素、氰基、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)烷氧基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、二(C1-C60)烷基氨基或二(C6-C60)芳氨基, 或者  $R_6$  和  $R_7$  可以经由具有或不具有稠环的(C3-C12)亚烷基或(C3-C12)亚烯基连接形成脂环、或者单或多环芳环;

$R_6$  和  $R_7$  中的烷基或芳基, 或者它们经由 (C3-C12)亚烷基或(C3-C12)亚烯基连接而成的脂环、或者单环或多环芳环, 可以进一步被一个或多个取代基所取代, 所述取代基选自具有或不具有卤素取代基的(C1-C60)烷基、卤素、氰基、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)烷氧基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、二(C1-C60)烷基氨基、二(C6-C60)芳基氨基、苯

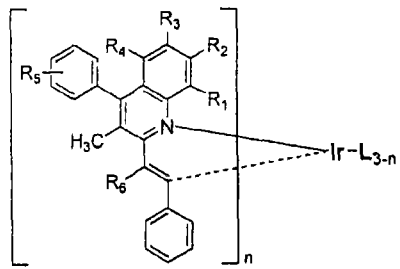


基、萘基、蒽基、芴基、螺二芴基和 ; 并且

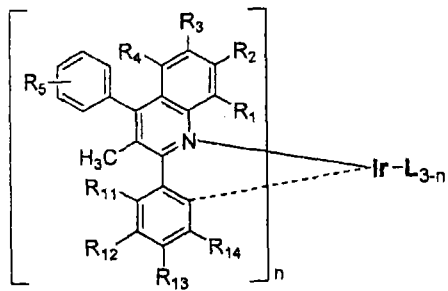
$n$  为 1 至 3 的整数。

2、根据权利要求 1 的有机电致发光化合物, 其选自化学式(2)至(7)之一表示的化合物:

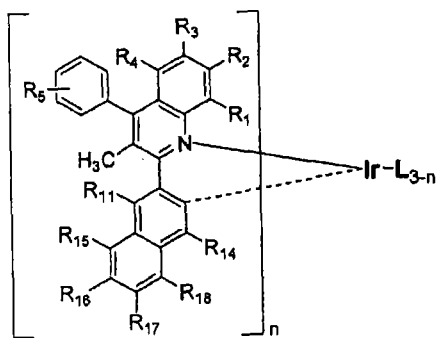
化学式2



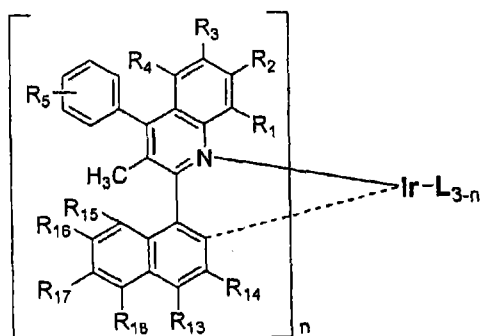
化学式3



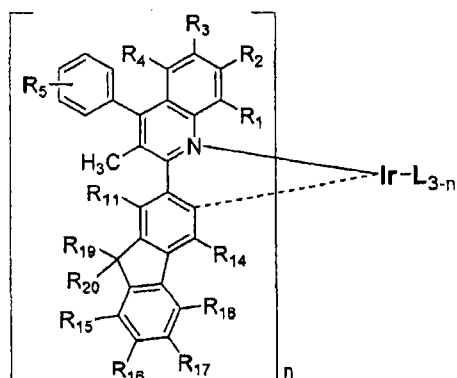
化学式4



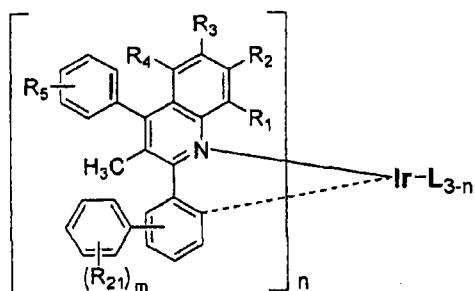
化学式5



化学式6

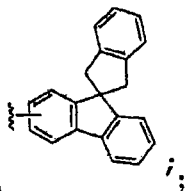


化学式 7



其中, L、R<sub>1</sub>、R<sub>2</sub>、R<sub>3</sub>、R<sub>4</sub>、R<sub>5</sub>、R<sub>6</sub>和n定义同权利要求1化学式(1)；

R<sub>11</sub>至R<sub>18</sub>独立地表示氢、(C1-C60)烷基、卤素、氰基、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)烷氧基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、二(C1-C6)烷基氨基、二(C6-C60)芳氨基、苯基、萘基、蒽基、苈基、



螺二苈基或

螺二苈基或  $i$ ；  
R<sub>11</sub>至R<sub>13</sub>中的烷基、苯基、萘基、蒽基或苈基可以进一步被一个或多个取代基取代，所述取代基选自具有或不具有卤素取代基的(C1-C60)烷基、(C1-C60)烷氧基、卤素、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、二(C1-C60)烷基氨基、二(C6-C60)芳氨基和(C6-C60)芳基；

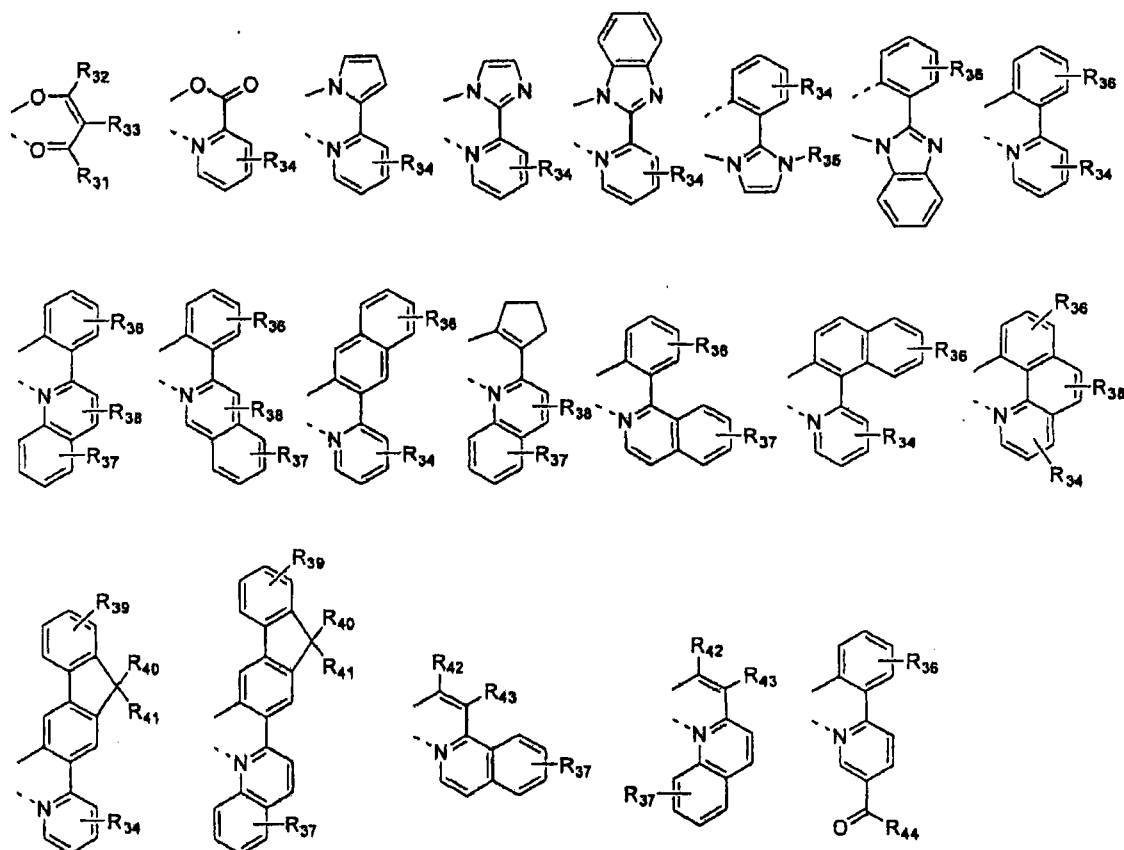
R<sub>19</sub>至R<sub>20</sub>独立地表示氢、(C1-C60)烷基或(C6-C60)芳基，或者R<sub>19</sub>至R<sub>20</sub>经由具有或不具有稠环的(C3-C12)亚烷基或(C3-C12)亚烯基连接形成脂环、或者单或多环芳环；

R<sub>21</sub>表示(C1-C60)烷基、卤素、氰基、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)烷氧基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、苯基、

二(C1-C60)烷基氨基、二(C6-C60)芳氨基、萘基、9,9-二(C1-C60)烷基苄基或者9,9-二(C6-C60)芳基苄基；并且

m 为 1 至 5 的整数。

3、根据权利要求 1 的有机电致发光化合物，其中配体 (L) 具有下述化学式之一表示的结构：



其中， $R_{31}$  和  $R_{32}$  独立地表示氢、具有或不具有卤素取代基的(C1-C60)烷基、具有或不具有(C1-C60)烷基取代基的苯基、或者卤素；

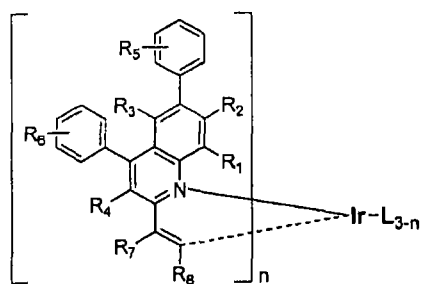
$R_{33}$  至  $R_{39}$  独立地表示氢、(C1-C60)烷基、具有或不具有(C1-C60)烷基取代基的苯基、三(C1-C60)烷基甲硅烷基或者卤素；

$R_{40}$  至  $R_{43}$  独立地表示氢、(C1-C60)烷基、具有或不具有(C1-C60)烷基取代基的苯基；和

$R_{44}$  表示(C1-C60)烷基、具有或不具有(C1-C60)烷基取代基的苯基，或者卤素。

4、一种有机电致发光装置，其由第一电极；第二电极；和至少一个插入第一电极和第二电极之间的有机层组成；其中有机层包括含有化学式 (1) 表示的

有机电致发光化合物的电致发光区域:



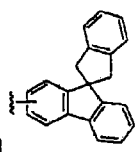
其中, L 是有机配体;

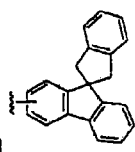
$R_1$  到  $R_4$  独立地表示氢、(C1-C60)烷基、(C1-C60)烷氧基、(C3-C60)环烷基、卤素、三(C1-C60)烷基甲硅烷基或三(C6-C60)芳基甲硅烷基;

$R_5$  表示氢、(C1-C60)烷基、卤素、或(C6-C60)芳基;

$R_6$  和  $R_7$  独立地表示氢、具有或不具有卤素取代基的(C1-C60)烷基、(C6-C60)芳基、卤素、氰基、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)烷氧基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、二(C1-C60)烷基氨基或二(C6-C60)芳氨基, 或者  $R_6$  和  $R_7$  可以经由具有或不具有稠环的(C3-C12)亚烷基或(C3-C12)亚烯基连接形成脂环、或者单或多环芳环;

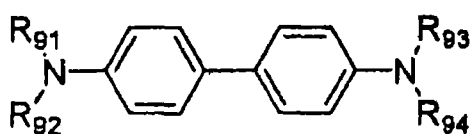
$R_6$  和  $R_7$  中的烷基或芳基, 或者它们经由 (C3-C12)亚烷基或(C3-C12)亚烯基连接而成的脂环、或者单环或多环芳环, 可以进一步被一个或多个取代基所取代, 所述取代基选自具有或不具有卤素取代基的(C1-C60)烷基、卤素、氰基、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)烷氧基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、二(C1-C60)烷基氨基、二(C6-C60)芳氨基、苯



基、萘基、蒽基、芴基、螺二芴基和 ; 并且

$n$  为 1 至 3 的整数, 以及一个或多个基质, 所述基质选自 1,3,5-三吡唑基苯、聚乙烯基吡唑、*m*-双吡唑苯基、4,4',4''-三(N-吡唑基)三苯胺、1,3,5-三(2-吡唑基)苯、1,3,5-三(2-吡唑基-5-甲基苯基)苯、双(4-吡唑基苯基)硅烷和选自化学式 (8) 至 (11) 之一表示的化合物的一种或多种基质其:

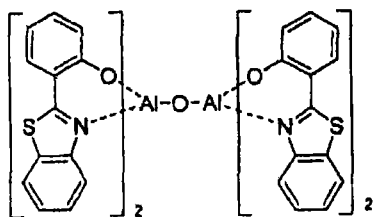
化学式 8



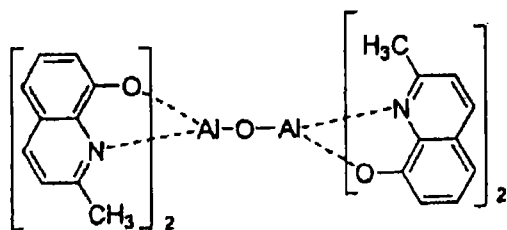
在化学式(8)中,  $R_{91}$  至  $R_{94}$  独立地表示氢、卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C1-C60)烷氧基、(C1-C60)烷硫基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、羧基、硝基或者羟基, 或者  $R_{91}$  至  $R_{94}$  中的每一个可以经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基与相邻取代基连接形成脂环、或单环或多环芳环;

$R_{91}$  至  $R_{94}$  的烷基、烯基、炔基、环烷基、杂环烷基、芳基、杂芳基、芳基甲硅烷基、烷基甲硅烷基、烷基氨基、或者芳基氨基, 或者由两个相邻取代基经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基连接形成的脂环、或者单环或多环芳环, 可以进一步被一个或多个取代基取代, 所述取代基选自卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C1-C60)烷氧基、(C1-C60)烷硫基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、羧基、硝基或者羟基。

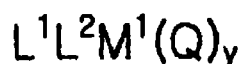
化学式 9



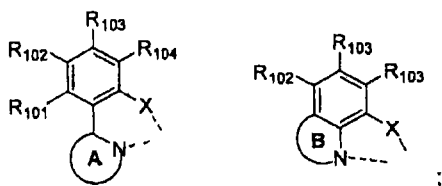
化学式 10



化学式 11



在化学式 (11) 中, 配体,  $L_1$  和  $L_2$  独立地选自以下结构:



$M^1$  是二价或三价金属;

当  $M^1$  是二价金属时  $y$  是 0, 而当  $M^1$  是三价金属时  $y$  是 1;

$Q$  表示(C6-C60)芳氧基或三(C6-C60)芳基甲硅烷基, 且  $Q$  的芳氧基和三芳基甲硅烷基可以进一步被(C1-C60)烷基或者(C6-C60)芳基取代;

$X$  表示 O、S 或 Se;

环 A 表示噁唑、噻唑、咪唑、噁二唑、噻二唑、苯并噁唑、苯并噻唑、苯并咪唑、吡啶或喹啉;

环 B 表示吡啶或喹啉, 并且环 B 可以进一步被(C1-C60)烷基、或者具有或不具有(C1-C60)烷基取代基的苯基或萘基取代;

$R_{101}$  至  $R_{104}$  独立地表示氢、卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C1-C60)烷氧基、(C1-C60)烷硫基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、羧基、硝基或者羟基, 或者  $R_{101}$  至  $R_{104}$  中的每一个可以经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基与相邻取代基连接形成脂环、或单环或多环芳环; 并且吡啶或喹

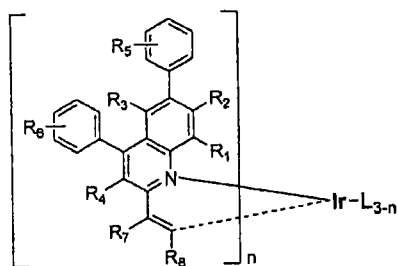


啉可以与  $R_{101}$  一起形成化学键从而形成稠环；

环 A、 $R_{101}$  至  $R_{104}$  的烷基、烯基、炔基、环烷基、杂环烷基、芳基、杂芳基、芳基甲硅烷基、烷基甲硅烷基、烷基氨基、或者芳基氨基，或者由两个相邻取代基经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基连接形成的脂环、或者单环或多环芳环，可以进一步被一个或多个取代基取代，所述取代基选自卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C1-C60)烷氧基、(C1-C60)烷硫基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、羧基、硝基或者羟基。

5、根据权利要求 4 的有机电致发光装置，其中有机层包括一种或多种选自芳胺化合物和苯乙烯基芳胺化合物的化合物，或者一种或多种金属，所述金属选自 1 族、2 族有机金属、第 4 周期和第 5 周期的过渡金属、镧系金属和 d-过渡金属。

6、根据权利要求 4 的有机电致发光装置，其为一种含有化学式 (1) 表示的有机电致发光化合物的有机显示器：



其中，L 是有机配体；

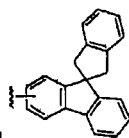
$R_1$  到  $R_4$  独立地表示氢、(C1-C60)烷基、(C1-C60)烷氧基、(C3-C60)环烷基、卤素、三(C1-C60)烷基甲硅烷基或三(C6-C60)芳基甲硅烷基；

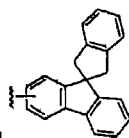
$R_5$  表示氢、(C1-C60)烷基、卤素、或(C6-C60)芳基；

$R_6$  和  $R_7$  独立地表示氢、具有或不具有卤素取代基的(C1-C60)烷基、(C6-C60)芳基、卤素、氰基、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)烷氧基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、二(C1-C60)烷基氨基或二

(C6-C60)芳氨基, 或者  $R_6$  和  $R_7$  可以经由具有或不具有稠环的(C3-C12)亚烷基或(C3-C12)亚烯基连接形成脂环、或者单或多环芳环;

$R_6$  和  $R_7$  中的烷基或芳基, 或者通过经由 (C3-C12)亚烷基或(C3-C12)亚烯基连接而成的脂环、或者单环或多环芳环, 可以进一步被一个或多个取代基所取代, 所述取代基选自具有或不具有卤素取代基的(C1-C60)烷基、卤素、氰基、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)烷氧基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、二(C1-C60)烷基氨基、二(C6-C60)芳基氨基、苯



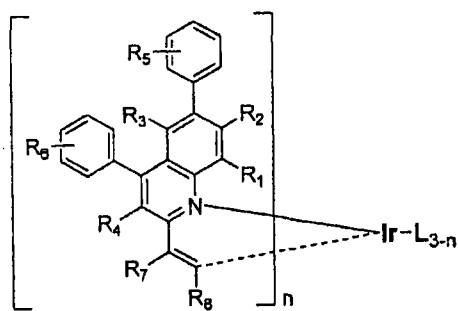
基、萘基、蒽基、芴基、螺二芴基和 ; 并且

$n$  为 1 至 3 的整数, 且化合物同时具有蓝或绿波长的电致发光峰值。

7、根据权利要求 4 的有机电致发光装置, 其中有机层包括电致发光层和电荷生成层。

8、根据权利要求 4 的有机电致发光装置, 其中在电极对中的一个或两个电极的内表面上放置还原掺杂剂和有机物质的混合层或者氧化掺杂剂和有机物质的混合区域。

9、一种有机太阳能电池, 其包括一种电致发光化合物, 所述电致发光化合物包括化学式 (1) 表示的有机电致发光化合物:



其中,  $L$  是有机配体;

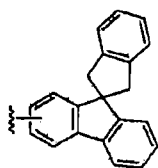
$R_1$  到  $R_4$  独立地表示氢、(C1-C60)烷基、(C1-C60)烷氧基、(C3-C60)环烷基、卤素、三(C1-C60)烷基甲硅烷基或三(C6-C60)芳基甲硅烷基;

$R_5$  表示氢、(C1-C60)烷基、卤素、或(C6-C60)芳基;

$R_6$  和  $R_7$  独立地表示氢、具有或不具有卤素取代基的(C1-C60)烷基、(C6-C60)芳基、卤素、氰基、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)烷氧基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、二(C1-C60)烷基氨基或二

(C6-C60)芳氨基, 或者  $R_6$  和  $R_7$  可以经由具有或不具有稠环的(C3-C12)亚烷基或(C3-C12)亚烯基连接形成脂环、或者单或多环芳环;

$R_6$  和  $R_7$  中的烷基或芳基, 或者它们经由 (C3-C12)亚烷基或(C3-C12)亚烯基连接而成的脂环、或者单环或多环芳环, 可以进一步被一个或多个取代基所取代, 所述取代基选自具有或不具有卤素取代基的(C1-C60)烷基、卤素、氰基、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)烷氧基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、二(C1-C60)烷基氨基、二(C6-C60)芳基氨基、苯



基、萘基、蒽基、苈基、螺二苈基和  $i$ ; 并且  $n$  为 1 至 3 的整数。

## 新的电致发光化合物及使用该化合物的电致发光装置

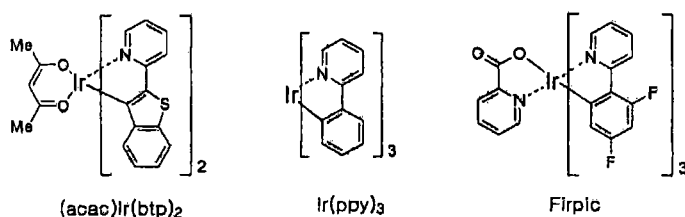
技术领域

本发明涉及表现出高发光效率的新的电致发光化合物，以及含有该化合物的有机电致发光装置和有机太阳能电池。

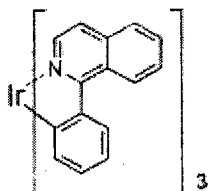
发明背景

决定 OLED（有机发光二极管）发光效率的重要因素是电致发光材料的类型。虽然至今荧光材料已被广泛地用作电致发光材料，但是考虑到电致发光机制，磷光材料的研发是在理论上将发光效率提高至四（4）倍的最好方法之一。

迄今为止，普遍已知铱(III)配合物作为磷光材料，包括(acac)Ir(btp)<sub>2</sub>、Ir(ppy)<sub>3</sub>和 Firpic，分别为红色、绿色和蓝色磷光材料。特别是，最近日本、欧洲和美国已经研究了许多磷光材料。



在常规红色磷光材料中，个别材料已被报告具有好的 EL（电致发光）性质。然而，它们之中很少有材料已达到商品化水平。作为最优选的材料，可能提到 1-苯基异喹啉的铱配合物，已知其具有优秀的 EL 性质并表现出具有高发光效率的暗红色纯度。[参见 A. Tsuboyama 等，美国化学协会通讯 (J. Am. Chem. Soc.) 2003, 125(42), 12971-12979.]



1-苯基异喹啉

而且，红色材料，没有明显的使用寿命的问题，如果它们具有良好的色纯

度或发光效率的话具有易于商业化的倾向。因此，由于其优异的色纯度和发光效率，上述铱配合物是一种具有显著商业化能力的材料。

然而，铱配合物仍然被看作是一种仅适用于小显示器的材料，而对于中或大型的 OLED 面板实际上需要比已知材料更高的 EL 性质水平。

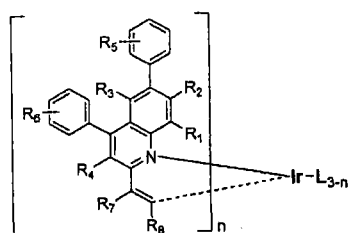
### 发明内容

为了克服上述传统技术中的问题，本发明发明人经过深入细致地努力，现已研究开发了新的有机电致发光化合物从而获得具有优秀的发光效率和以外提高的使用寿命的有机 EL 装置。最后，发明人发现当铱配合物作为电致发光装置的掺杂剂时改善了发光效率和寿命性质，所述铱配合物通过在主要配体化合物的喹啉 3-位上引入甲基以及同时在 4-位上引入苯基衍生物，并完成本发明。因此，本发明的目的是提供新的有机电致发光化合物，其具有使化合物具有比传统红色磷光材料更优异的性质的骨架。本发明的另一个目的是提供一种新的有机电致发光化合物，其适用于中或大型 OLED 面板。

本发明的再一个目的是提供一种含有新有机电致发光化合物的有机电致发光装置和有机太阳能电池。

因此，本发明涉及新的有机电致发光化合物和含有该化合物的有机电致发光装置。特别是，根据本发明的有机电致发光化合物特征在于其用化学式 (1) 表示：

化学式 (1)



其中，L 是有机配体；

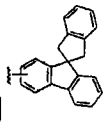
R<sub>1</sub> 到 R<sub>4</sub> 独立地表示氢、(C1-C60)烷基、(C1-C60)烷氧基、(C3-C60)环烷基、卤素、三(C1-C60)烷基甲硅烷基或三(C6-C60)芳基甲硅烷基；

R<sub>5</sub> 表示氢、(C1-C60)烷基、卤素、或(C6-C60)芳基；

R<sub>6</sub> 和 R<sub>7</sub> 独立地表示氢、具有或不具有卤素取代基的(C1-C60)烷基、(C6-C60)芳基、卤素、氰基、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)

烷氧基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、二(C1-C60)烷基氨基、或二(C6-C60)芳氨基，或者  $R_6$  和  $R_7$  可以经由具有或不具有稠环的(C3-C12)亚烷基或(C3-C12)亚烯基连接形成脂环、或者单或多环芳环；

$R_6$  和  $R_7$  中的烷基或芳基，或者通过经由 (C3-C12)亚烷基或(C3-C12)亚烯基连接而成的脂环、或者单环或多环芳环，可以进一步被一个或多个取代基所取代，所述取代基选自具有或不具有卤素取代基的(C1-C60)烷基、卤素、氰基、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)烷氧基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、二(C1-C60)烷基氨基、二(C6-C60)芳基氨基、苯

基、萘基、蒽基、芴基、螺二芴基和 ; 并且  $n$  为 1 至 3 的整数。

### 附图简述

图 1 是 OLED 的剖视图。

### 发明详述

现在引用附图，图 1 图解说明了一个 OLED 的剖视图，其含有一个玻璃 1、透明电极 2、空穴注入层 3、空穴传输层 4、电致发光层 5、电子传输层 6、电子注入层 7 和 Al 阴极 8。

这里描述的术语“烷基”和任何含有“烷基”部分的取代基包括直链和支链类型。

这里描述的术语“芳基”表示芳烃去掉一个氢原子后获得的有机基团。各个环包括含有 4 至 7 个，优选 5 至 6 个环原子的单环系或稠环系。具体的实例包括苯基、萘基、联苯基、蒽基、茛基、芴基、菲基、苯并菲基 (triphenylenyl)、芘基、茈基、屈基、并四苯基 (naphthacenyl) 和荧蒽基 (fluoranthenyl)，但不限于此。

这里描述的术语“杂芳基”表示含有 1 至 4 个选自 N、O 和 S 的作为芳环主链原子的杂原子且剩余芳环主链原子为碳原子的芳基。杂芳基可以是 5-或 6-元单环杂芳基或与一个或多个苯环稠和的多环杂芳基，并且其可以是部分饱和。杂芳基可以包括二价芳基，其中杂原子可以被氧化或季铵化形成 N-氧化物和季

铵盐。具体实例包括,单环杂芳基例如呋喃基、苯硫基(thiophenyl)、吡咯基、咪唑基、吡唑基、噻唑基、噻二唑基、异噻唑基、异噁唑基、噁唑基、噁二唑基、三嗪基、四嗪基、三唑基(triazolyl)、四唑基、呋咱基、吡啶基、吡嗪基、嘧啶基、哒嗪基;多环杂芳基例如苯并呋喃基、苯并苯硫基(benzothiophenyl)、异苯并呋喃基、苯并咪唑基、苯并噻唑基、苯并异噻唑基、苯并异噁唑基、苯并噁唑基、异氮茛基(isoindolyl)、吲哚基、吲唑基、苯并噻二唑基、喹啉基、异喹啉基、噌啉基(cinnoliny)、喹唑啉基、喹喔啉基、咔唑基、菲啶基和苯并间二氧杂环戊烯基(benzodioxolyl);和相应的N-氧化物(吡啶基N-氧化物、喹啉基N-氧化物)及其季铵盐;但不仅限于此。

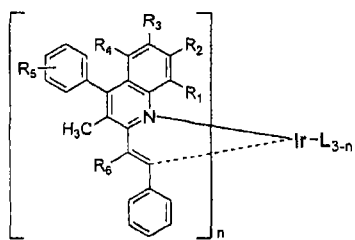
化学式(1)的萘基可以是1-萘基或者2-萘基;蒽基可以是1-蒽基、2-蒽基或9-蒽基;和苧基可以是1-苧基、2-苧基、3-苧基、4-苧基或9-苧基。

这里描述的包括“(C1-C60)烷基”部分的取代基可以含有1至60个碳原子、1至20个碳原子、或者1至10个碳原子。包括“(C6-C60)芳基”部分的取代基可以含有6至60个碳原子、6至20个碳原子、或者6至12个碳原子。包括“(C3-C60)杂芳基”部分的取代基可以含有3至60个碳原子、4至20个碳原子、或4至12个碳原子。包括“(C3-C60)环烷基”部分的取代基可以含有3至60个碳原子、3至20个碳原子、或3至7个碳原子。包括“(C2-C60)烯基或炔基”部分的取代基可以含有2至60个碳原子、2至20个碳原子、或2至10个碳原子。

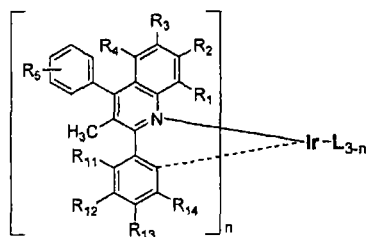
在化学式(1)表示的化合物中, $R_6$ 和 $R_7$ 通过经由(C3-C12)亚烷基或(C3-C12)亚烯基连接形成的脂环、或者单环或多环芳环,可以是苯、萘、蒽、苧、茛或菲。化学式(1)中方括号( $\square$ )内的化合物作为铱的主要配体,L作为辅助配体。根据本发明的有机电致发光化合物还可以包括主要配体:辅助配体=2:1( $n=2$ )的配合物和主要配体:辅助配体=1:2( $n=1$ )的配合物,以及不含有辅助配体(L)( $n=3$ )的三螯合配合物。

根据本发明的有机电致发光化合物可以例举为化学式(2)至(7)之一表示的化合物:

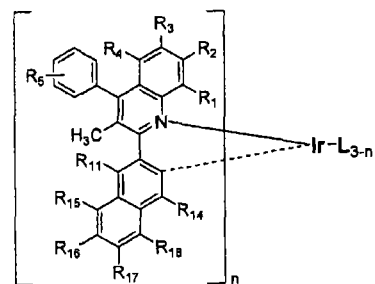
化学式2



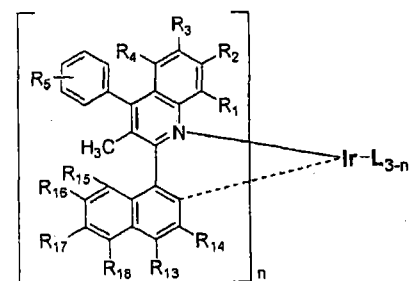
化学式 3



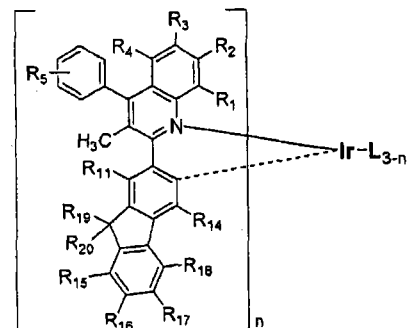
化学式 4



化学式 5

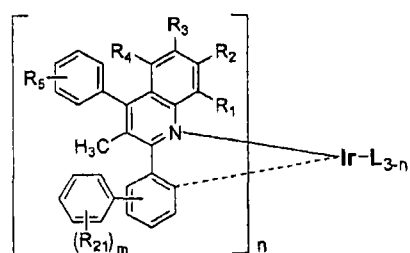


化学式 6



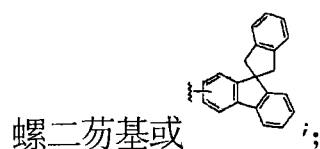
化学式 7





其中, L、R<sub>1</sub>、R<sub>2</sub>、R<sub>3</sub>、R<sub>4</sub>、R<sub>5</sub>、R<sub>6</sub>和n如化学式(1)所定义;

R<sub>11</sub>至R<sub>18</sub>独立地表示氢、(C1-C60)烷基、卤素、氰基、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)烷氧基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、二(C1-C6)烷基氨基、二(C6-C60)芳氨基、苯基、萘基、蒽基、苝基、



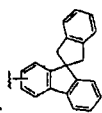
R<sub>11</sub>至R<sub>18</sub>中的烷基、苯基、萘基、蒽基或苝基可以进一步被一个或多个取代基取代,所述取代基选自具有或不具有卤素取代基的(C1-C60)烷基、(C1-C60)烷氧基、卤素、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、二(C1-C60)烷基氨基、二(C6-C60)芳氨基和(C6-C60)芳基;

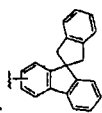
R<sub>19</sub>至R<sub>20</sub>独立地表示氢、(C1-C60)烷基或(C6-C60)芳基,或者R<sub>19</sub>至R<sub>20</sub>经由具有或不具有稠环的(C3-C12)亚烷基或(C3-C12)亚烯基连接形成脂环、或者单或多环芳环;

R<sub>21</sub>表示(C1-C60)烷基、卤素、氰基、三(C1-C60)烷基甲硅烷基、三(C6-C60)芳基甲硅烷基、(C1-C60)烷氧基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、苯基、二(C1-C6)烷基氨基、二(C6-C60)芳氨基、萘基、9,9-二(C1-C60)烷基苝基或者9,9-二(C6-C60)芳基苝基;并且

m为1至5的整数。

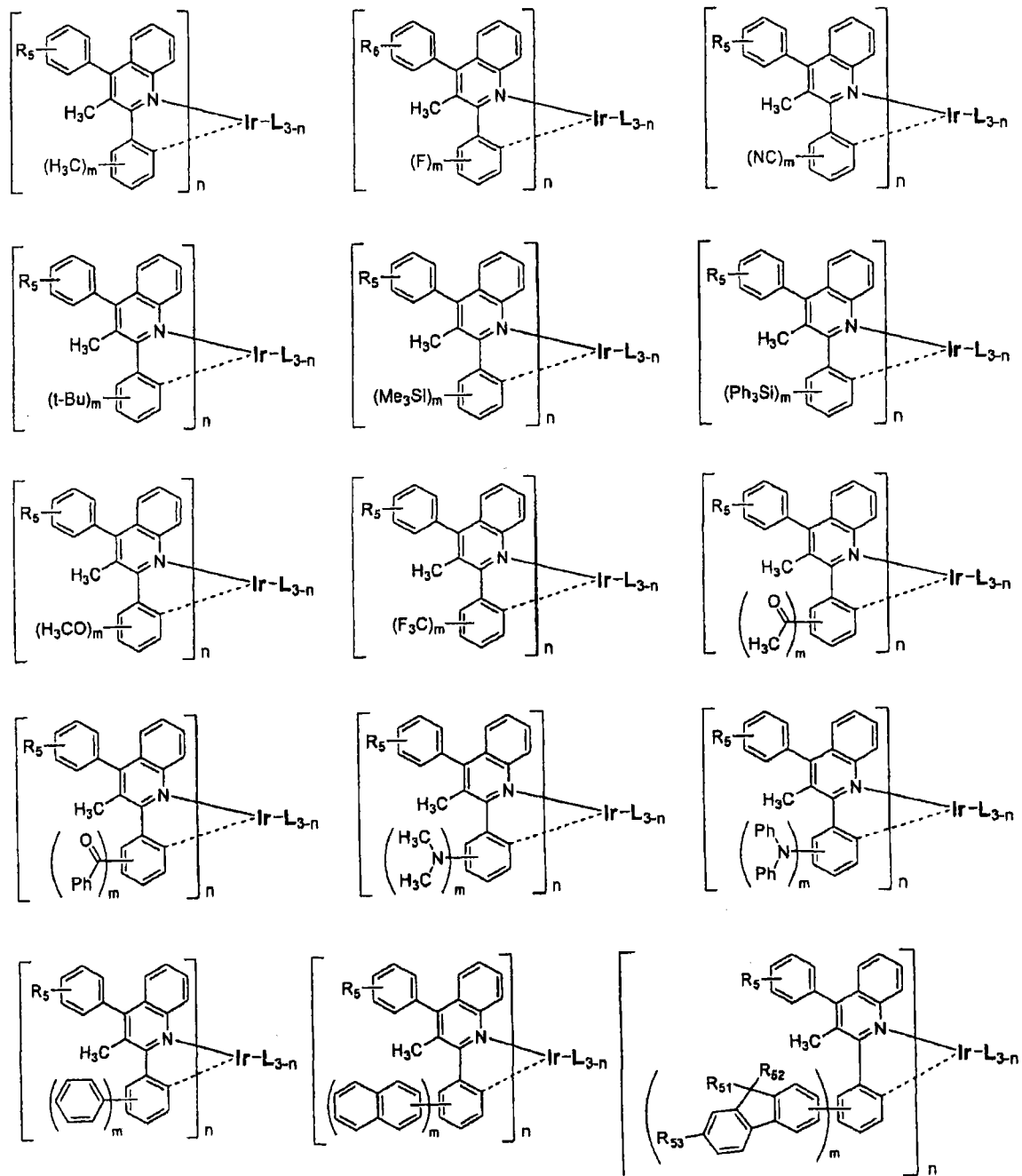
R<sub>11</sub>至R<sub>18</sub>可以独立地表示氢、甲基、乙基、正丙基、异丙基、正丁基、异丁基、叔丁基、正戊基、异戊基、正己基、正庚基、正辛基、2-乙基己基、正壬基、三氟甲基、氟、氰基、三甲基甲硅烷基、三丙基甲硅烷基、三(叔丁基)甲硅烷基、叔丁基二甲基甲硅烷基、三苯基甲硅烷基、甲氧基、乙氧基、丁氧基、甲基羰基、乙基羰基、叔丁基羰基、苯基羰基、二甲氨基、二苯氨基、苯基、

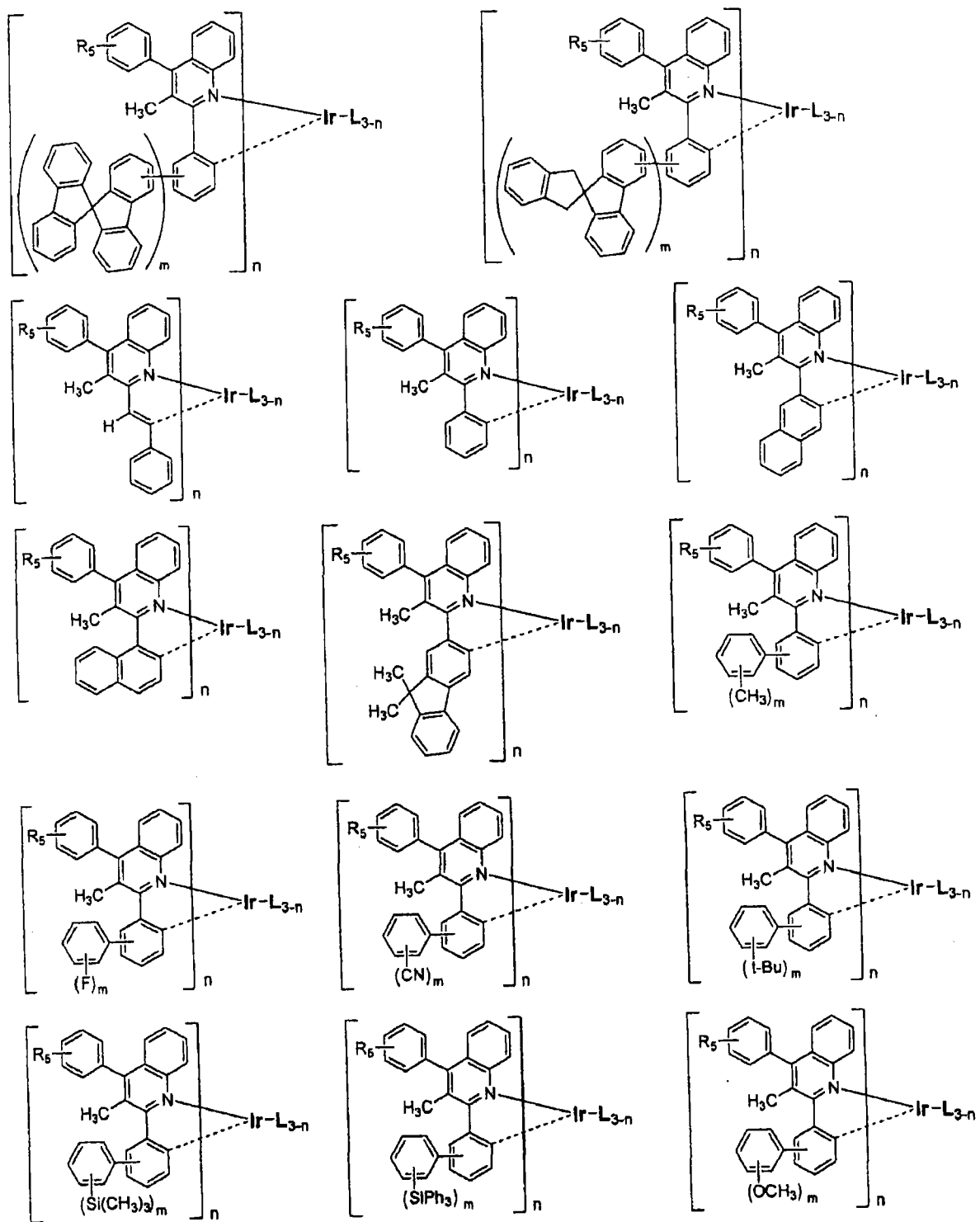


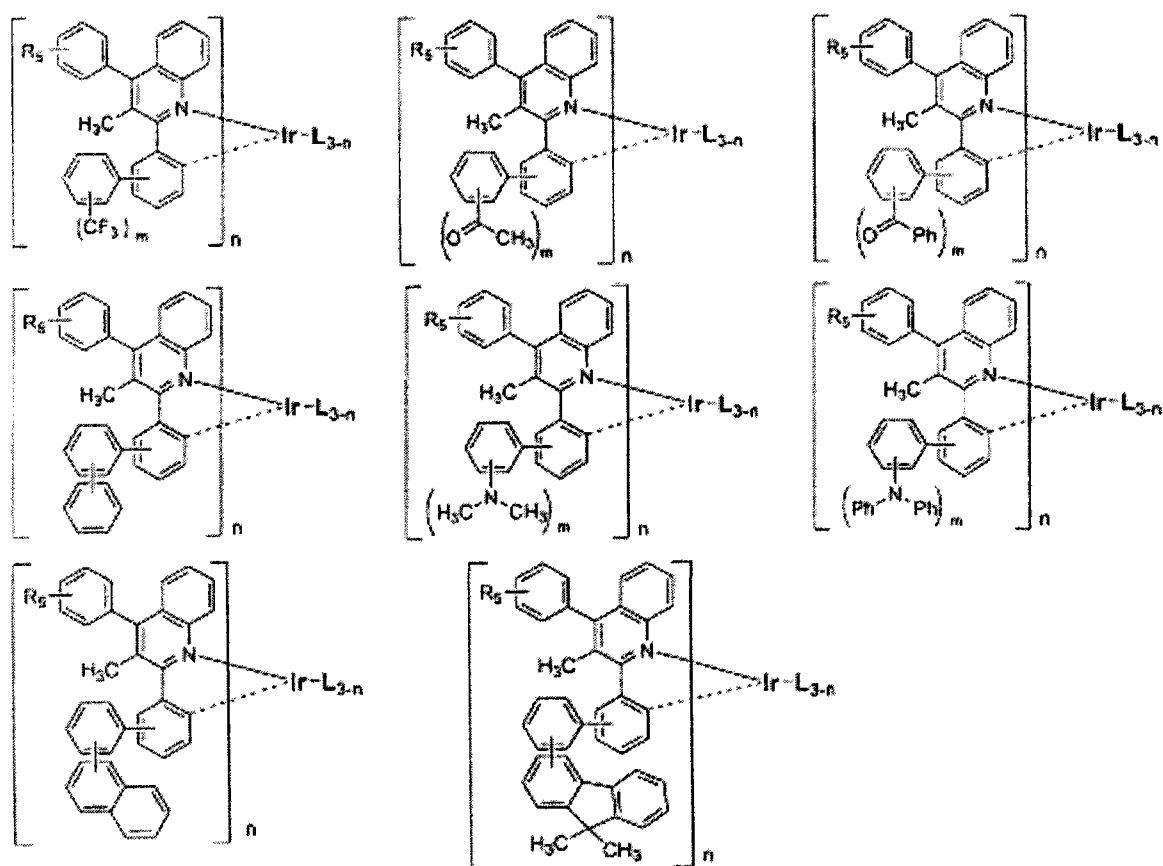
萘基、蒽基、芴基或者 ; 并且芴基可以进一步被甲基、乙基、正丙基、异丙基、正丁基、异丁基、叔丁基、正戊基、异戊基、正己基、正庚基、正辛基、2-乙基己基、正壬基、苯基、萘基、蒽基、三甲基甲硅烷基、三丙基甲硅烷基、三(叔丁基)甲硅烷基、叔丁基二甲基甲硅烷基或三苯基甲硅烷基取代。

优选地, 化学式(1)的  $R_1$  至  $R_4$  独立地表示氢、甲基、乙基、正丙基、异丙基、正丁基、异丁基、叔丁基、正戊基、异戊基、正己基、正庚基、正辛基、乙基己基、甲氧基、乙氧基、丁氧基、环丙基、环己基、环庚基、氟、三甲基甲硅烷基、三丙基甲硅烷基、三(叔丁基)甲硅烷基、叔丁基二甲基甲硅烷基或三苯基甲硅烷基; 且  $R_6$  表示氢、甲基、乙基、正丙基、异丙基、正丁基、异丁基、叔丁基、正戊基、异戊基、正己基、正庚基、正辛基、乙基己基、氟、苯基、萘基、蒽基、芴基或螺二芴基。

根据本发明的有机电致发光化合物可以特定地举例为下述化合物, 但不限于此:







其中，L 表示有机配体；

R<sub>5</sub> 表示氢、甲基、乙基、正丙基、异丙基、正丁基、异丁基、叔丁基、正戊基、异戊基、正己基、正庚基、正辛基、乙基己基、氟、苯基或萘基；

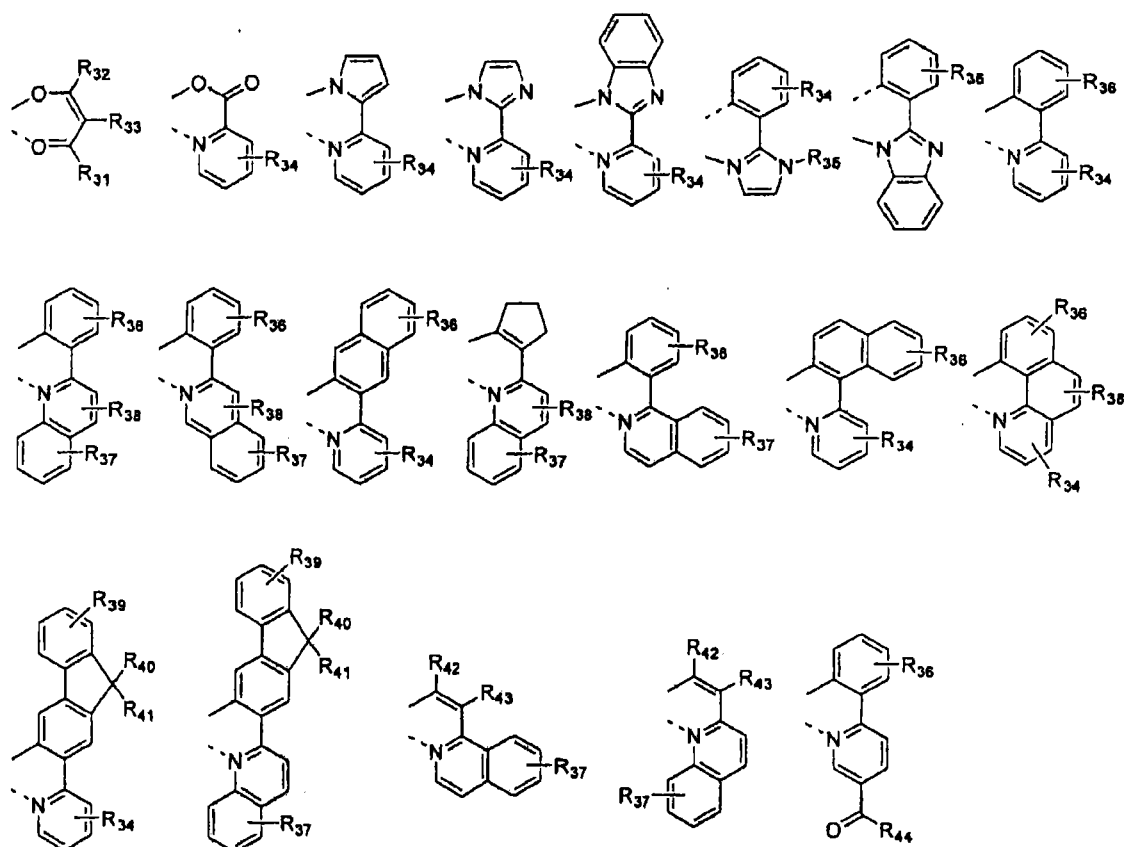
R<sub>51</sub> 和 R<sub>52</sub> 独立地表示甲基、乙基、正丙基、异丙基、正丁基、异丁基、叔丁基、正戊基、异戊基、正己基、正庚基、正辛基、乙基己基、苯基或萘基；或者 R<sub>51</sub> 至 R<sub>52</sub> 可以经由具有或不具有稠环的(C3-C12)亚烷基或(C3-C12)亚烯基连接形成脂环、或者单或多环芳环；

R<sub>53</sub> 表示氢、甲基、乙基、正丙基、异丙基、正丁基、异丁基、叔丁基、正戊基、异戊基、正己基、正庚基、正辛基、2-乙基己基、三甲基甲硅烷基、三丙基甲硅烷基、三(叔丁基)甲硅烷基、叔丁基二甲基甲硅烷基、三苯基甲硅烷基、苯基或萘基；

m 是 1 至 5 的整数；并且

n 是 1 至 3 的整数。

根据本发明的有机电致发光化合物的辅助配体 (L) 包括以下结构：



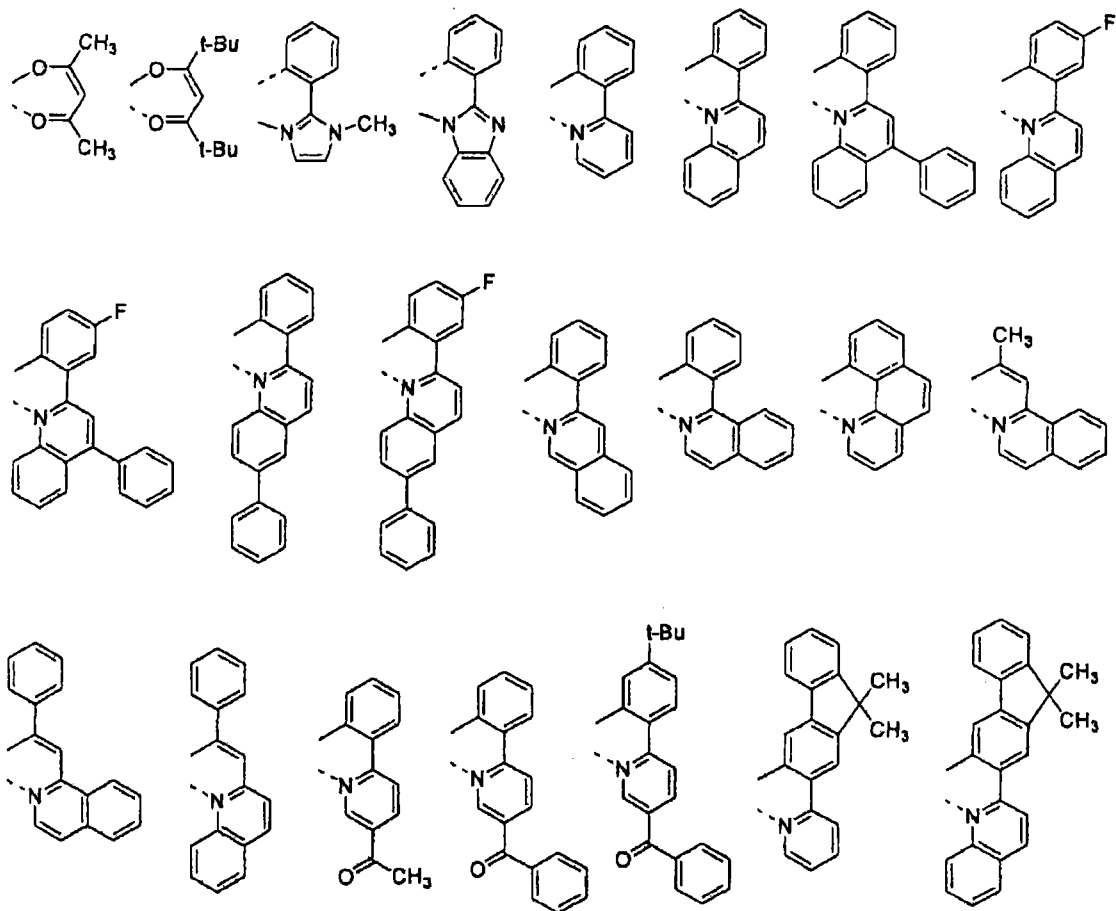
其中,  $R_{31}$  和  $R_{32}$  独立地表示氢、具有或不具有卤素取代基的(C1-C60)烷基、具有或不具有(C1-C60)烷基取代基的苯基、或者卤素;

$R_{33}$  至  $R_{39}$  独立地表示氢、(C1-C60)烷基、具有或不具有(C1-C60)烷基取代基的苯基、三(C1-C60)烷基硅烷基或者卤素;

$R_{40}$  至  $R_{43}$  独立地表示氢、(C1-C60)烷基、具有或不具有(C1-C60)烷基取代基的苯基; 和

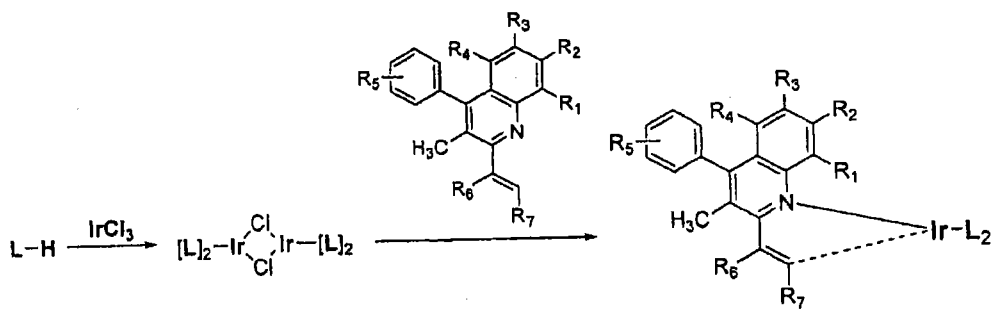
$R_{44}$  表示(C1-C60)烷基、具有或不具有(C1-C60)烷基取代基的苯基, 或者卤素。

根据本发明的有机电致发光辅助配体(L)可以例举为下述结构, 但不仅限于此:

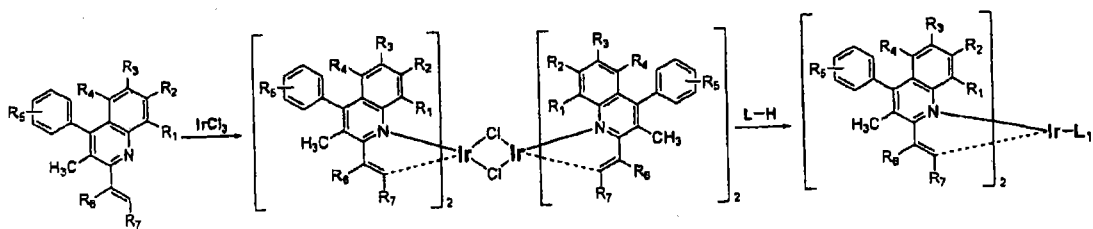


参照下述反应方案（1）至（3）描述制备根据本发明的有机电致发光化合物的工艺：

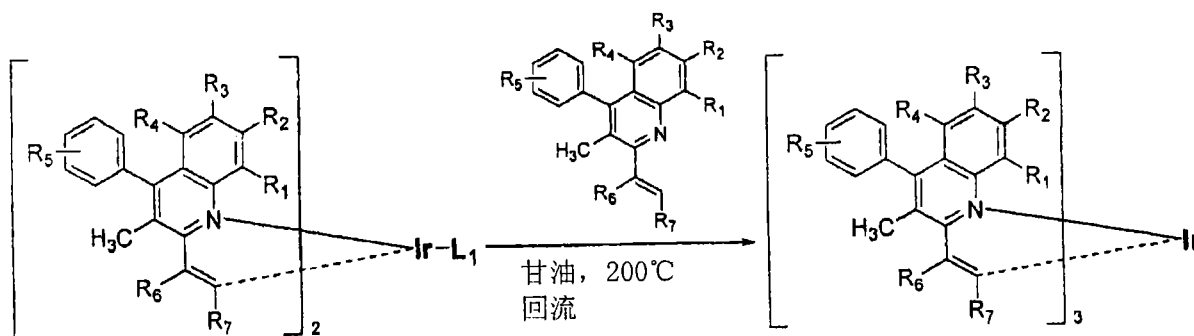
### 反应方案 1



### 反应方案 2



### 反应方案 3



其中,  $R_1$ 、 $R_2$ 、 $R_3$ 、 $R_4$ 、 $R_5$ 、 $R_6$ 、 $R_7$ 和L如化学式(1)所定义。

反应方案(1)提供了一种  $n=1$  的化学式(1)化合物, 其中在溶剂中以 1:2-3 的摩尔比混合三氯化铱 ( $\text{IrCl}_3$ ) 和辅助配体 (L-H), 在分离二铱二聚物前将混合物加热回流。在反应阶段, 优选的溶剂是醇或者醇/水混合溶剂, 例如 2-乙氧基乙醇和 2-乙氧基乙醇/水混合物。然后, 将分离出的二铱二聚物和主要配体化合物一起在有机溶剂中加热, 形成作为终产物的具有主要配体:辅助配体=1:2 比例的有机磷光铱化合物。使用与有机溶剂混合的  $\text{AgCF}_3\text{SO}_3$ 、 $\text{Na}_2\text{CO}_3$  或  $\text{NaOH}$  进行反应, 所述有机溶剂如乙氧基乙醇和 2-甲氧基乙醚。

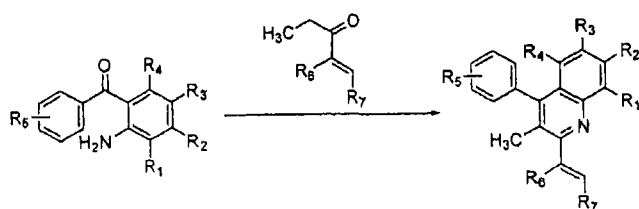
反应方案(2)提供了一种  $n=2$  的化学式(1)化合物, 其中在溶剂中以 1:2-3 的摩尔比混合三氯化铱 ( $\text{IrCl}_3$ ) 和主要配体化合物, 在分离二铱二聚物前将混合物加热回流。在反应阶段, 优选的溶剂是醇或者醇/水混合溶剂, 例如 2-乙氧基乙醇和 2-乙氧基乙醇/水混合物。然后, 将分离出的二铱二聚物和辅助配体化合物 (L-H) 一起在有机溶剂中加热, 形成作为终产物的具有主要配体:辅助配体=2:1 比例的有机磷光铱化合物。终产物中主要配体化合物和辅助配体 (L) 的摩尔比取决于依赖于组合物的反应物的适当摩尔比。使用与有机溶剂混合的  $\text{AgCF}_3\text{SO}_3$ 、 $\text{Na}_2\text{CO}_3$  或  $\text{NaOH}$  进行反应, 所述有机溶剂如 2-乙氧基乙醇、2-甲氧基乙醚和 1,2-二氯乙烷。

反应方案(3)提供了一种  $n=3$  的化学式(1)化合物, 其中根据反应方案(2)制备的铱配合物和主要配体化合物以 1:2-3 的摩尔比在丙三醇中混合, 混合物回流条件下加热从而获得配位有三个主要配体的有机磷光铱配合物。

用作本发明主要配体的化合物可以根据反应方案(4)制备, 基于常规工艺, 但是不仅限于此:

反应方案(4)





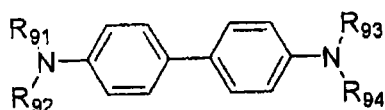
其中  $R_1$  至  $R_7$  如化学式 (1) 所定义。

本发明还提供了有机太阳能电池，其包括一个或多个化学式 (1) 表示的有机电致发光化合物。

本发明还提供了一种有机电致发光装置，其包括第一电极；第二电极；和至少一个插入第一电极和第二电极之间的有机层；其中所述有机层包括一个或多个化学式 (1) 表示的化合物。

根据本发明的有机电致发光装置的特征在于有机层包括电致发光区域，其包括 0.01-10% 重量的一个或多个化学式 (1) 表示的有机电致发光化合物作为电致发光掺杂剂，和一个或多个基质。用于根据本发明的有机电致发光装置的基质不作特别限定，但是可以例举为 1,3,5-三咪唑基苯、聚乙烯基咪唑、m-双咪唑基苯基、4,4',4''-三(N-咪唑基)三苯胺、1,3,5-三(2-咪唑苯基)苯、1,3,5-三(2-咪唑基-5-甲氧基苯基)苯、双(4-咪唑基苯基)硅烷或者化学式 (8) 至 (11) 之一表示的化合物：

化学式 8

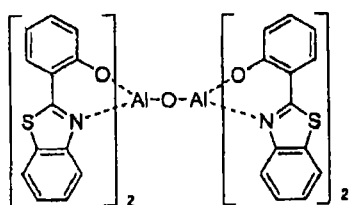


在化学式 (8) 中， $R_{91}$  至  $R_{94}$  独立地表示氢、卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C1-C60)烷氧基、(C1-C60)烷硫基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、羧基、硝基或者羟基，或者  $R_{91}$  至  $R_{94}$  中的每一个可以经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基与相邻取代基连接形成一个脂环、或单环或多环芳环；

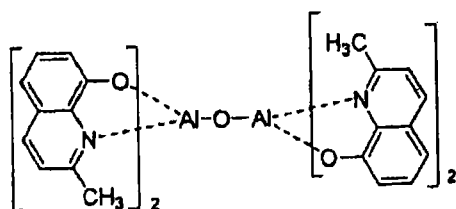
$R_{91}$  至  $R_{94}$  的烷基、烯基、炔基、环烷基、杂环烷基、芳基、杂芳基、芳基

甲硅烷基、烷基甲硅烷基、烷基氨基、或者芳基氨基，或者由两个相邻取代基经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基连接形成的脂环、或者单环或多环芳环，可以进一步被一个或多个取代基取代，所述取代基选自卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C1-C60)烷氧基、(C1-C60)烷硫基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、羧基、硝基或者羟基。

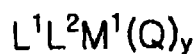
化学式 9



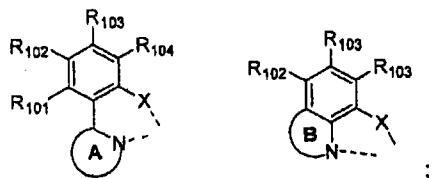
化学式 10



化学式 11



在化学式 (11) 中，配体， $L_1$  和  $L_2$  独立地选自以下结构：



$M^1$  是二价或三价金属；

当  $M^1$  是二价金属时  $y$  是 0，而当  $M^1$  是三价金属时  $y$  是 1；

$Q$  表示(C6-C60)芳氧基或三(C6-C60)芳基甲硅烷基，且  $Q$  的芳氧基和三芳

基甲硅烷基可以进一步被(C1-C60)烷基或者(C6-C60)芳基取代;

X 表示 O、S 或 Se;

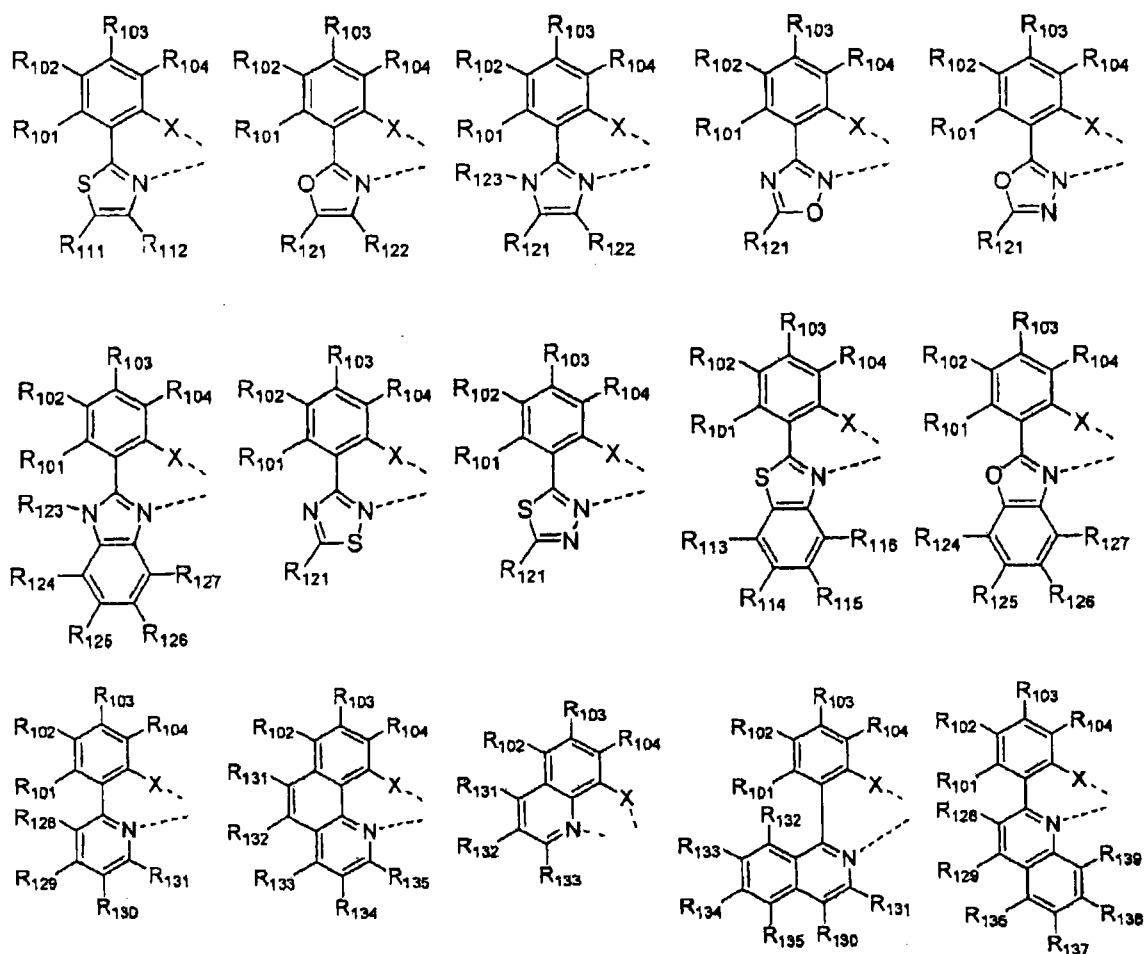
环 A 表示噁唑、噻唑、咪唑、噁二唑、噻二唑、苯并噁唑、苯并噻唑、苯并咪唑、吡啶或喹啉;

环 B 表示吡啶或喹啉, 并且环 B 可以进一步被(C1-C60)烷基、或者具有或不具有(C1-C60)烷基取代基的苯基或萘基取代;

$R_{101}$  至  $R_{104}$  独立地表示氢、卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C1-C60)烷氧基、(C1-C60)烷硫基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、羧基、硝基或者羟基, 或者  $R_{101}$  至  $R_{104}$  中的每一个可以经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基与相邻取代基连接形成脂环、或单环或多环芳环; 并且吡啶或喹啉可以与  $R_{101}$  形成化学键从而形成稠环;

环 A、 $R_{101}$  至  $R_{104}$  的烷基、烯基、炔基、环烷基、杂环烷基、芳基、杂芳基、芳基甲硅烷基、烷基甲硅烷基、烷基氨基、或者芳基氨基, 或者由两个相邻取代基经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基连接形成的脂环、或者单环或多环芳环, 可以进一步被一个或多个取代基取代, 所述取代基选自卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C1-C60)烷氧基、(C1-C60)烷硫基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、羧基、硝基或者羟基。

配体,  $L^1$  和  $L^2$  独立地选自以下结构:



其中, X表示O、S或Se;

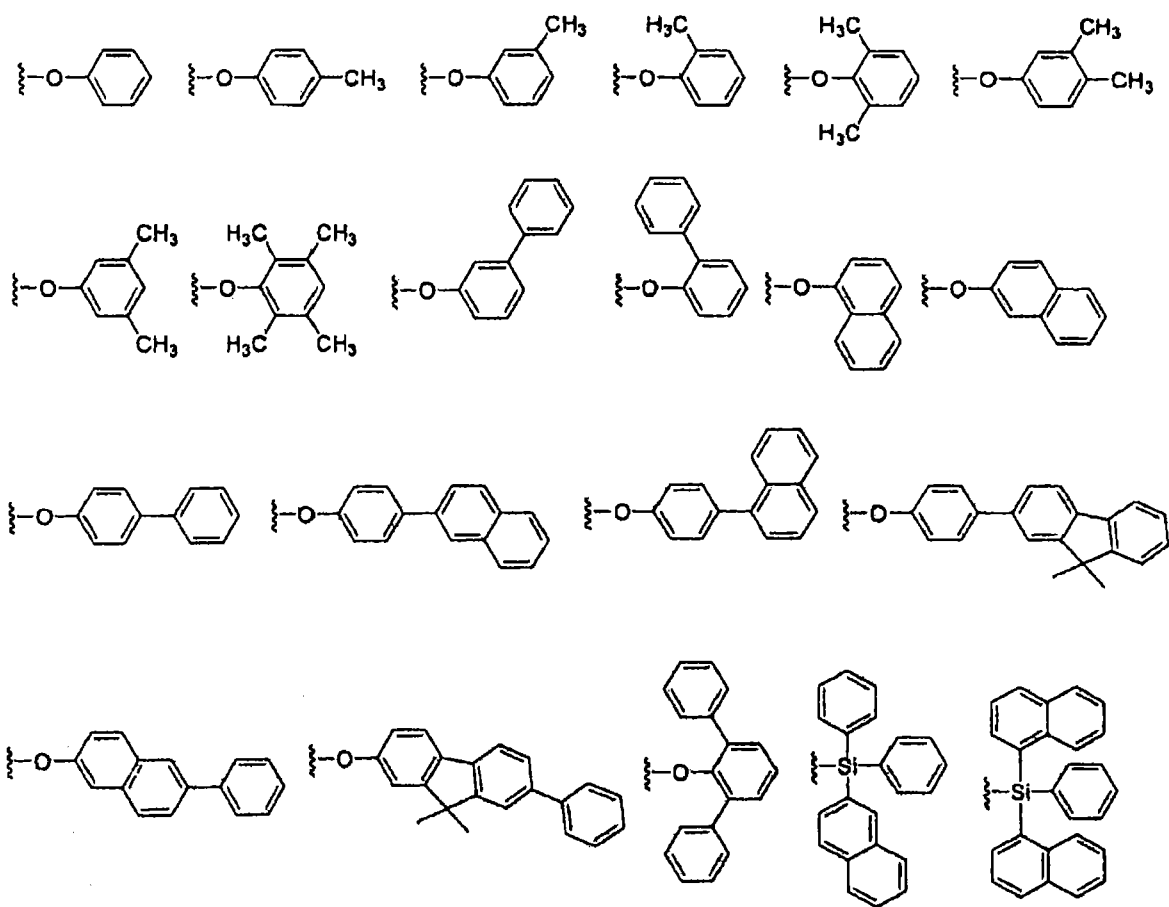
R<sub>101</sub>至R<sub>104</sub>独立地表示氢、卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自N、O和S的杂原子的5-或6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C1-C60)烷氧基、(C1-C60)烷硫基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、羧基、硝基或者羟基,或者R<sub>101</sub>至R<sub>104</sub>中的每一个可以经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基与相邻取代基连接形成脂环、或单环或多环芳环;

R<sub>111</sub>至R<sub>116</sub>和R<sub>121</sub>至R<sub>139</sub>独立地表示氢、卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自N、O和S的杂原子的5-或6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)

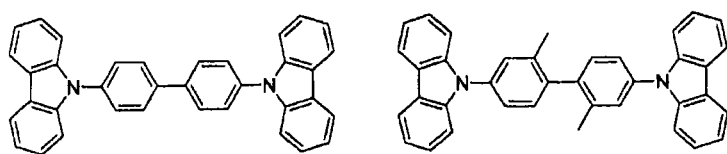
芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C1-C60)烷氧基、(C1-C60)烷硫基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、羧基、硝基或者羟基，或者  $R_{111}$  至  $R_{116}$  和  $R_{121}$  至  $R_{139}$  中的每一个可以经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基与相邻取代基连接形成脂环、或单环或多环芳环；

$R_{101}$  至  $R_{104}$ 、 $R_{111}$  至  $R_{116}$  和  $R_{121}$  至  $R_{139}$  的烷基、烯基、炔基、环烷基、杂环烷基、芳基、杂芳基、芳基甲硅烷基、烷基甲硅烷基、烷基氨基、或者芳基氨基，或者由两个相邻取代基经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基连接形成的脂环、或者单环或多环芳环，可以进一步被一个或多个取代基取代，所述取代基选自卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C1-C60)烷氧基、(C1-C60)烷硫基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、羧基、硝基或者羟基。

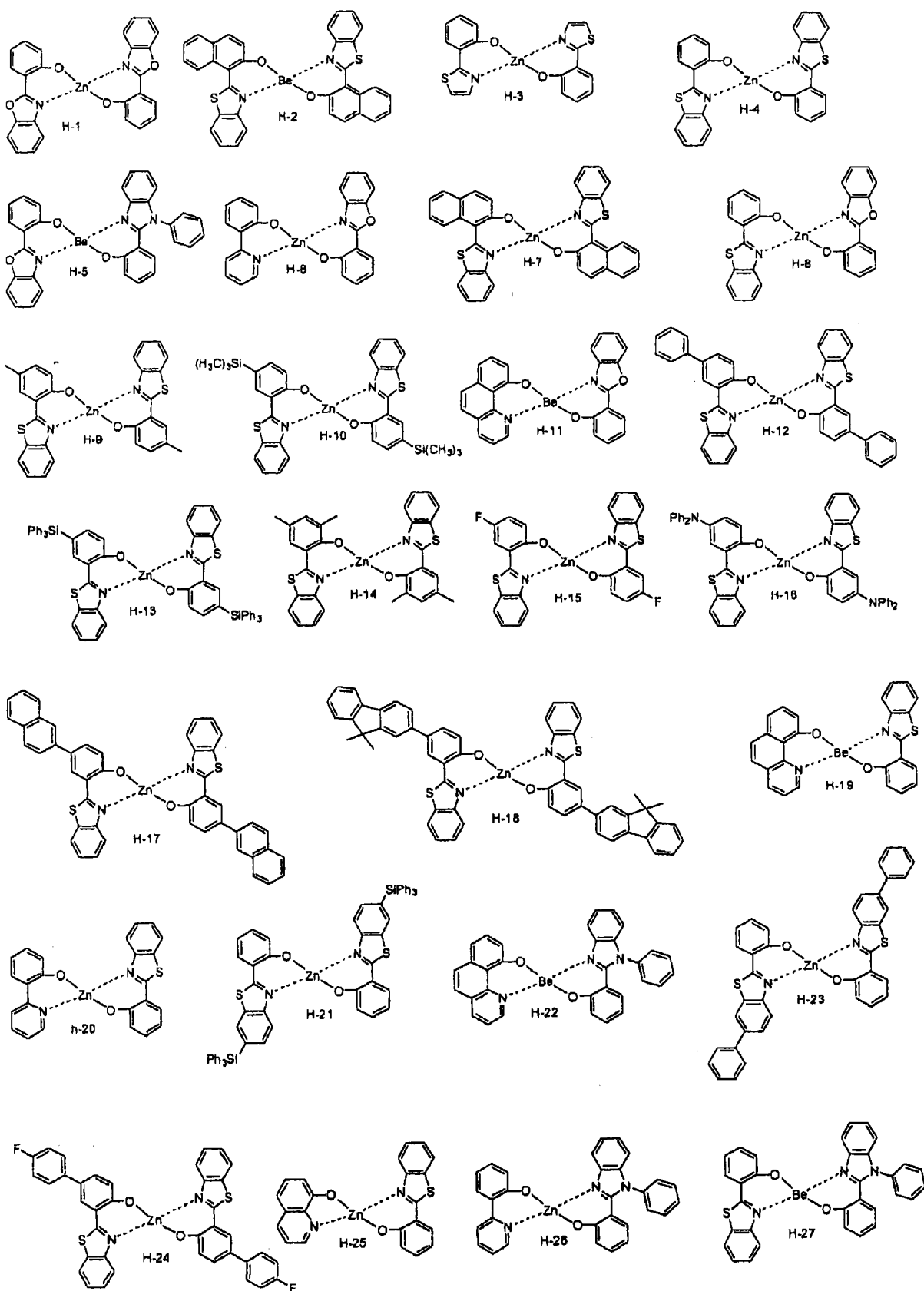
在化学式 (11) 中， $M^1$  是选自 Be、Zn、Mg、Cu 和 Ni 的二价金属，或者选自 Al、Ga、In 和 B 的三价金属，且 Q 选自以下结构：

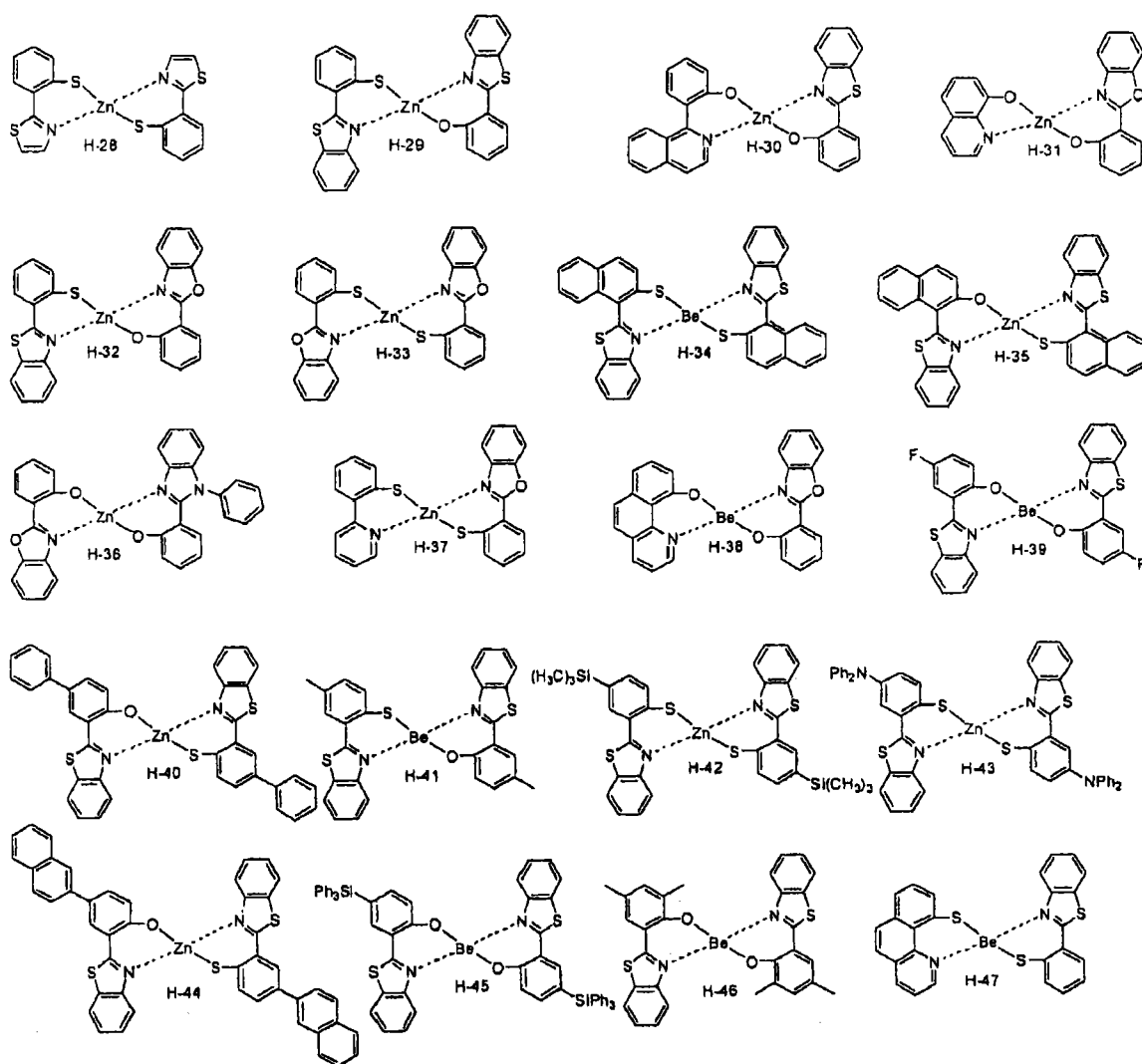


化学式(8)的化合物可以特别例举为下述结构表示的化合物,但不仅限于此。

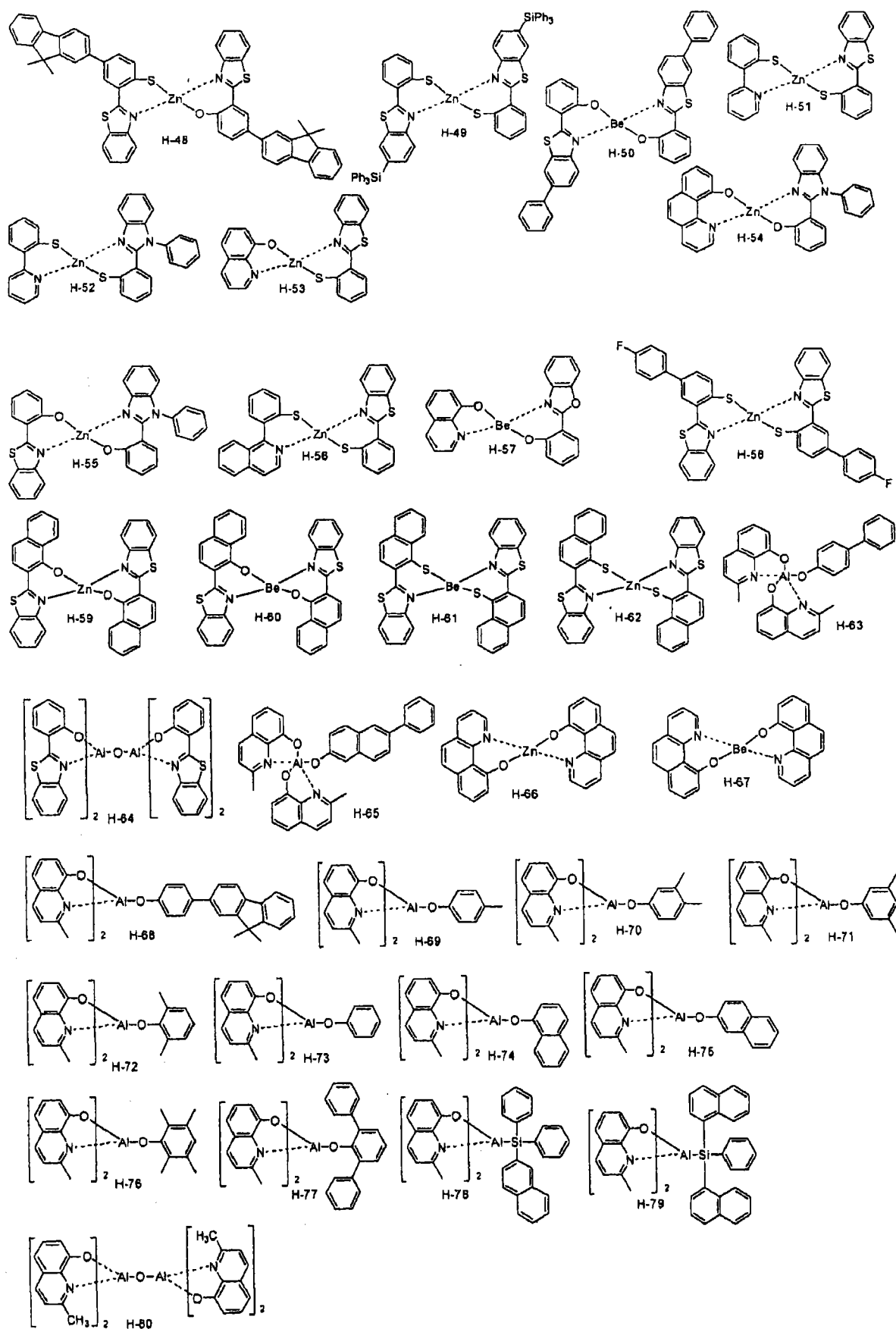


化学式(9)至(11)表示的化合物可以特别例举为以下结构之一,但不仅限于此。





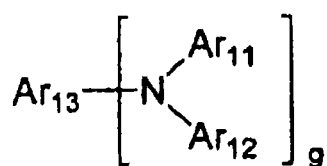




电致发光层指的是电致发光发生层，并且其可以是单层或由两个或更多分层的层组成的多层。当根据本发明的组成使用基质-掺杂剂混合物时，可以确实显著改善了装置寿命以及发光效率。

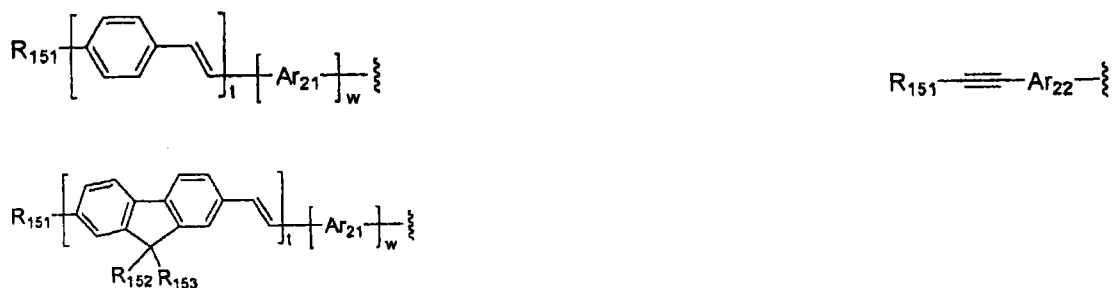
根据本发明的有机电致发光装置可以进一步包括一种或多种选自芳胺化合物和苯乙烯基芳胺化合物的化合物，以及化学式(1)表示的有机电致发光化合物。芳胺或苯乙烯基芳胺化合物的实例包括化学式(12)表示的化合物，但不限于此：

化学式 12

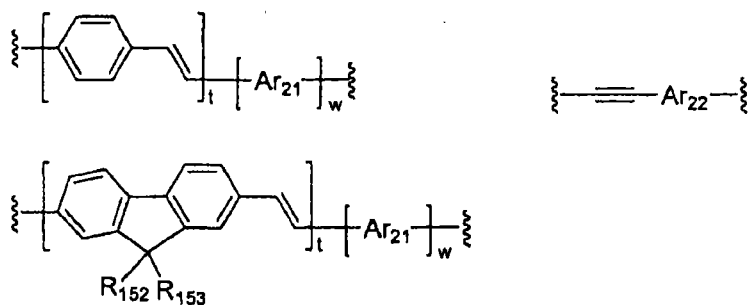


其中  $\text{Ar}_{11}$  和  $\text{Ar}_{12}$  独立地表示(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、(C6-C60)芳基氨基、(C1-C60)烷基氨基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、或者(C3-C60)环烷基，或者  $\text{Ar}_{11}$  和  $\text{Ar}_{12}$  可以经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基连接形成脂环、或单环或多环芳环；

当  $g$  是 1 时， $\text{Ar}_{13}$  表示(C6-C60)芳基、(C4-C60)杂芳基、或者下列结构式之一表示的芳基：



当  $g$  是 2 时， $\text{Ar}_{13}$  表示(C6-C60)亚芳基、(C4-C60)亚杂芳基、或者下列结构式之一表示的亚芳基：



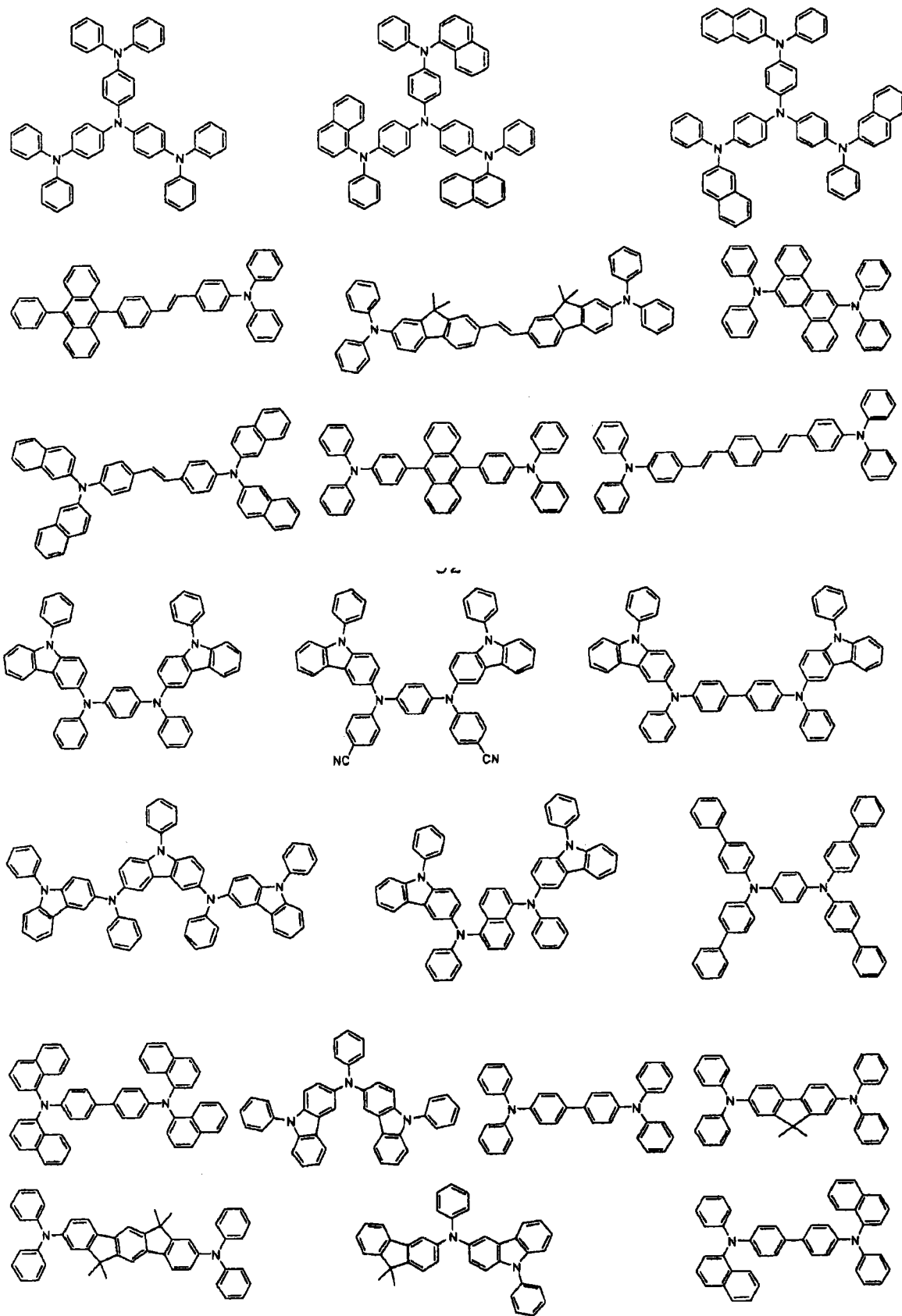
其中 Ar<sub>21</sub> 和 Ar<sub>22</sub> 独立地表示(C6-C60)亚芳基或(C4-C60)亚杂芳基;

R<sub>151</sub>、R<sub>152</sub> 和 R<sub>153</sub> 独立地表示氢、(C1-C60)烷基或(C6-C60)芳基;

t 为 1 至 4 的整数, w 为 0 或 1 的整数; 并且

Ar<sub>11</sub> 和 Ar<sub>12</sub> 中的烷基、芳基、杂芳基、芳基氨基、烷基氨基、环烷基或杂环烷基, 或者 Ar<sub>13</sub> 中的芳基、杂芳基、亚芳基或者亚杂芳基, Ar<sub>21</sub> 和 Ar<sub>22</sub> 中的亚芳基或亚杂芳基, 或者 R<sub>151</sub> 至 R<sub>153</sub> 的烷基或者芳基, 可以进一步被一个或多个取代基取代, 所述取代基选自卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C6-C60)芳氧基、(C1-C60)烷氧基、(C6-C60)芳硫基、(C1-C60)烷硫基、(C1-C60)烷氧基羰基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、羧基、硝基或者羟基。

芳胺化合物和苯乙烯基芳胺化合物可以更特别地例举为下述化合物, 但不限于此。



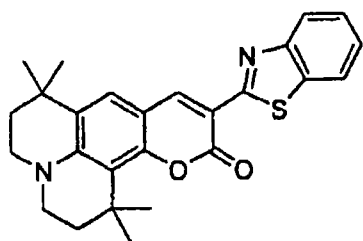
在根据本发明的有机电致发光装置中，有机层可进一步包括一种或多种金

属，所述金属选自第1族、第2族有机金属、第4周期和第5周期的过渡金属、镧系金属和d-过渡金属，以及化学式(1)表示的有机电致发光化合物。除电致发光层外，有机层可以包括电荷生成层。

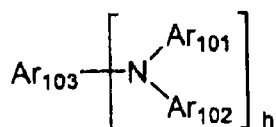
本发明可以实现具有独立发光模式的像素结构的电致发光装置，其同时包括平行的含有作为亚像素的化学式(1)化合物的有机电致发光装置和一个或多个包括一个或多个选自芳胺化合物和苯乙烯基芳胺化合物的化合物的亚像素。

此外，有机电致发光装置是一种有机显示器，其包括一个或多个选自具有蓝或绿波长峰值的化合物，同时。具有蓝或绿波长峰的化合物可以例举为化学式(13)至(17)之一表示的化合物，但不限于此。

化学式 13

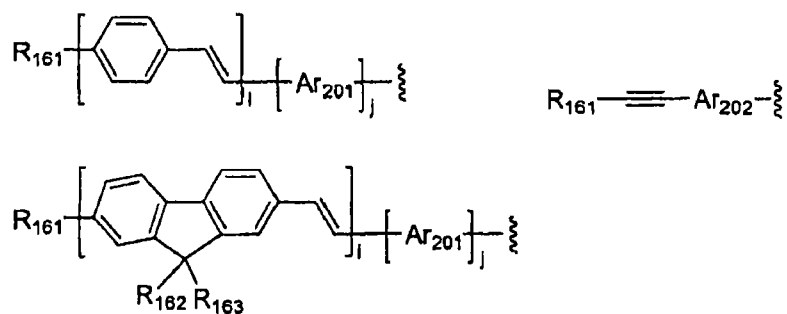


化学式 14

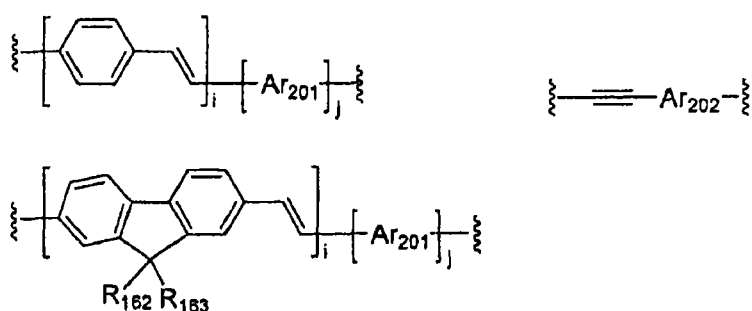


化学式(14)中， $\text{Ar}_{101}$ 和 $\text{Ar}_{102}$ 独立地表示(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、(C6-C60)芳基氨基、(C1-C60)烷基氨基、含有一个或多个选自N、O和S的杂原子的5-或6-元杂环烷基、或者(C3-C60)环烷基，或者 $\text{Ar}_{101}$ 和 $\text{Ar}_{102}$ 可以经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基连接形成脂环、或单环或多环芳环；

当h是1时， $\text{Ar}_{103}$ 表示(C6-C60)芳基、(C4-C60)杂芳基、或者下列结构式之一表示的芳基：



当  $h$  是 2 时,  $Ar_{103}$  表示(C6-C60)亚芳基、(C4-C60)亚杂芳基、或者下列结构式之一表示的亚芳基:



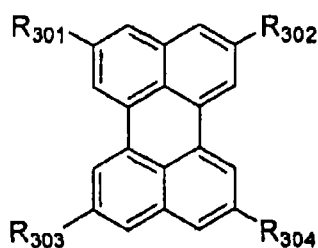
其中  $Ar_{201}$  和  $Ar_{202}$  独立地表示(C6-C60)亚芳基或(C4-C60)亚杂芳基;

$R_{161}$ 、 $R_{162}$  和  $R_{163}$  独立地表示氢、(C1-C60)烷基或(C6-C60)芳基;

$i$  为 1 至 4 的整数,  $j$  为 0 或 1 的整数; 并且

$Ar_{101}$  和  $Ar_{102}$  中的烷基、芳基、杂芳基、芳基氨基、烷基氨基、环烷基或杂环烷基, 或者  $Ar_{103}$  中的芳基、杂芳基、亚芳基或者亚杂芳基,  $Ar_{201}$  和  $Ar_{202}$  中的亚芳基或亚杂芳基, 或者  $R_{161}$  至  $R_{163}$  的烷基或者芳基, 可以进一步被一个或多个取代基取代, 所述取代基选自卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C6-C60)芳氧基、(C1-C60)烷氧基、(C6-C60)芳硫基、(C1-C60)烷硫基、(C1-C60)烷氧基羰基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、羧基、硝基或者羟基。

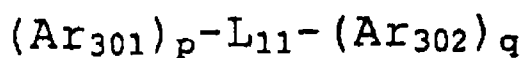
化学式 (15)



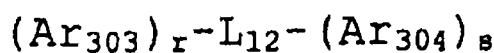
在化学式(15)中,  $R_{301}$  至  $R_{304}$  独立地表示氢、卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C1-C60)烷氧基、(C1-C60)烷硫基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、羧基、硝基或者羟基, 或者  $R_{301}$  至  $R_{304}$  中的每一个可以经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基与相邻取代基连接形成脂环、或单环或多环芳环;

$R_{301}$  至  $R_{304}$  的烷基、烯基、炔基、环烷基、杂环烷基、芳基、杂芳基、芳基甲硅烷基、烷基甲硅烷基、烷基氨基、或者芳基氨基, 或者由两个相邻取代基经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基连接形成的脂环、或者单环或多环芳环, 可以进一步被一个或多个取代基取代, 所述取代基选自卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C1-C60)烷氧基、(C1-C60)烷硫基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、(C1-C60)烷基羰基、(C6-C60)芳基羰基、羧基、硝基或者羟基。

化学式 16



化学式 17



在化学式 (16) 和 (17) 中,

$\text{L}_{11}$  表示(C6-C60)亚芳基或(C4-C60)亚杂芳基;

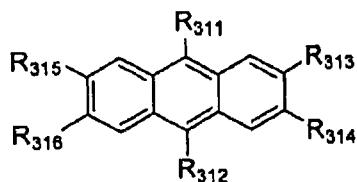
$\text{L}_{12}$  表示亚蒽基;

$\text{Ar}_{301}$  到  $\text{Ar}_{304}$  独立地选自氢、(C1-C60)烷基、(C1-C60)烷氧基、卤素、(C4-C60)杂芳基、(C5-C60)环烷基和(C6-C60)芳基, 并且  $\text{Ar}_{301}$  到  $\text{Ar}_{304}$  中的环烷基、芳基或杂芳基可以进一步被一个或多个取代基取代, 所述取代基选自具有或不具有至少一个选自具有或不具有卤素取代基的(C1-C60)烷基, (C1-C60)烷氧基, (C3-C60)环烷基, 卤素, 氰基, 三(C1-C60)烷基甲硅烷基, 二(C1-C60)烷基(C6-C60)芳基甲硅烷基和三(C6-C60)芳基甲硅烷基的取代基的(C6-C60)芳基或者(C4-C60)杂芳基、具有或不具有卤素取代基的(C1-C60)烷基、(C1-C60)烷氧基、(C3-C60)环烷基、卤素、氰基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基和三(C6-C60)芳基甲硅烷基; 以及

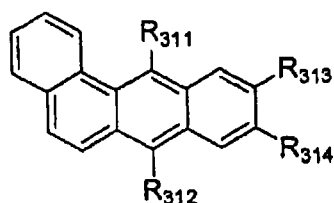
$p$ 、 $q$ 、 $r$  和  $s$  独立地表示 0 至 4 的整数。

化学式 (16) 或者 (17) 表示的化合物可以被例举为化学式 (18) 至 (21) 之一表示的衍生物。

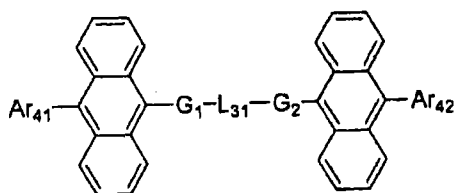
化学式 18



化学式 19



化学式 20



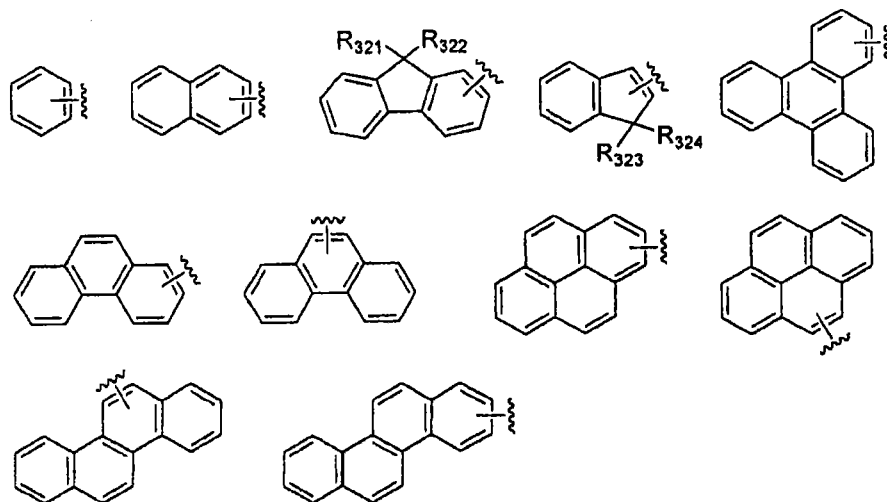


在化学式(18)至(20)中,  $R_{311}$ 和 $R_{312}$ 独立地表示(C6-C60)芳基、(C4-C60)杂芳基或者含有一个或多个选自N、O和S的杂原子的5-或6-元杂环烷基或者(C3-C60)环烷基,并且 $R_{311}$ 和 $R_{312}$ 中的芳基或杂芳基可以进一步被一个或多个取代基取代,所述取代基选自(C1-C60)烷基、卤代(C1-C60)烷基、(C1-C60)烷氧基、(C3-C60)环烷基、(C6-C60)芳基、(C4-C60)杂芳基、卤素、氰基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基和三(C6-C60)芳基甲硅烷基;

$R_{313}$ 至 $R_{316}$ 独立地表示氢、(C1-C60)烷基、(C1-C60)烷氧基、卤素、(C4-C60)杂芳基、(C5-C60)环烷基或者(C6-C60)芳基,并且 $R_{313}$ 至 $R_{316}$ 中的杂芳基、环烷基或芳基可以进一步被一个或多个取代基取代,所述取代基选自具有或不具有卤素取代基的(C1-C60)烷基、(C1-C60)烷氧基、(C3-C60)环烷基、卤素、氰基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基和三(C6-C60)芳基甲硅烷基;

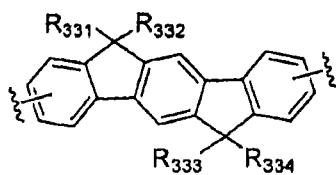
$G_1$ 和 $G_2$ 独立地表示化学键或者具有或不具有一个或多个取代基的(C6-C60)亚芳基,所述取代基选自(C1-C60)烷基、(C1-C60)烷氧基、(C6-C60)芳基、(C4-C60)杂芳基和卤素;

$Ar_{41}$ 和 $Ar_{42}$ 独立地表示选自下列结构的芳基或者(C4-C60)杂芳基:



$Ar_{41}$ 和 $Ar_{42}$ 中的芳基或杂芳基可以被一个或多个取代基取代,所述取代基选自(C1-C60)烷基、(C1-C60)烷氧基、(C6-C60)芳基和(C4-C60)杂芳基;

$L_{31}$ 表示(C6-C60)亚芳基、(C4-C60)亚杂芳基或者下列结构表示的化合物:

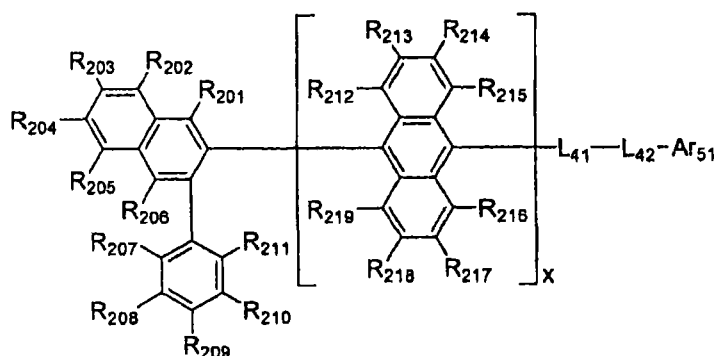


$L_{31}$  的亚芳基或亚杂芳基可以被一个或多个取代基取代, 所述取代基选自 (C1-C60)烷基、(C1-C60)烷氧基、(C6-C60)芳基、(C4-C60)杂芳基和卤素;

$R_{321}$ 、 $R_{322}$ 、 $R_{323}$  和  $R_{324}$  独立地表示氢、(C1-C60)烷基或者(C6-C60)芳基, 或者其中每一个可以经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基与相邻取代基连接形成脂环、或单环或多环芳环;

$R_{331}$ 、 $R_{332}$ 、 $R_{333}$  和  $R_{334}$  独立地表示氢、(C1-C60)烷基、(C1-C60)烷氧基、(C6-C60)芳基、(C4-C60)杂芳基或者卤素, 或者其中每一个可以经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基与相邻取代基连接形成一个脂环、或单环或多环芳环;

化学式 21



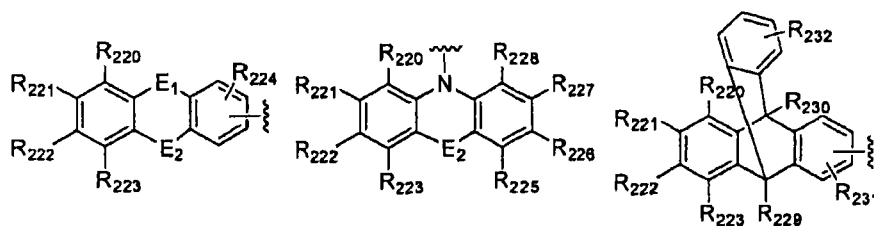
在化学式 21 中,

$L_{41}$  和  $L_{42}$  独立地表示化学键、(C6-C60)亚芳基、(C3-C60)亚杂芳基, 且  $L_{41}$  和  $L_{42}$  中的亚芳基或亚杂芳基可以进一步被一个或多个取代基取代, 所述取代基选自(C1-C60)烷基、卤素、氰基、(C1-C60)烷氧基、(C3-C60)环烷基、(C6-C60)芳基、(C3-C60)杂芳基、三(C1-C30)烷基甲硅烷基、二(C1-C30)烷基(C6-C30)芳基甲硅烷基和三(C6-C30)芳基甲硅烷基;

$R_{201}$  至  $R_{219}$  独立地表示氢、卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯

基、(C2-C60)炔基、(C1-C60)烷氧基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、羧基、硝基或羟基，或者各个  $R_{201}$  至  $R_{219}$  可以经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基与相邻取代基连接形成一个脂环、或单环或多环芳环；

$Ar_{51}$  表示(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、金刚烷基、(C7-C60)双环烷基、或者选自下述结构的取代基：



其中,  $R_{220}$  至  $R_{232}$  独立地表示氢、卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、(C1-C60)烷氧基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、羧基、硝基或羟基；

$E_1$  和  $E_2$  独立地表示化学键、 $-(CR_{233}R_{234})_Z-$ 、 $-N(R_{235})-$ 、 $-S-$ 、 $-O-$ 、 $-Si(R_{236})(R_{237})-$ 、 $-P(R_{238})-$ 、 $-C(=O)-$ 、 $-B(R_{239})-$ 、 $-In(R_{240})-$ 、 $-Se-$ 、 $-Ge(R_{241})(R_{242})-$ 、 $-Sn(R_{243})(R_{244})-$ 、 $-Ga(R_{245})-$  或者  $-C(R_{246})=C(R_{247})-$ ；

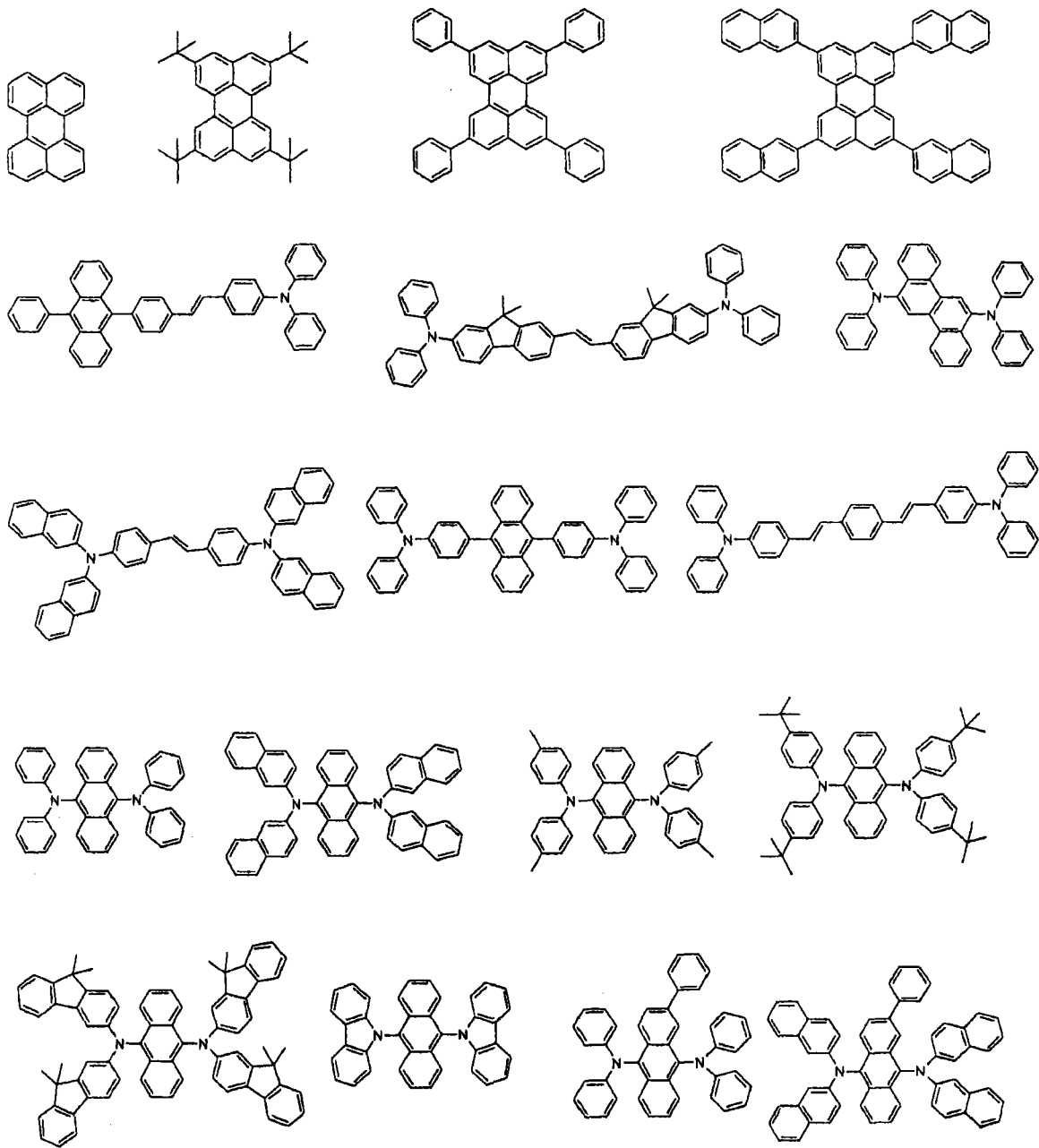
$R_{233}$  至  $R_{247}$  独立地表示氢、卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自 N、O 和 S 的杂原子的 5-或 6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、(C1-C60)烷氧基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、羧基、硝基或羟基；或者各个  $R_{233}$  至  $R_{247}$  可以经由具有或不具有稠环的(C3-C60)亚烷基或(C3-C60)亚烯基与相邻取代基连接形成脂环、或单环或多环芳环；

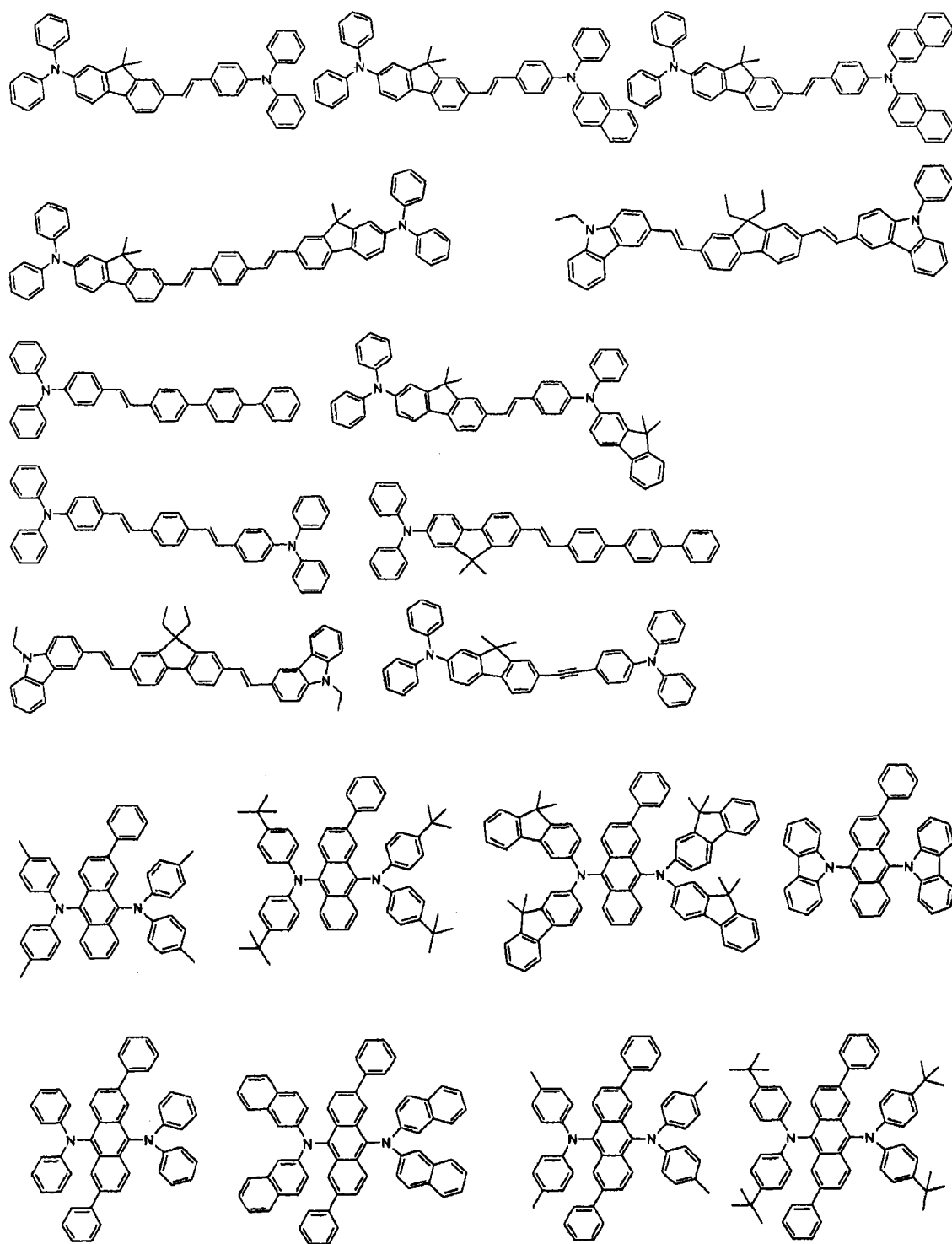
Ar<sub>51</sub>的芳基、杂芳基、杂环烷基、金刚烷基或者双环烷基，或者 R<sub>201</sub>至 R<sub>232</sub>的烷基、烯基、炔基、环烷基、杂环烷基、芳基、杂芳基、芳基甲硅烷基、烷基甲硅烷基、烷基氨基或芳氨基，可以进一步被一个或多个取代基取代，所述取代基选自卤素、(C1-C60)烷基、(C6-C60)芳基、(C4-C60)杂芳基、含有一个或多个选自N、O和S的杂原子的5-或6-元杂环烷基、(C3-C60)环烷基、三(C1-C60)烷基甲硅烷基、二(C1-C60)烷基(C6-C60)芳基甲硅烷基、三(C6-C60)芳基甲硅烷基、金刚烷基、(C7-C60)双环烷基、(C2-C60)烯基、(C2-C60)炔基、(C1-C60)烷氧基、氰基、(C1-C60)烷基氨基、(C6-C60)芳基氨基、(C6-C60)芳基(C1-C60)烷基、(C6-C60)芳氧基、(C6-C60)芳硫基、(C1-C60)烷氧基羰基、羧基、硝基和羟基；

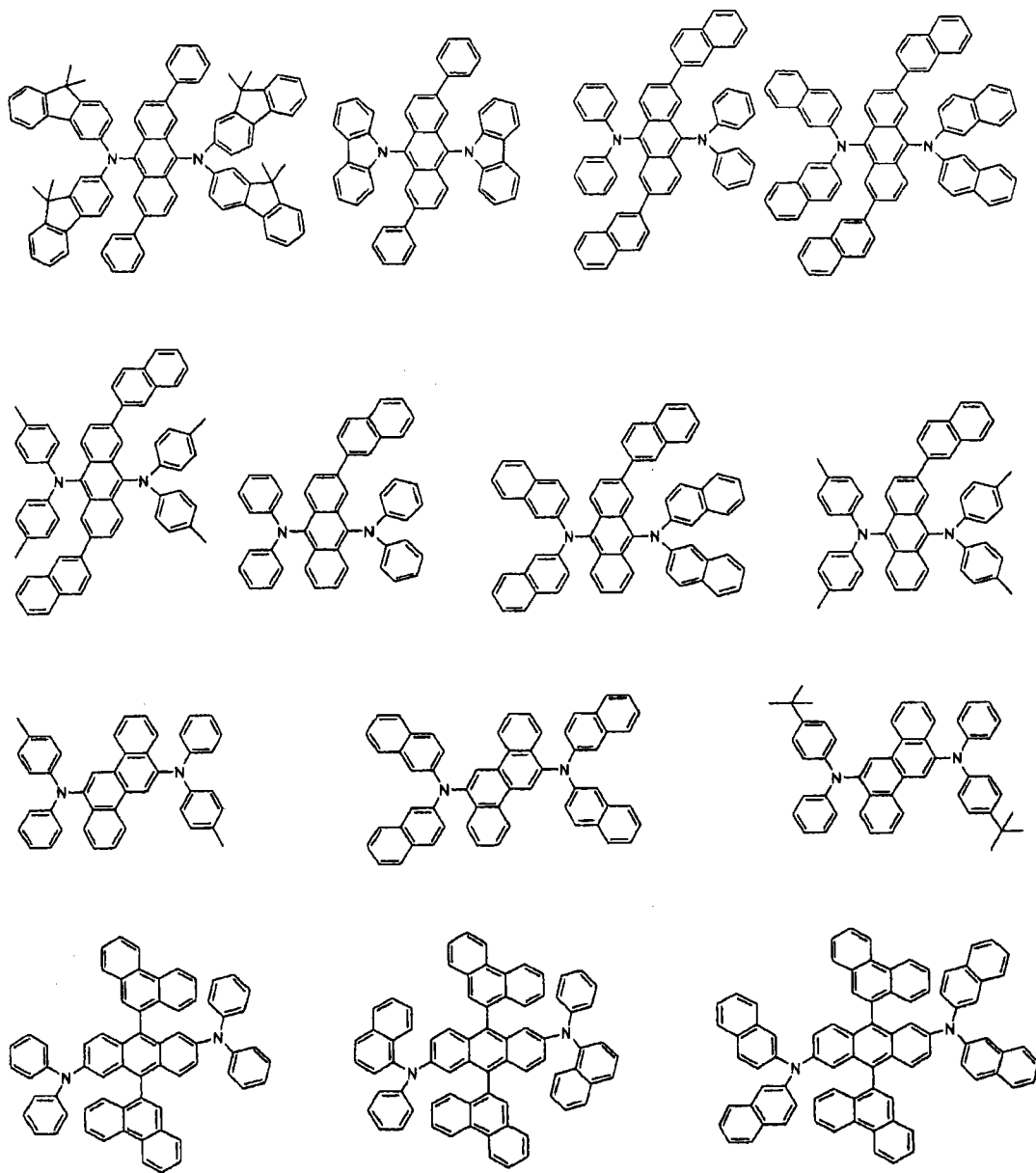
x 为 1 至 4 的整数；和

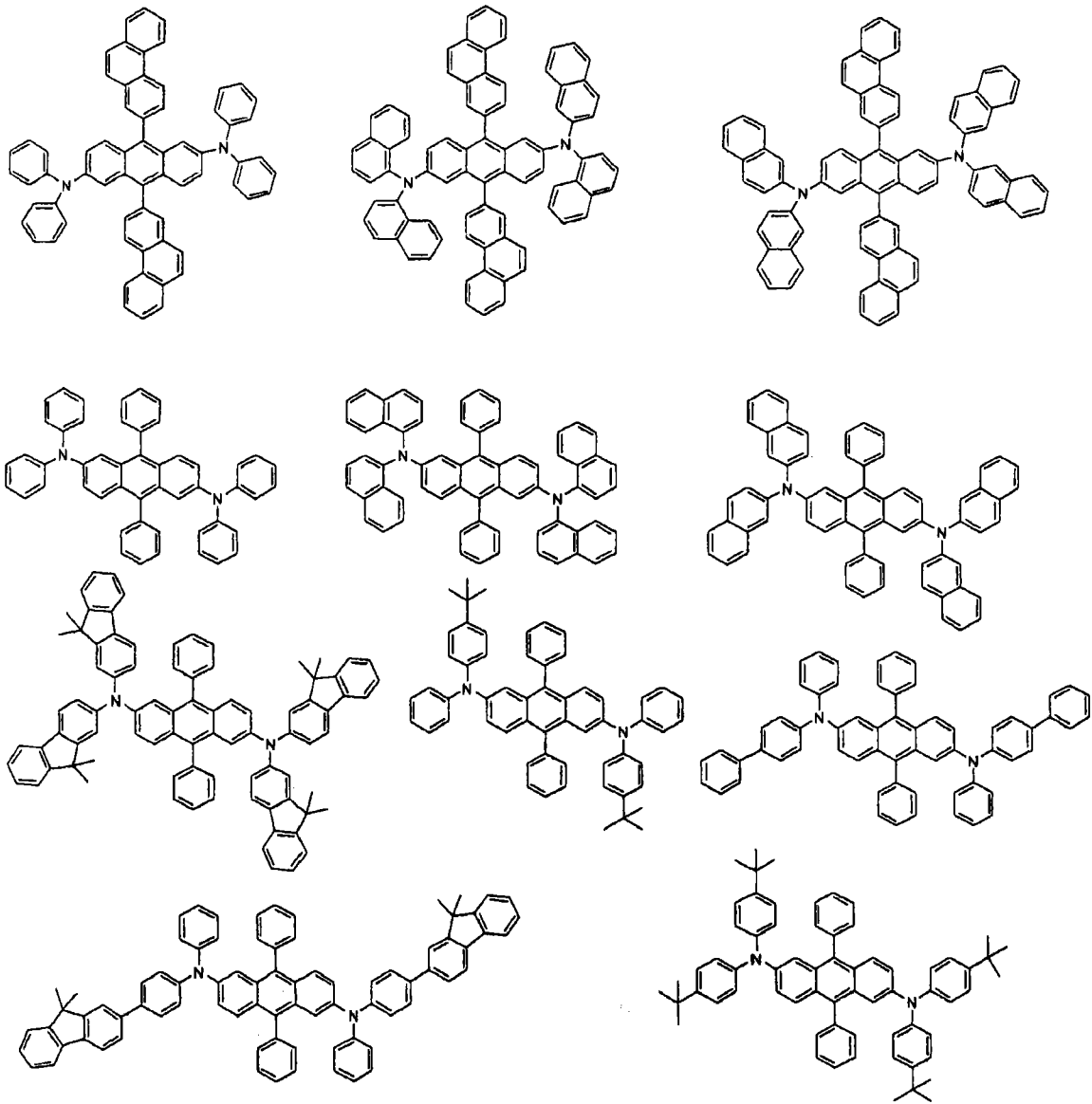
z 为 0 至 4 的整数。

具有绿色或蓝色电致发光的有机化合物和有机金属化合物可以被更特别地例举为下列化合物，但不限于此。

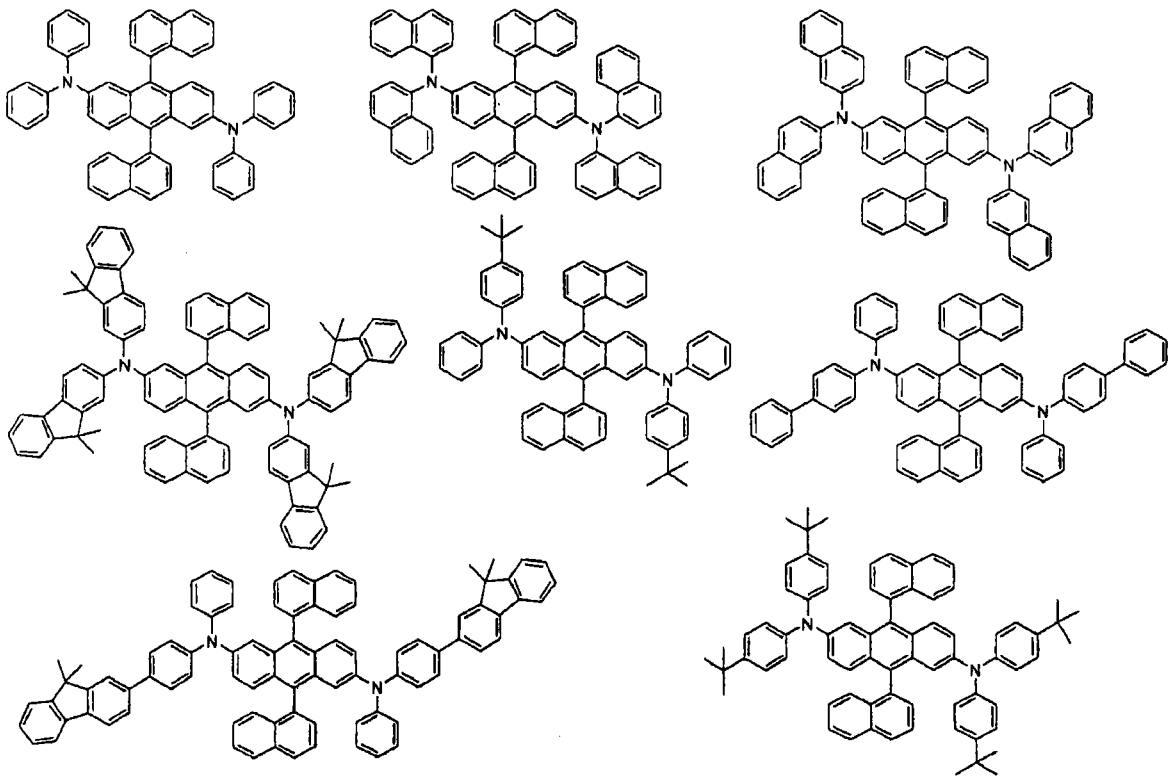


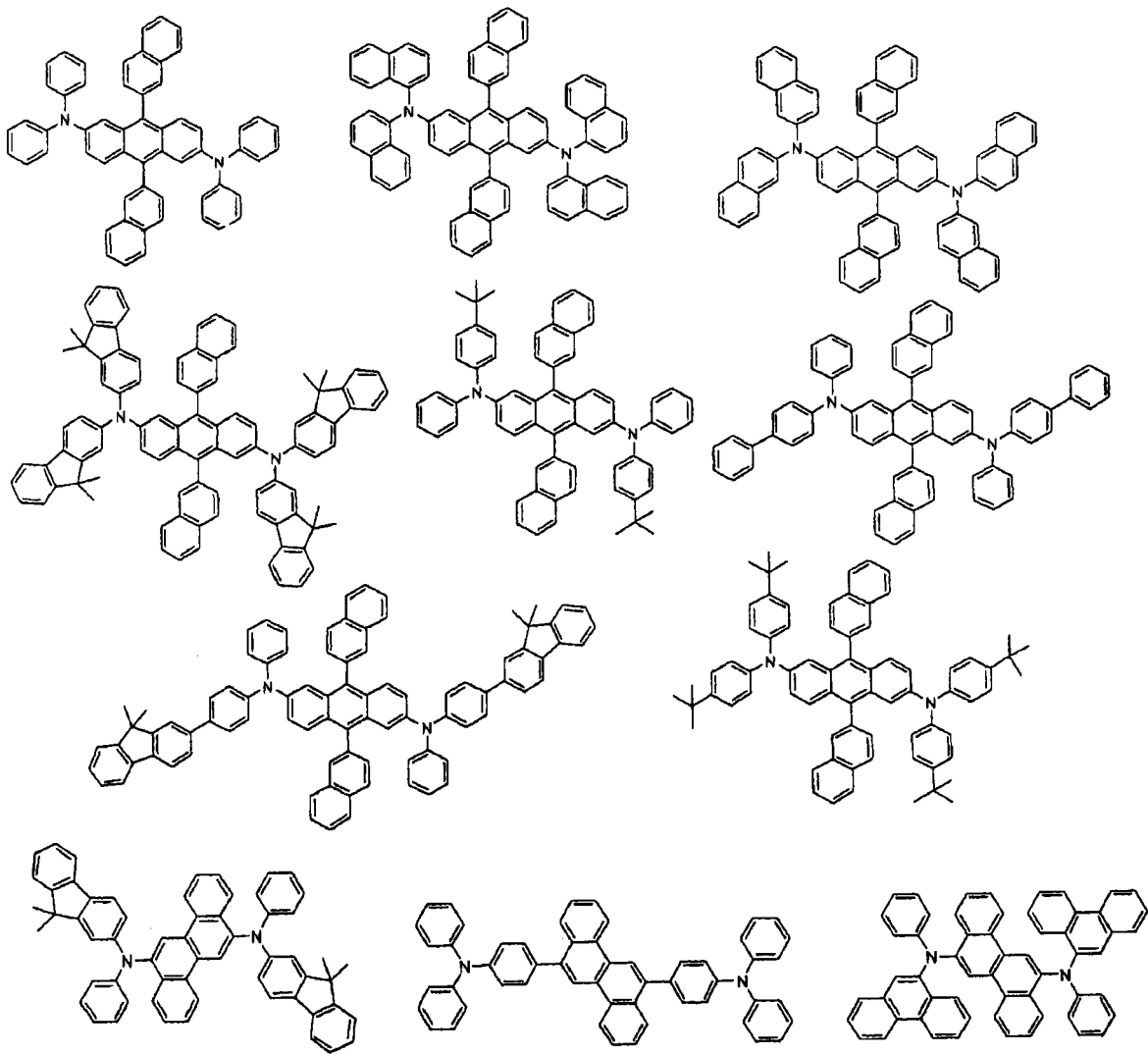


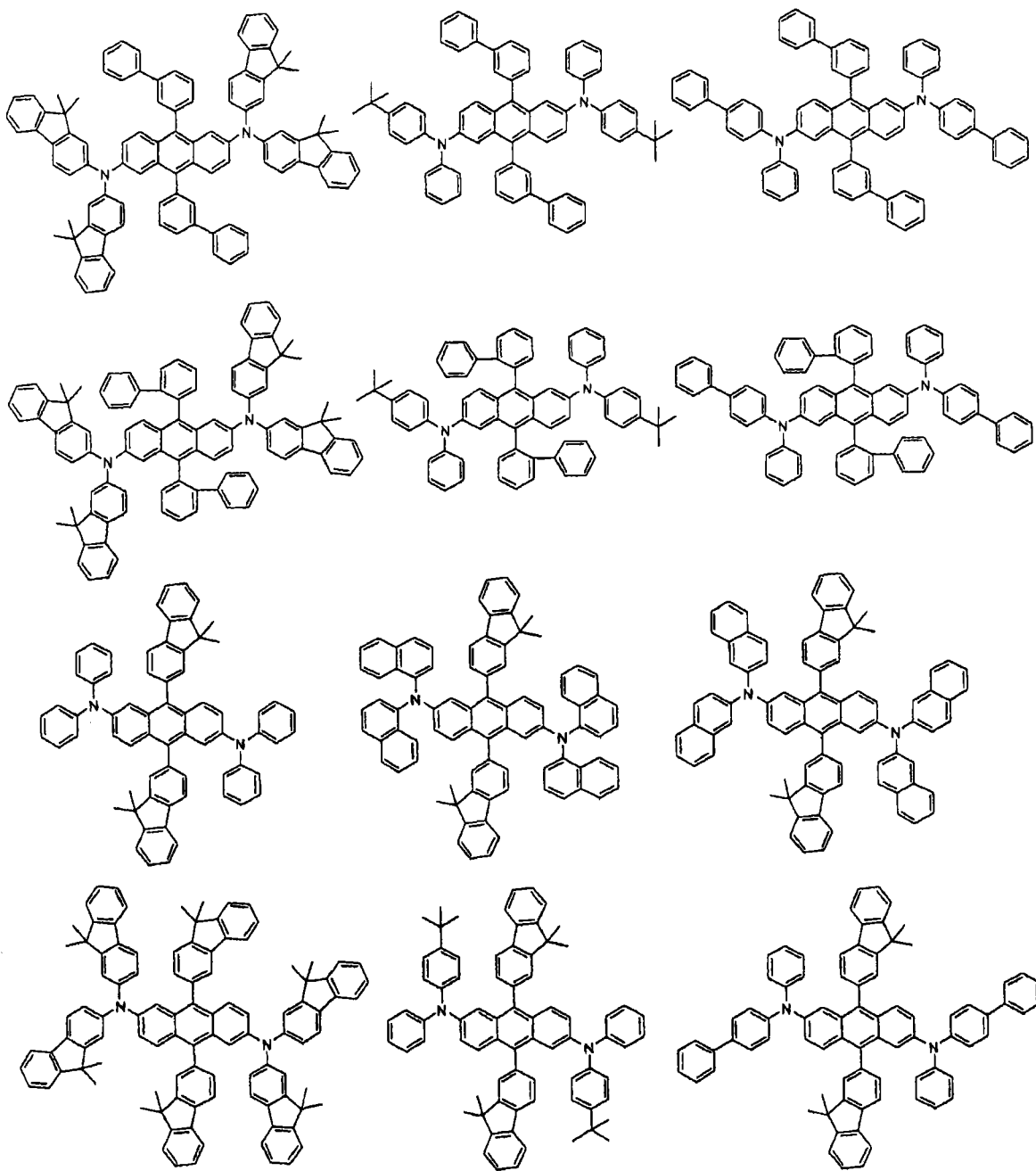


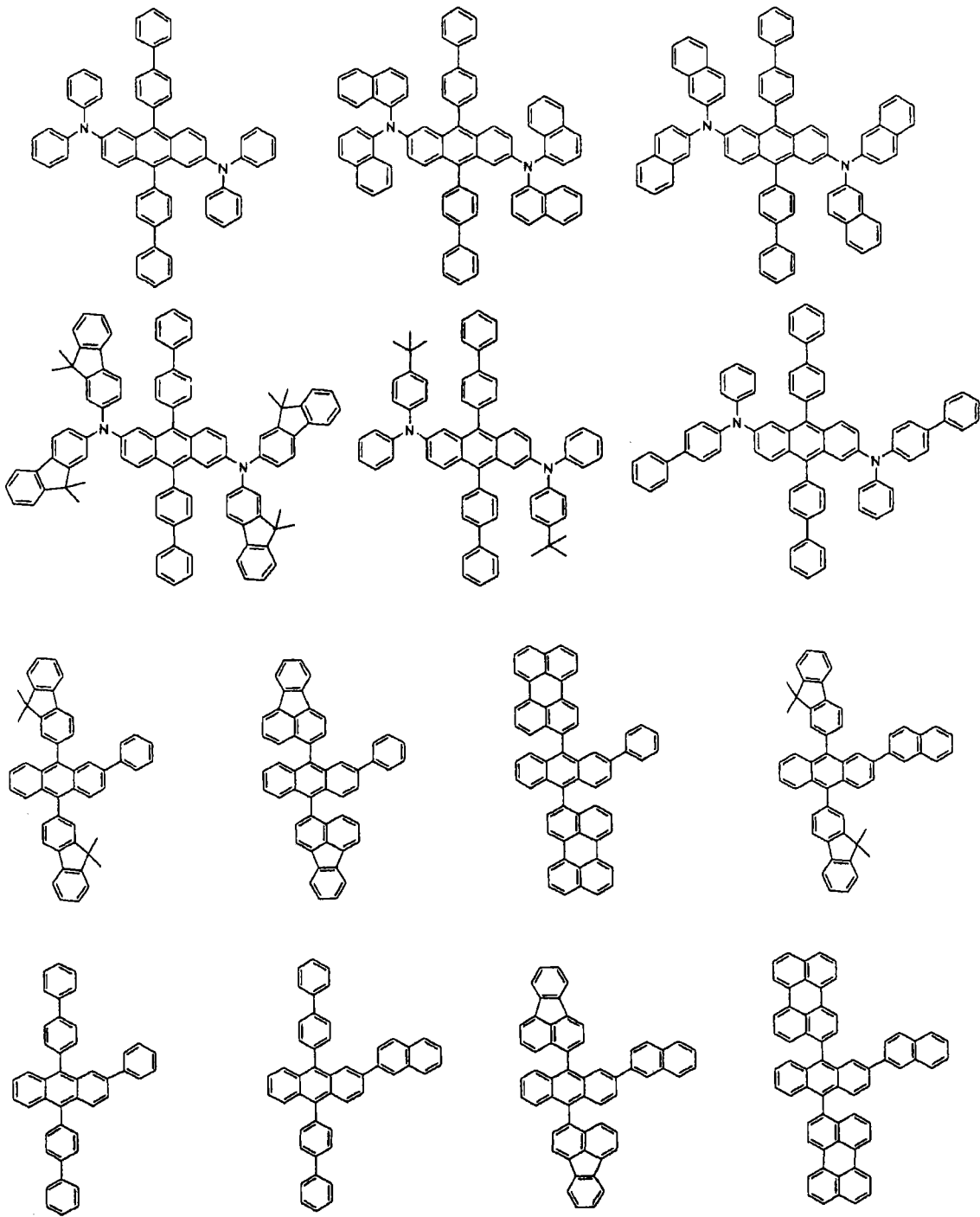


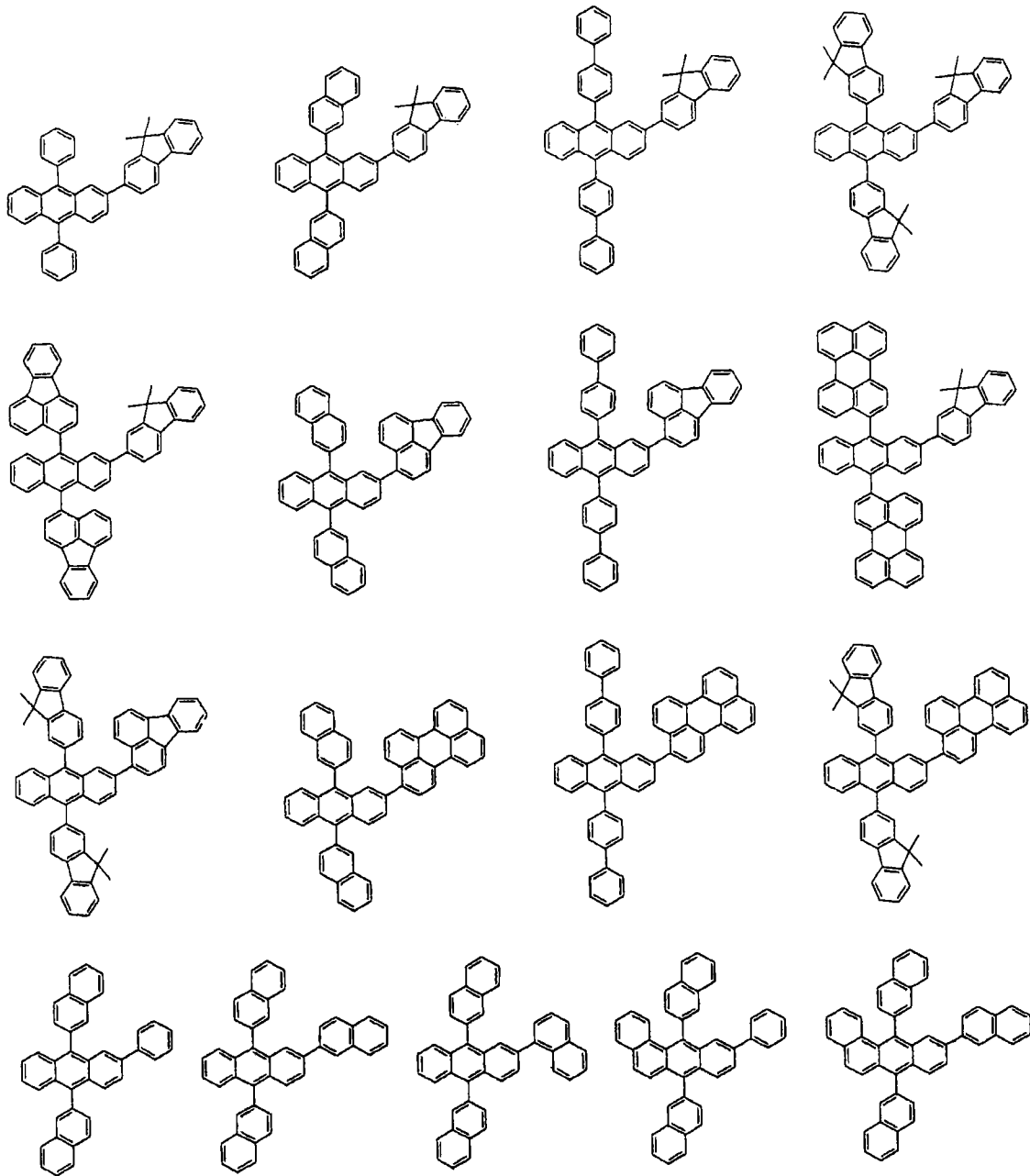


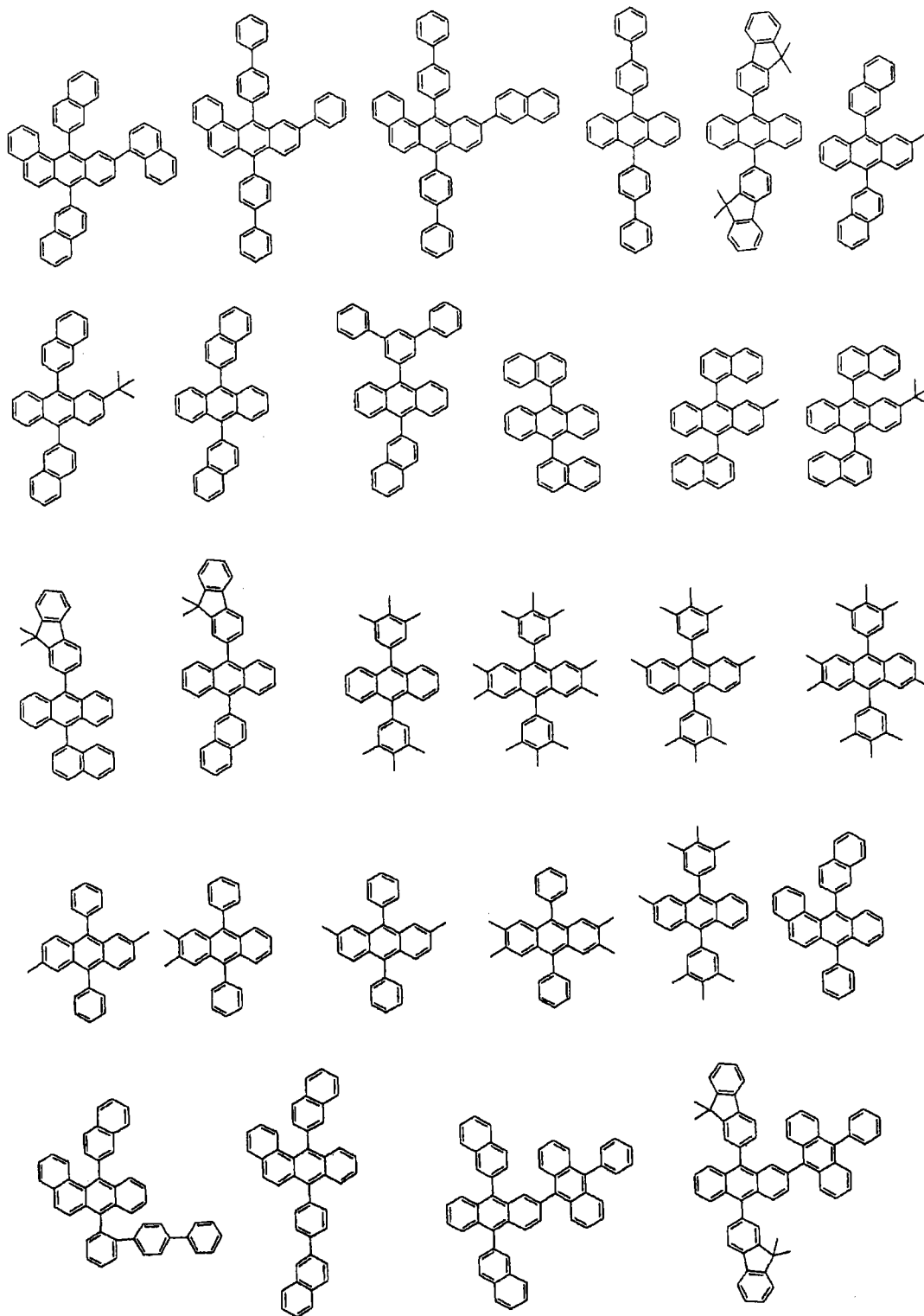


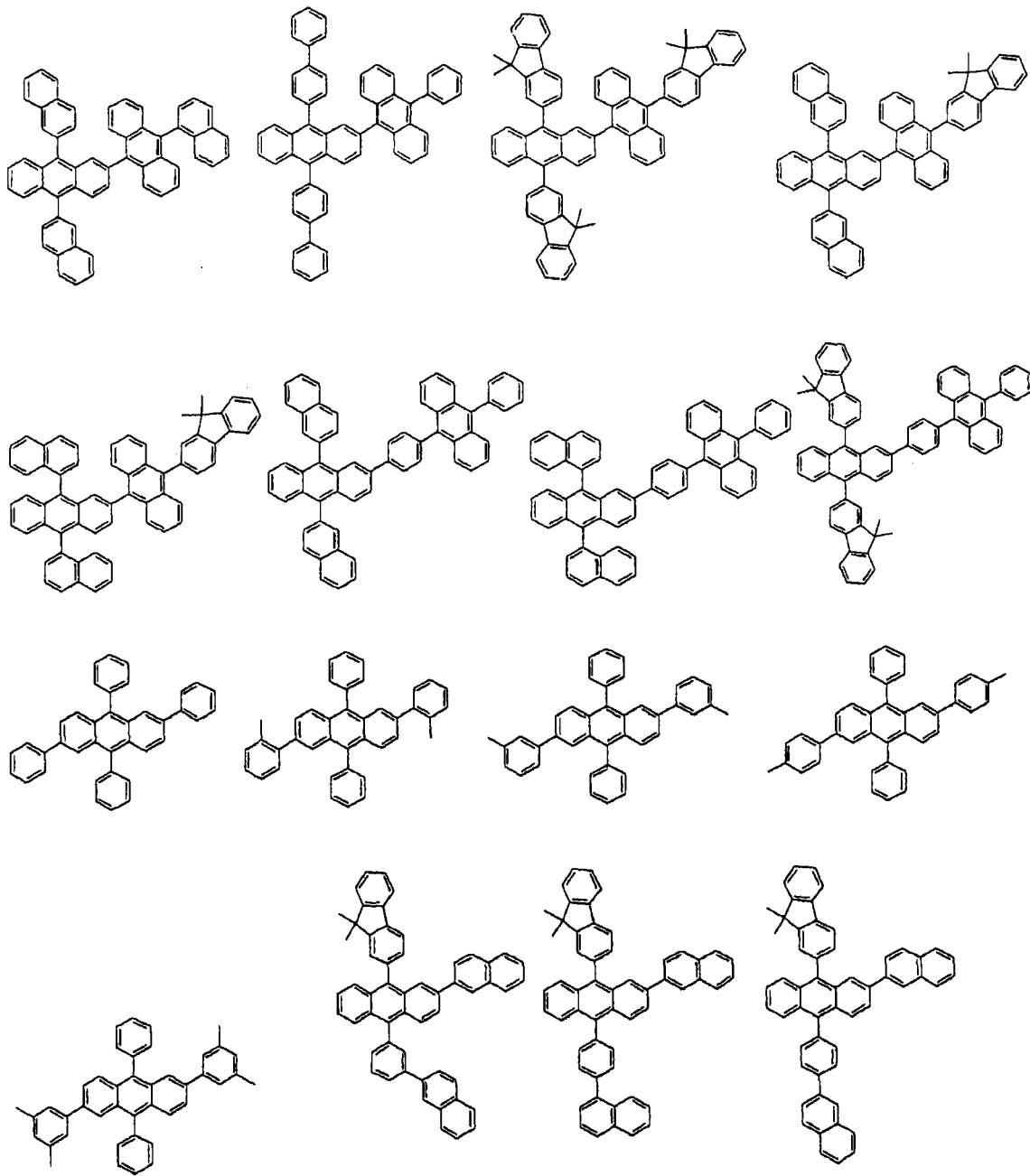


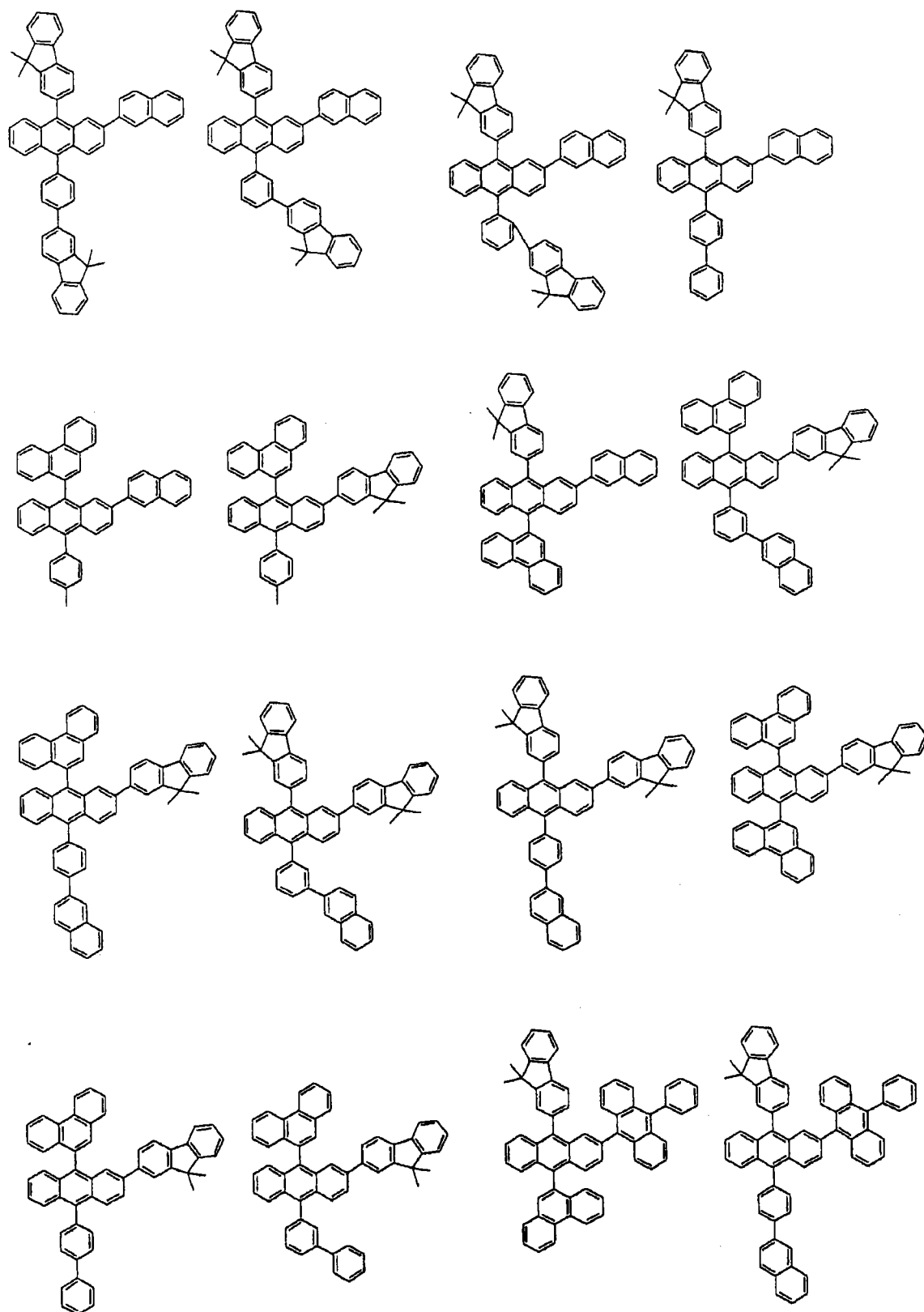




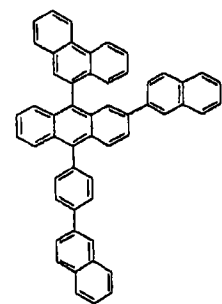
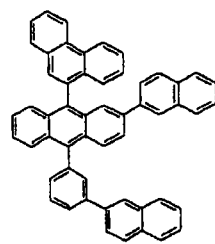
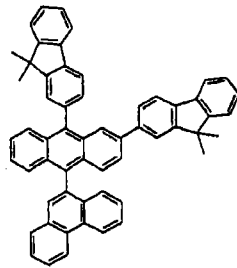
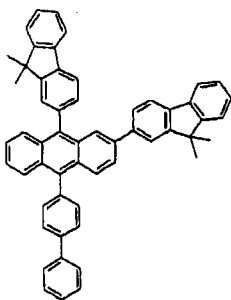
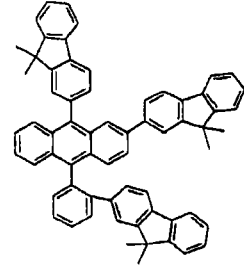
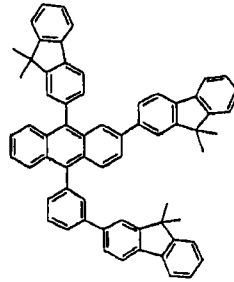
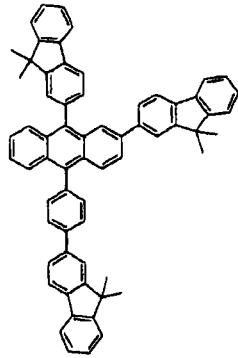
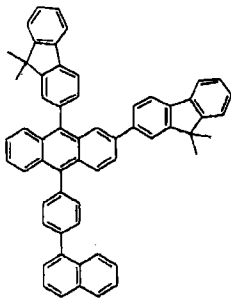
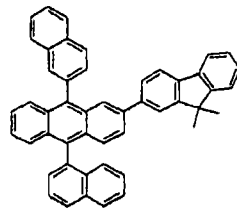
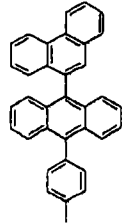
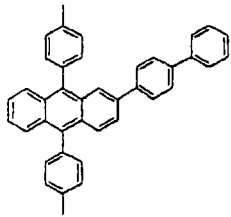
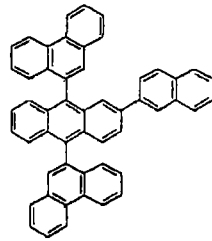
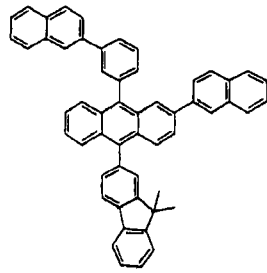
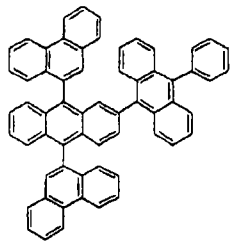


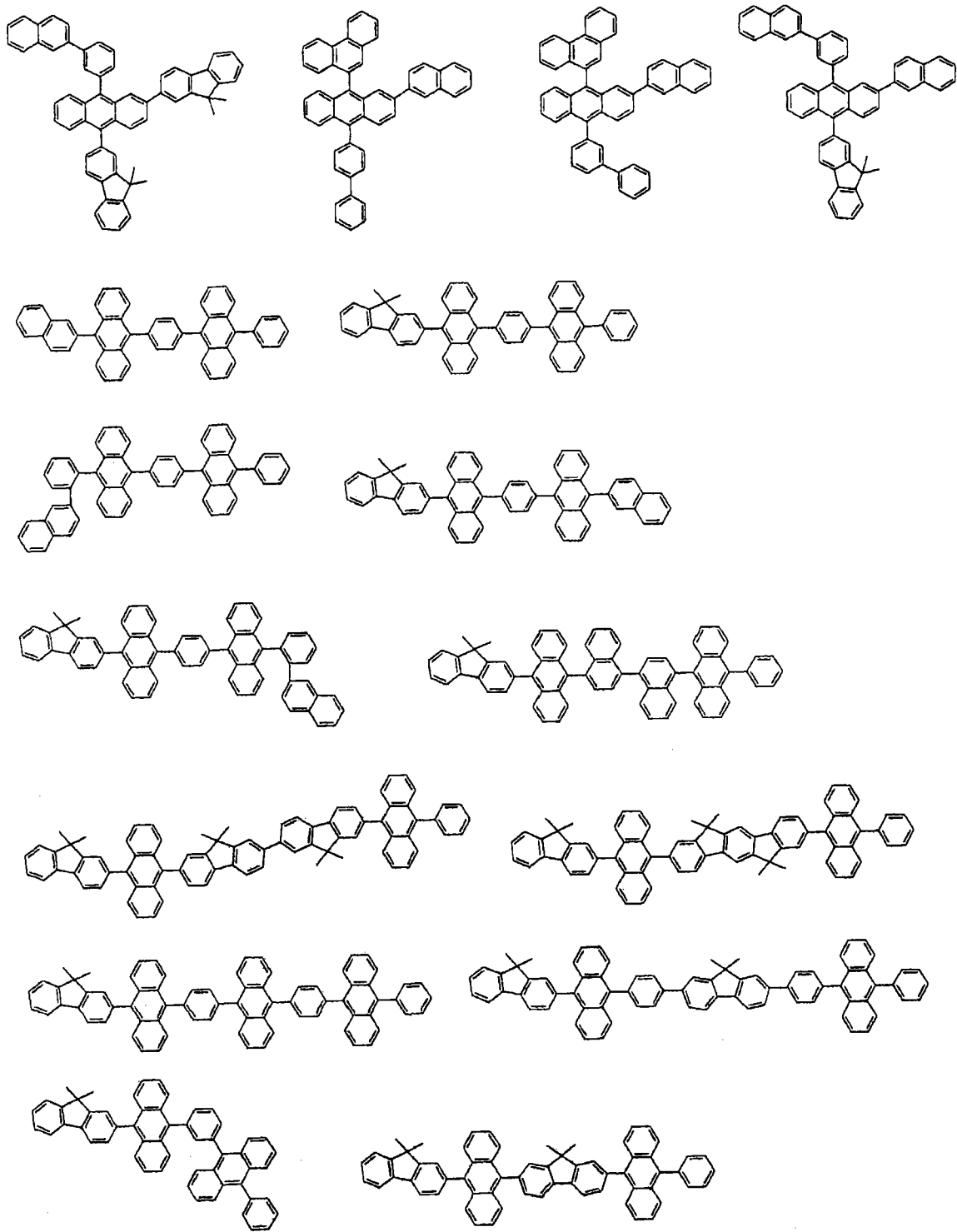


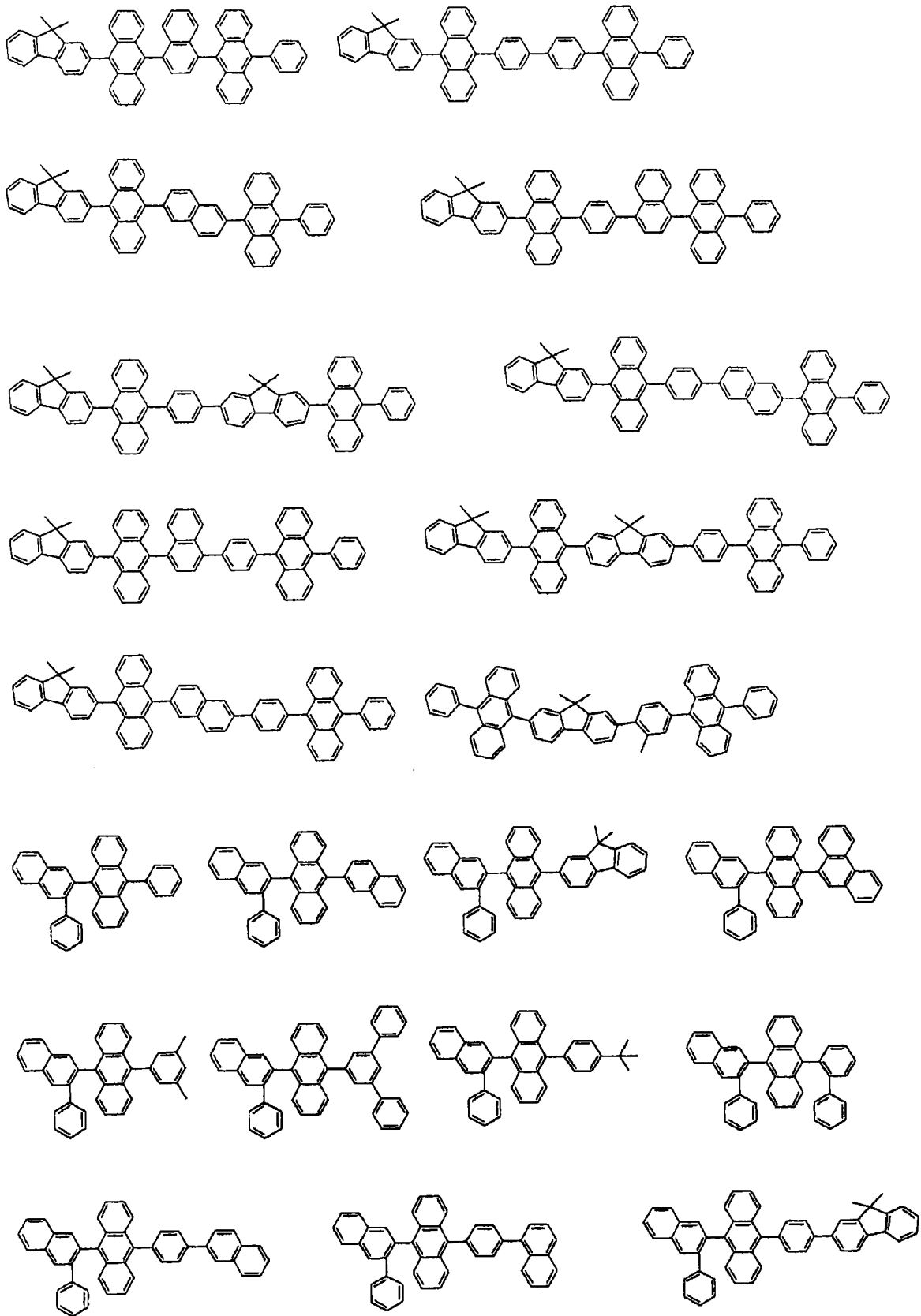


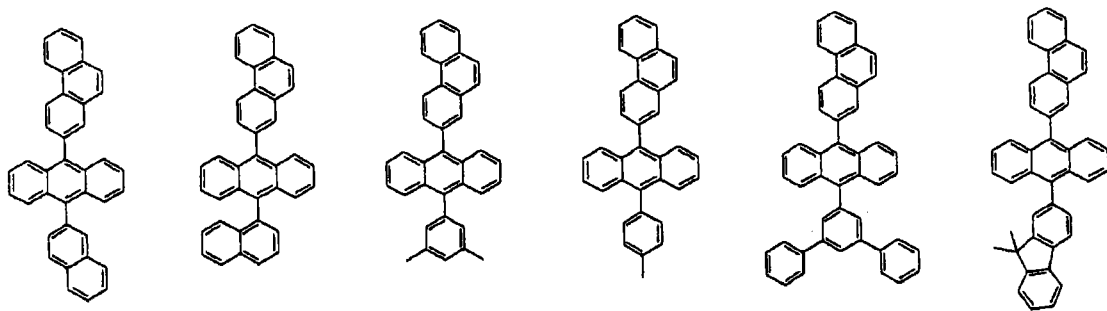
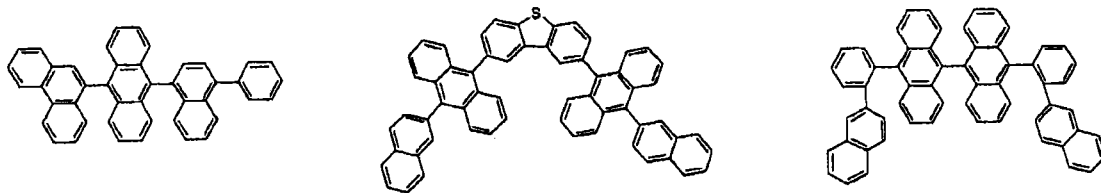
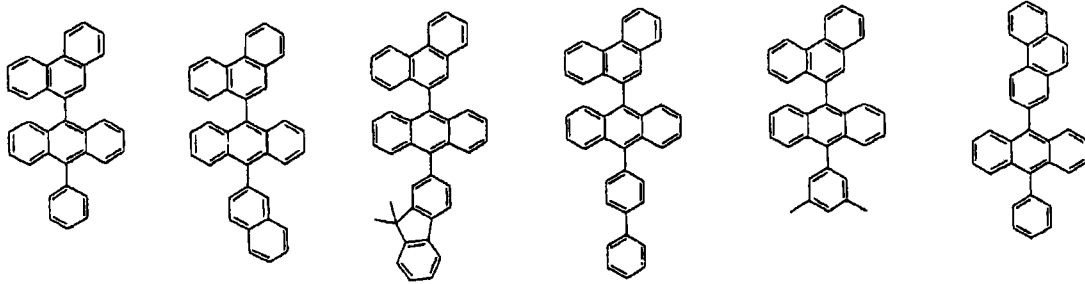
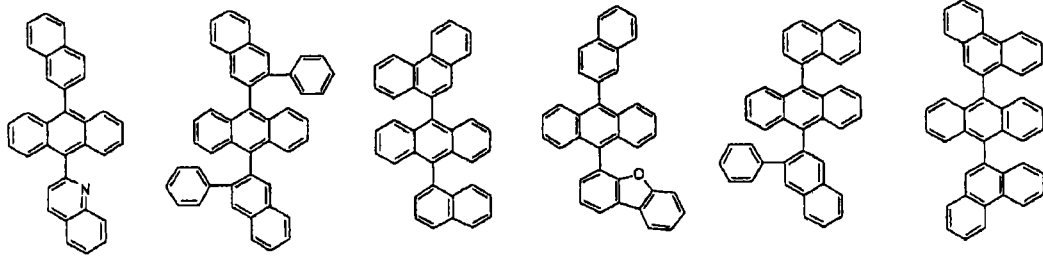
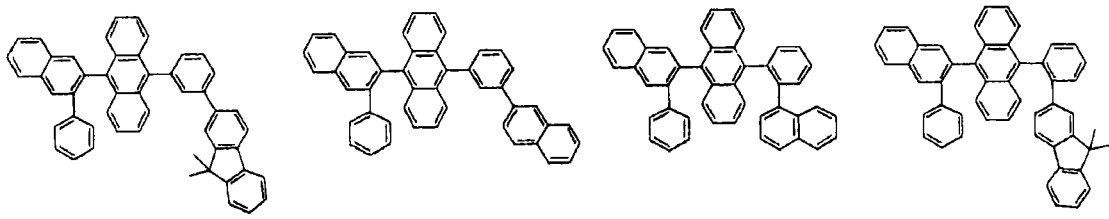


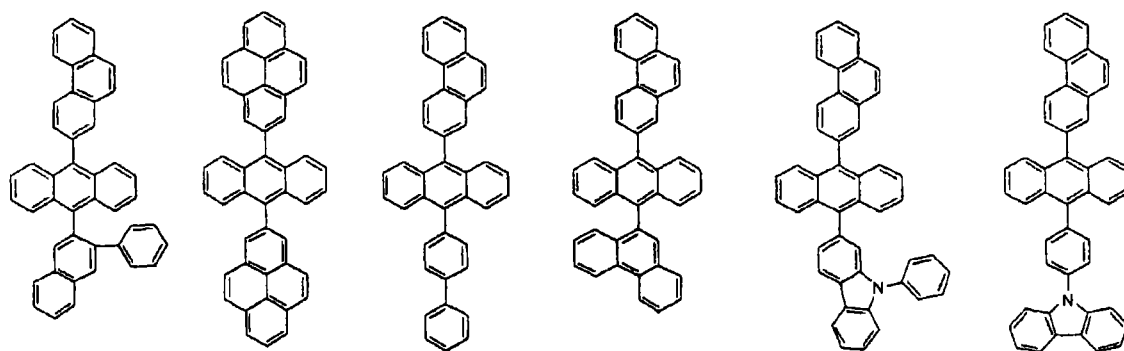












在根据本发明的有机电致发装置中，在电极对的至少一侧的内表面上，优选放置一个或多个层（在下文，称作“表面层”），所述层选自硫属元素化物层、金属卤化物层和金属氧化物层。特别是，优选在 EL 介质层的阳极表面上设置硅和铝金属的硫属元素化物（包括氧化物）层，和在 EL 介质层的阴极表面上设置金属卤化物层或金属氧化物层。结果是，可以获得操作稳定性。

硫属元素化物的例子优选包括  $\text{SiO}_x$  ( $1 \leq x \leq 2$ )、 $\text{AlO}_x$  ( $1 \leq x \leq 1.5$ )、 $\text{SiON}$ 、 $\text{SiAlON}$  等等。金属卤化物的例子优选包括  $\text{LiF}$ 、 $\text{MgF}_2$ 、 $\text{CaF}_2$ 、镧系氟化物等等。金属氧化物的例子优选包括  $\text{Cs}_2\text{O}$ 、 $\text{Li}_2\text{O}$ 、 $\text{MgO}$ 、 $\text{SrO}$ 、 $\text{BaO}$ 、 $\text{CaO}$  等等。

在根据本发明的有机电致发光装置中，在由此制造的电极对至少一个表面上还优选排列电子传递化合物和还原掺杂剂的混合区或者空穴传输化合物和氧化掺杂剂的混合区域。因此，电子传递化合物被还原成阴离子，从而易于从混合区域向 EL 介质的电子注入和传递。另外，由于空穴传输化合物被氧化形成阳离子，因此易于从混合区域向 EL 介质的空穴注入和传输。优选氧化掺杂剂包括各种路易斯酸和受体化合物。优选还原掺杂剂包括碱金属、碱金属化合物、碱土金属、稀土金属和它们的混合物。

根据本发明的有机电致发光化合物，具有比常规磷光材料更优秀的 EL 性质和热稳定性的主链，提供了与常规材料更高的量子效率和更低的操作电压。因此，如果在 OLED 面板中使用根据本发明的化合物，则在具有中至大型 OLED 研究中可以预期进一步提高的结果。如果在有机太阳能电池中使用这些化合物作为高效材料，则在可以预期比常规材料更优异的特性。

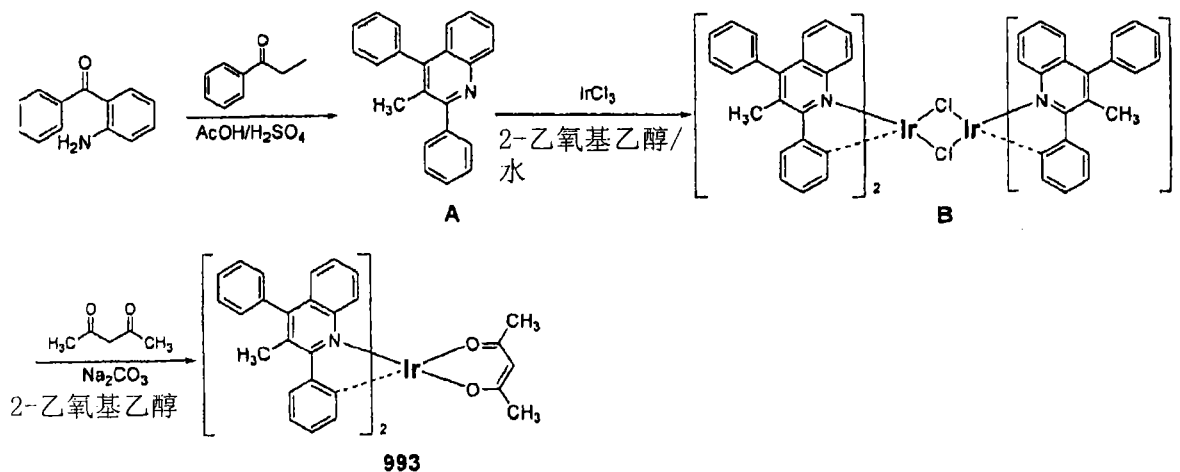
#### 最佳方式

本发明进一步描述了制备根据本发明的新的化合物的方法，其仅用于更好

的理解本发明，但这并不意味着对本发明范围的限制。

### 制备实施例

#### (制备实施例1) 化合物(993)的制备



#### 化合物(A)的制备

在反应容器中充入2-氨基二苯甲酮(10.0 g, 50.7 mmol)、1-甲基苯乙酮(6.7 mL, 50.7 mmol)、冰醋酸(169 mL)和硫酸(10滴)，在氩气氛围回流条件下搅拌混合物。当反应完成时，冷却混合物至室温。在其中加入过量氢氧化铵水溶液，过滤生成的固体，用蒸馏水洗涤。经由柱层析提纯得到化合物(A)(8.9 g, 60%)。

#### 化合物(B)的制备

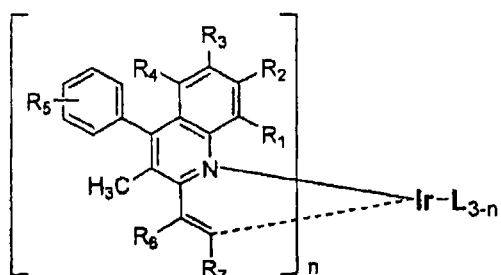
在反应容器中充入化合物(A)(7.0 g, 23.7 mmol)、氯化铱(3.2 g, 10.8 mmol)、2-乙氧基乙醇(36 mL)和蒸馏水(12 mL)，在氩气氛围回流条件下加热混合物24h。当反应完成时，冷却混合物至室温。过滤沉淀并彻底干燥得到化合物(B)(4.0 g, 71%)。

#### 化合物(993)的制备

在2-乙氧基乙醇(100 mL)中溶解化合物(B)(4.0 g, 3.9 mmol)、2,4-戊二酮(0.79 mL, 7.7 mmol)和碳酸钠(2.1 g, 19.3 mmol)，获得的溶液加热4小时。当反应完成时，冷却反应混合物至室温，过滤生成的固体沉淀。经由硅胶柱色谱提纯和重结晶得到红色晶体化合物(993)(1.7 g, 25%)。

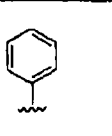
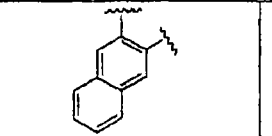
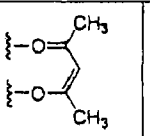
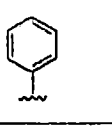
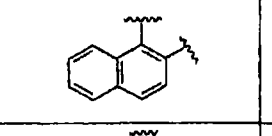
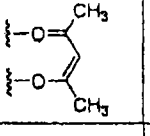
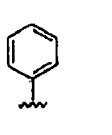
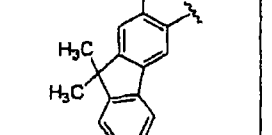
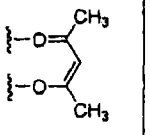
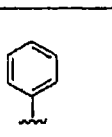
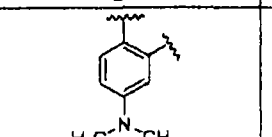
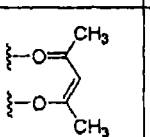
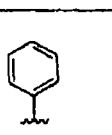
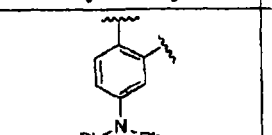
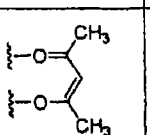
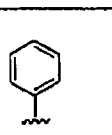
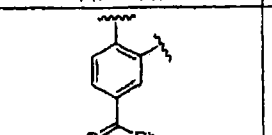
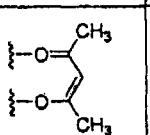
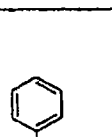
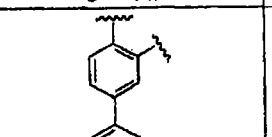
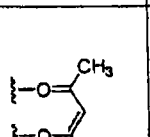
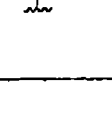
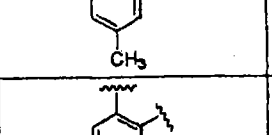
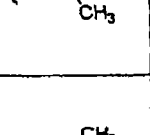
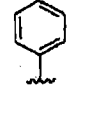
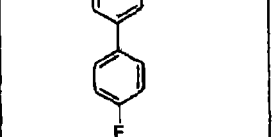
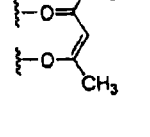
根据制备实施例 1 相同的步骤, 制备得到表 1 的有机磷光化合物 (化合物 1 至化合物 1004), 表 2 中列出了其  $^1\text{H}$ NMR 和 MS/FAB 数据。


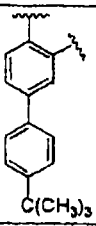
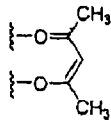

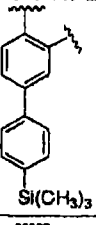
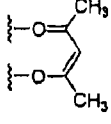

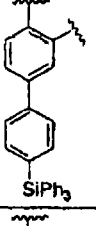
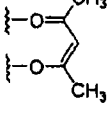

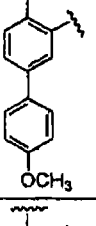
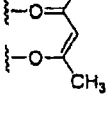

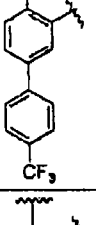
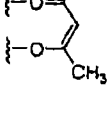

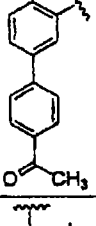
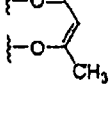

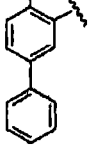
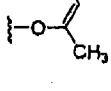
表 1


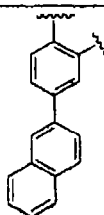
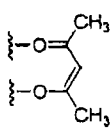

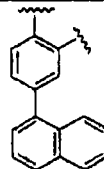
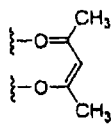

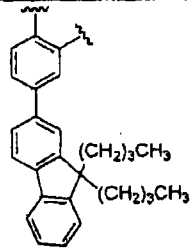
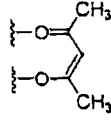

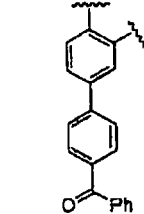
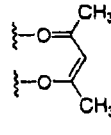

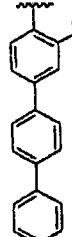
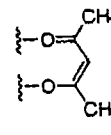

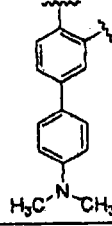
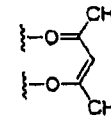

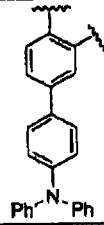
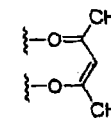



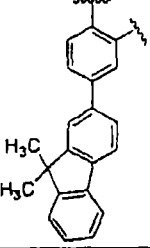
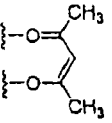

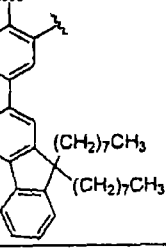
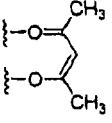

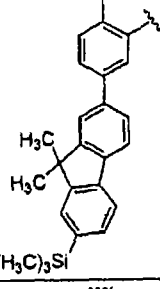
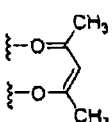

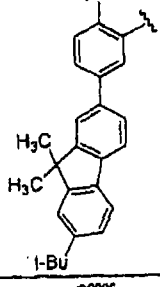
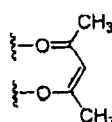

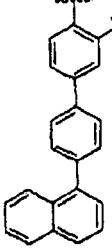
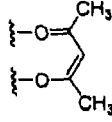
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
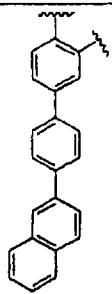
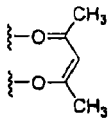

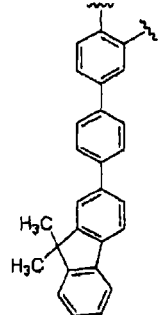
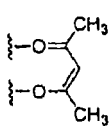

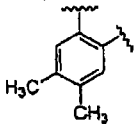
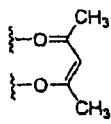

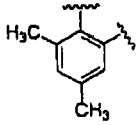
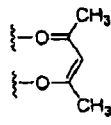

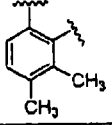
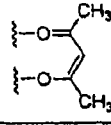

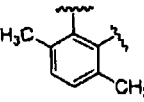
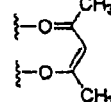

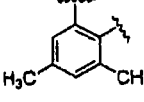
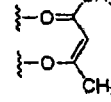

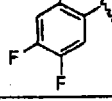
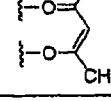

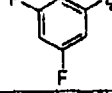
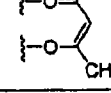



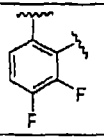
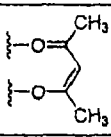

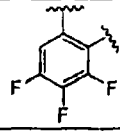
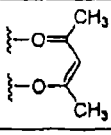

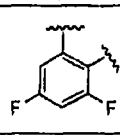
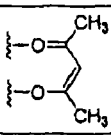

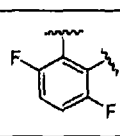
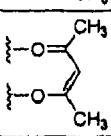

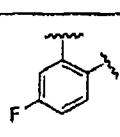
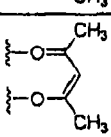

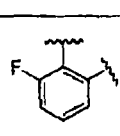
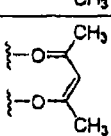

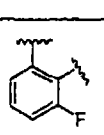
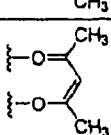

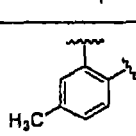
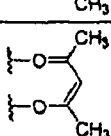

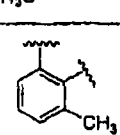
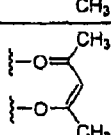

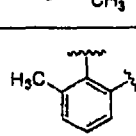
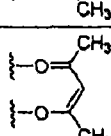

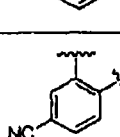
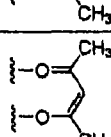

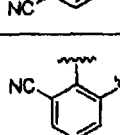
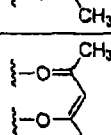
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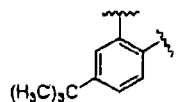
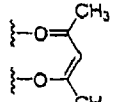

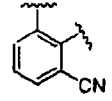
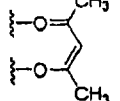

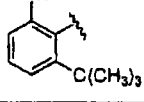
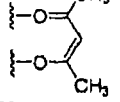

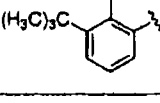
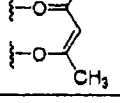

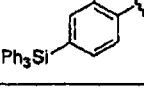
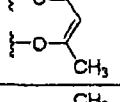
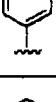
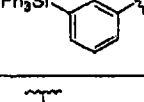
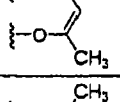

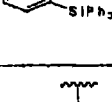
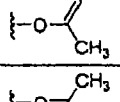
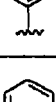
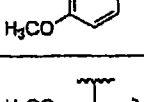
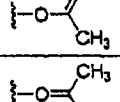

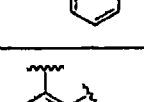
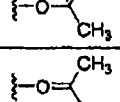
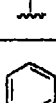
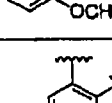
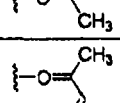
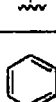
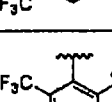
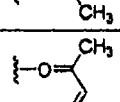

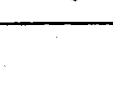
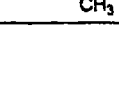
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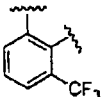
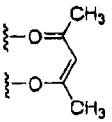

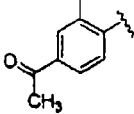
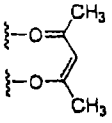

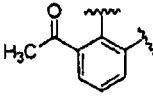
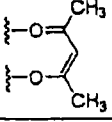

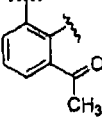
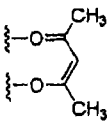

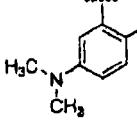
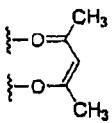

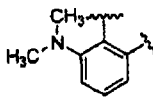
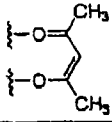

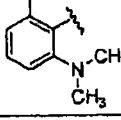
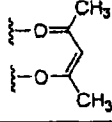

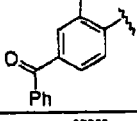
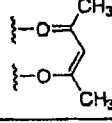

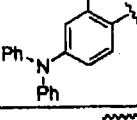
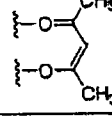

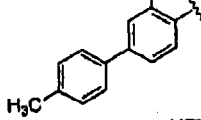
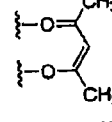

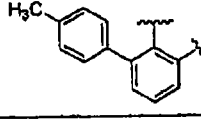
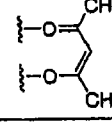

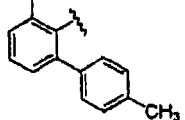
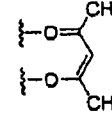
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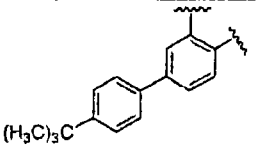
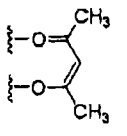

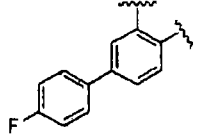
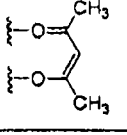

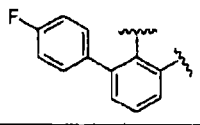
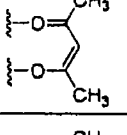

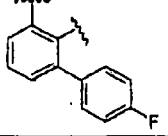
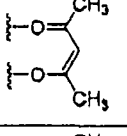

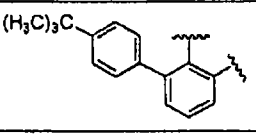
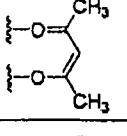

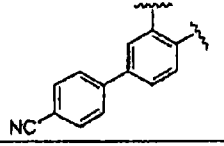
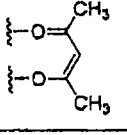

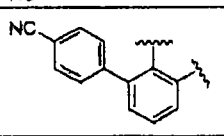
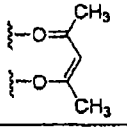

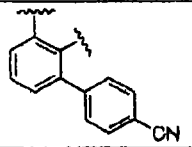
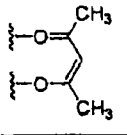

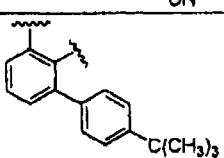
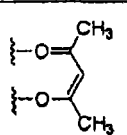

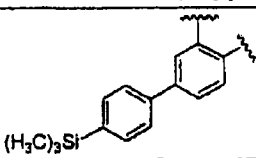
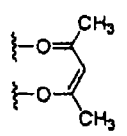

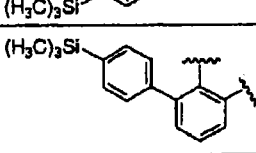
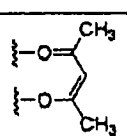
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
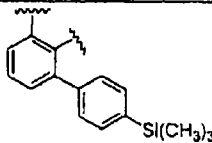
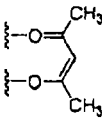

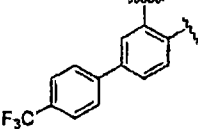
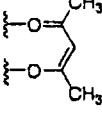

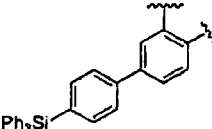
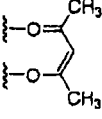

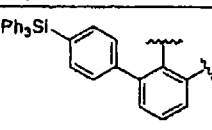
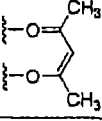

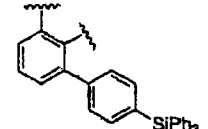
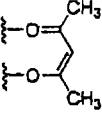

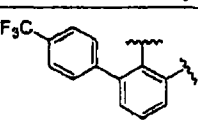
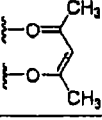

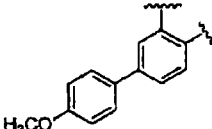
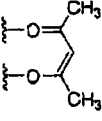

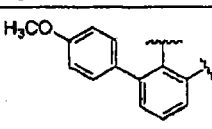
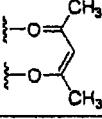

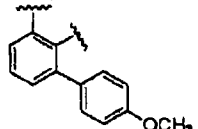
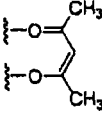

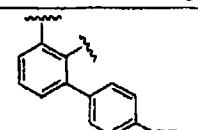
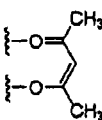

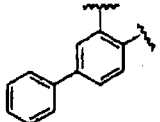
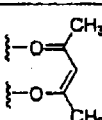
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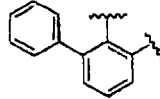
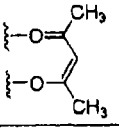

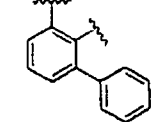
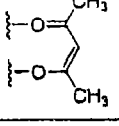

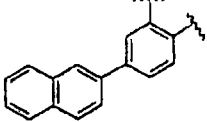
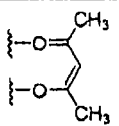
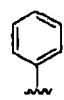
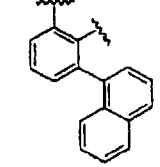
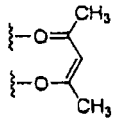

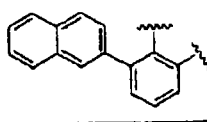
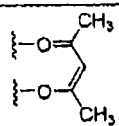
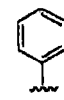
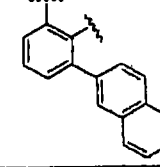
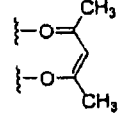

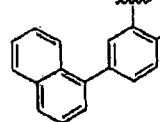
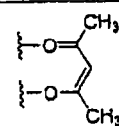

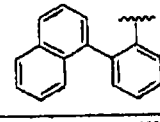
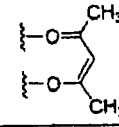
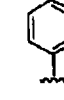
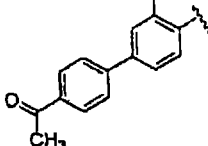
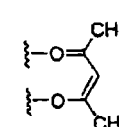

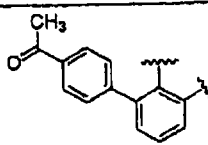
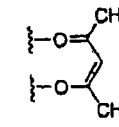
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
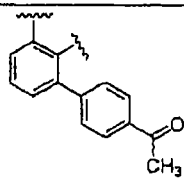
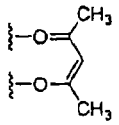

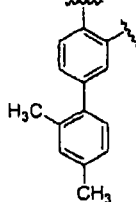
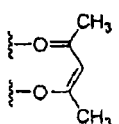

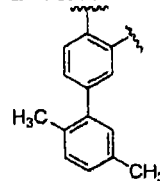
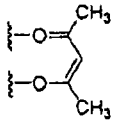

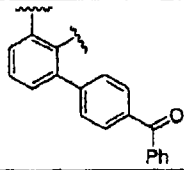
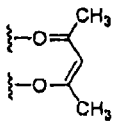

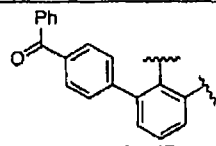
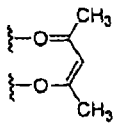

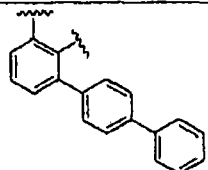
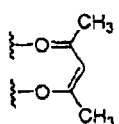

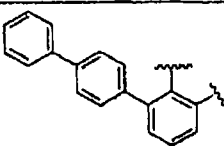
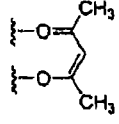

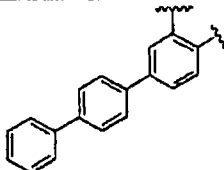
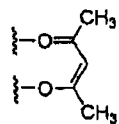

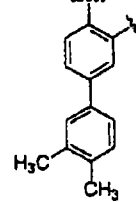
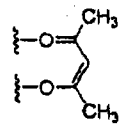
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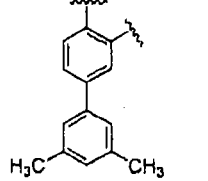
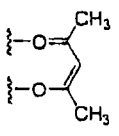

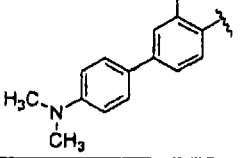
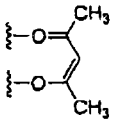

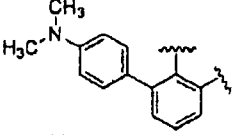
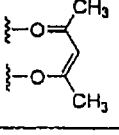

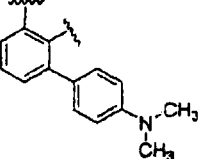
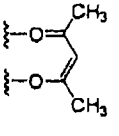

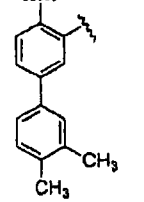
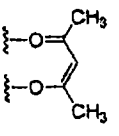

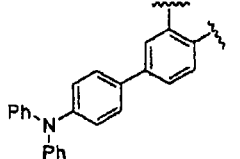
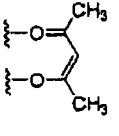

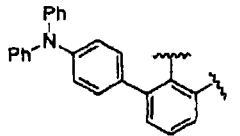
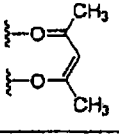

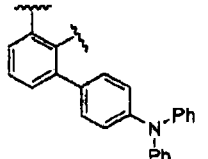
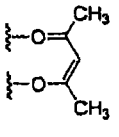

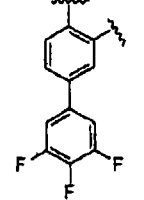
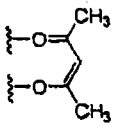



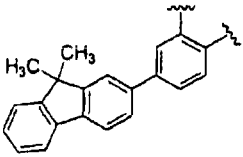
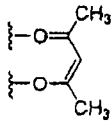

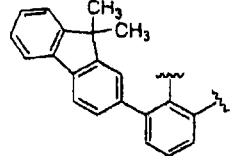
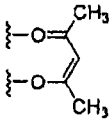

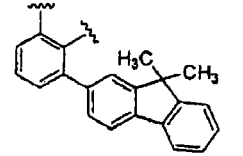
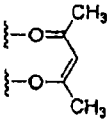

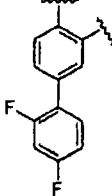
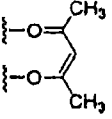

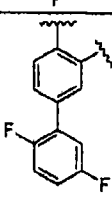
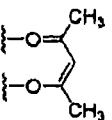

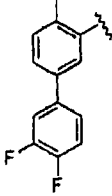
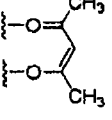

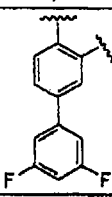
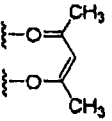

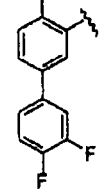
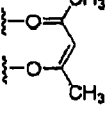
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
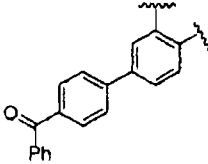
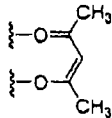

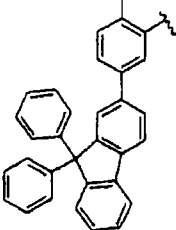
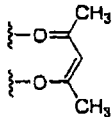

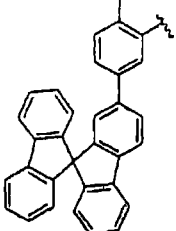
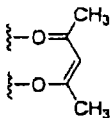

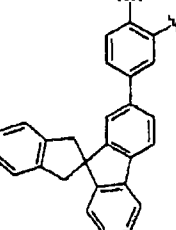
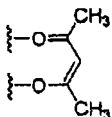

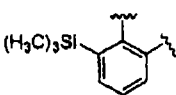
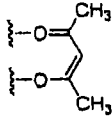

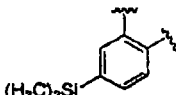
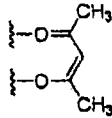

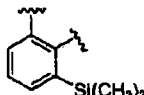
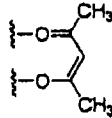

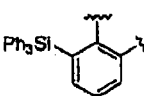
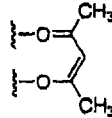

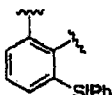
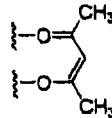
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
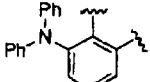
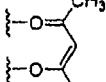

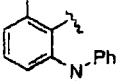
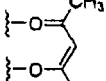

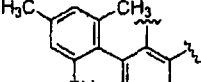
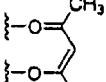

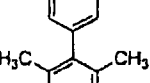
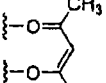


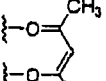

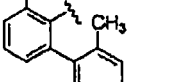
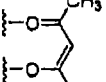

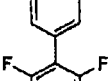
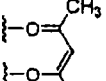

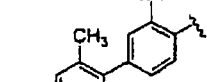
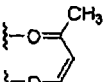

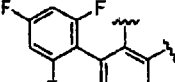
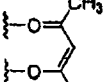

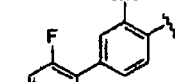
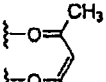
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
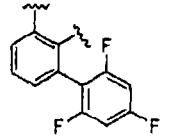
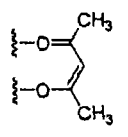

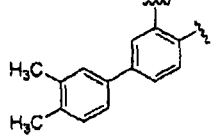
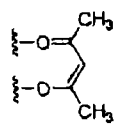

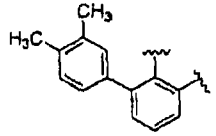
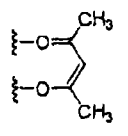

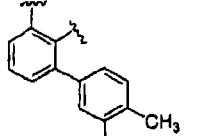
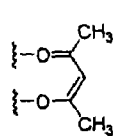

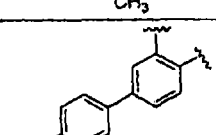
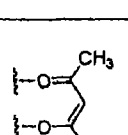

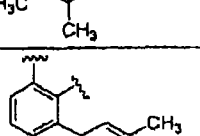
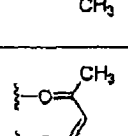

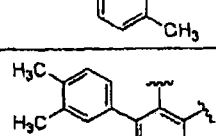
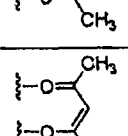

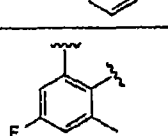
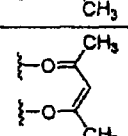

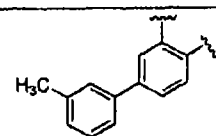
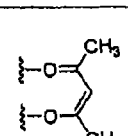

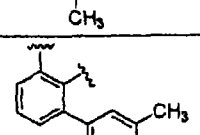
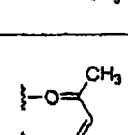
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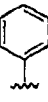
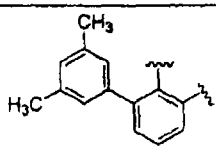
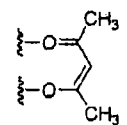
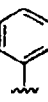
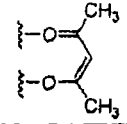
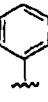
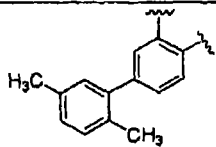
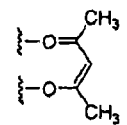
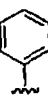
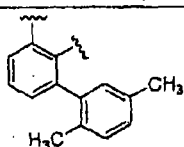
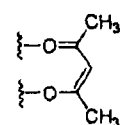
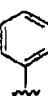
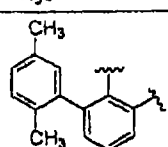
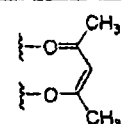
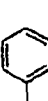
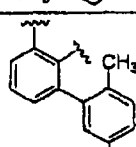
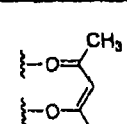

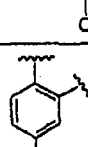
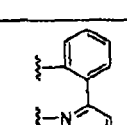

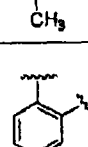
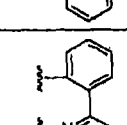
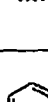
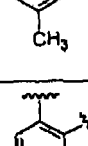
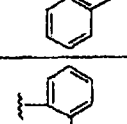
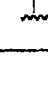
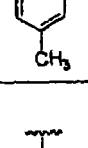
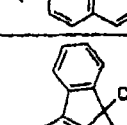
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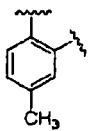
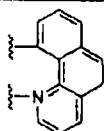

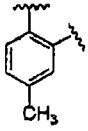
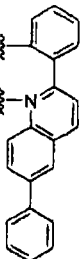

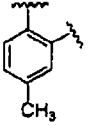
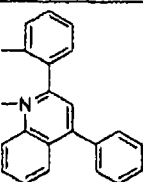

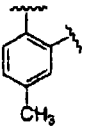
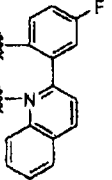

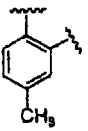
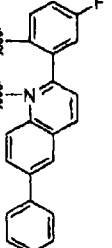

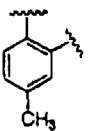
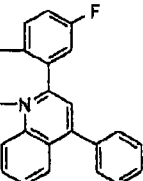

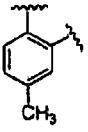
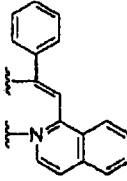

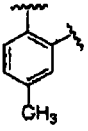
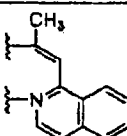
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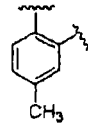
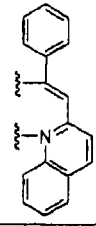

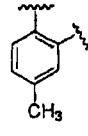
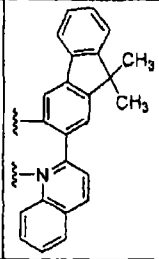

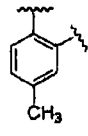
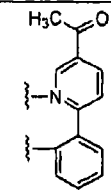

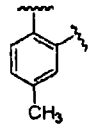
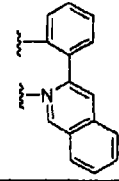

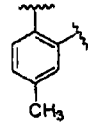
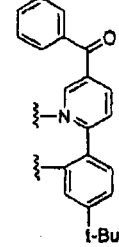

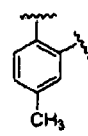
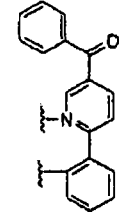

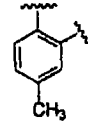
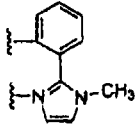
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
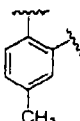
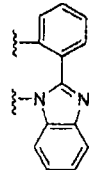

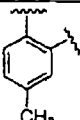
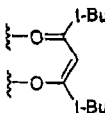

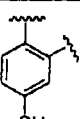
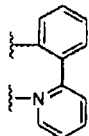

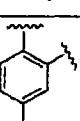
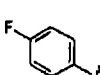
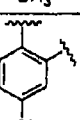
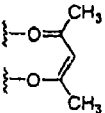
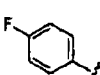
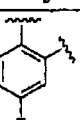
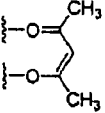
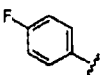
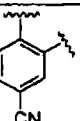
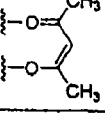
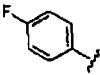
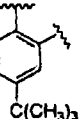
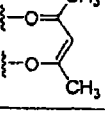
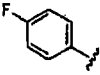
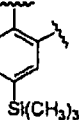
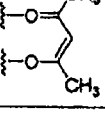
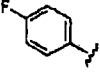
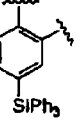
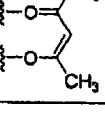
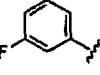
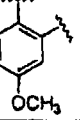
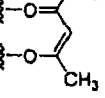


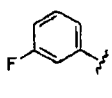
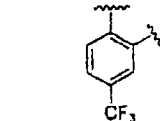
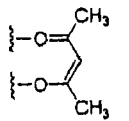
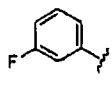
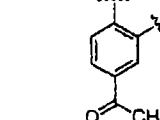
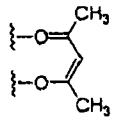
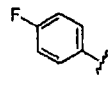
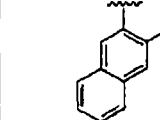
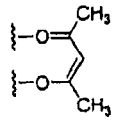
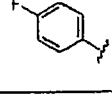
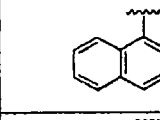
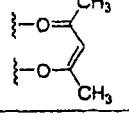
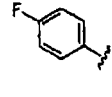
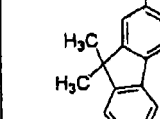
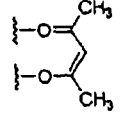
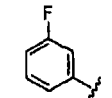
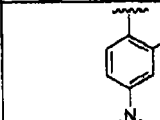
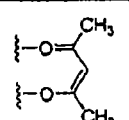
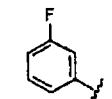
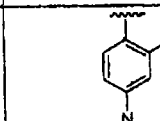
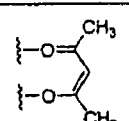
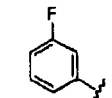
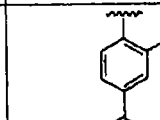
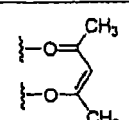
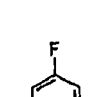
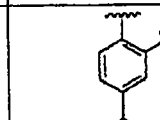
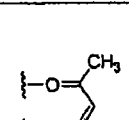
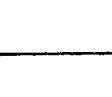
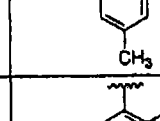
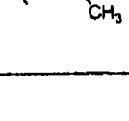
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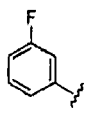
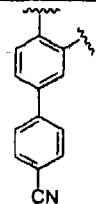
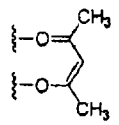
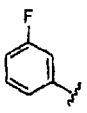
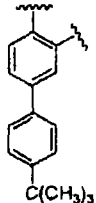
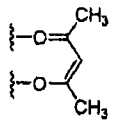
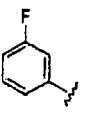
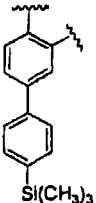
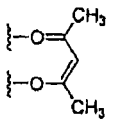
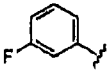
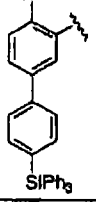
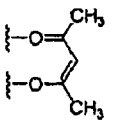
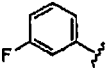
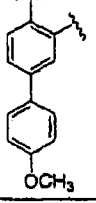
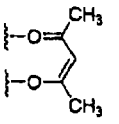
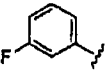
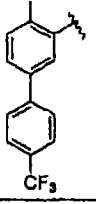
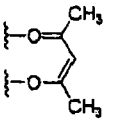
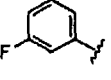
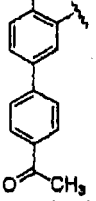
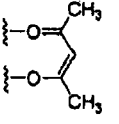
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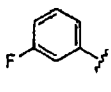
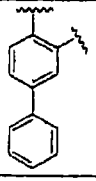
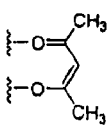
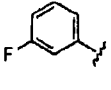
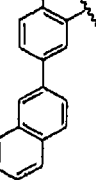
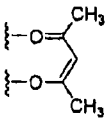
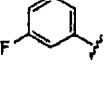
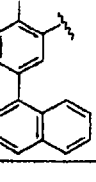
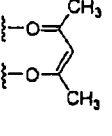
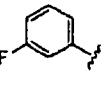
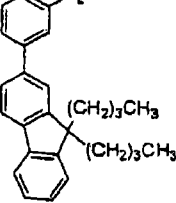
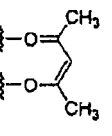
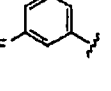
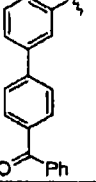
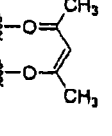
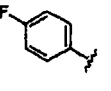
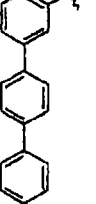
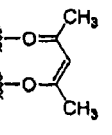
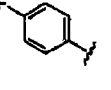
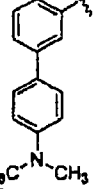
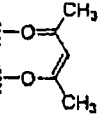
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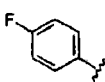
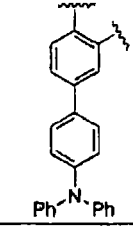
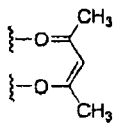
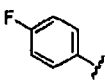
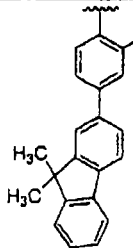
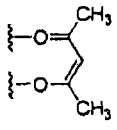
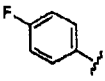
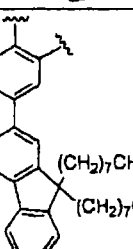
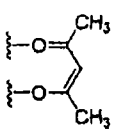
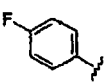
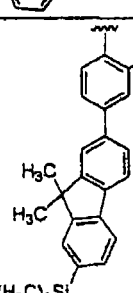
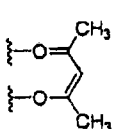
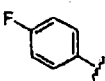
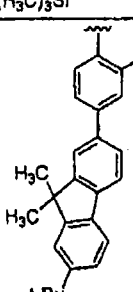
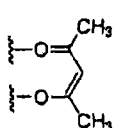
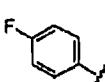
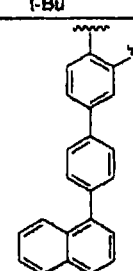
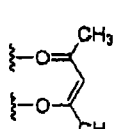
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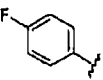
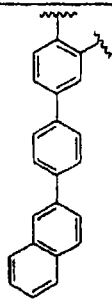
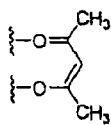
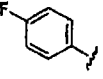
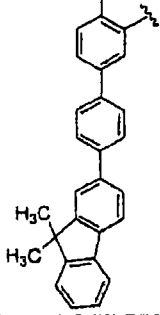
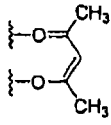
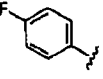
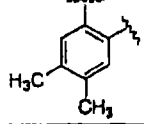
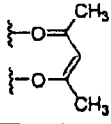
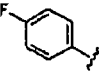
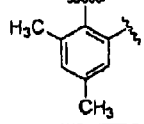
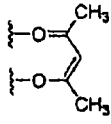
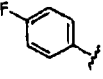
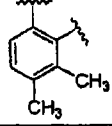
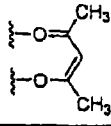
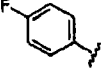
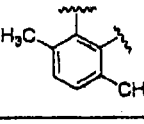
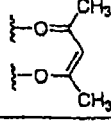
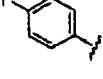
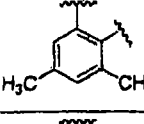
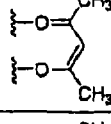
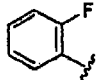
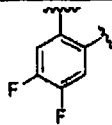
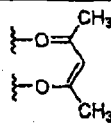
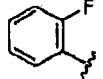
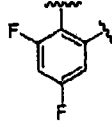
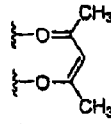
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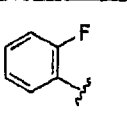
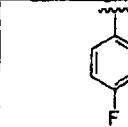
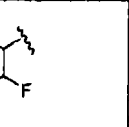
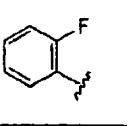
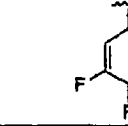
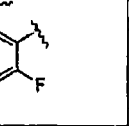
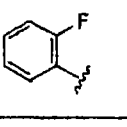
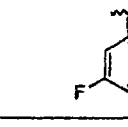
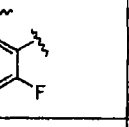
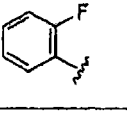
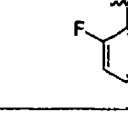
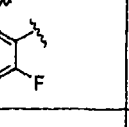
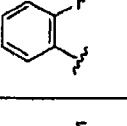
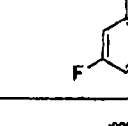
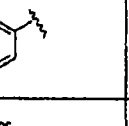
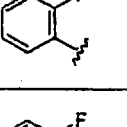
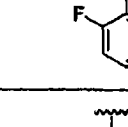
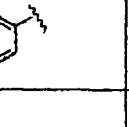
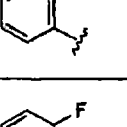
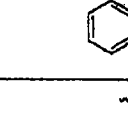
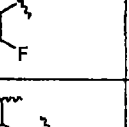
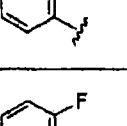
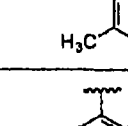

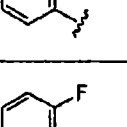
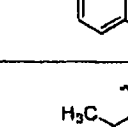
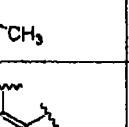
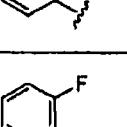
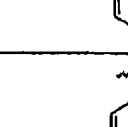
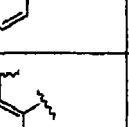
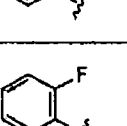
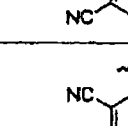
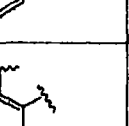
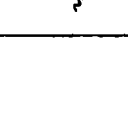
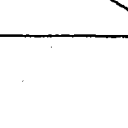
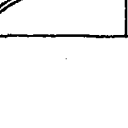
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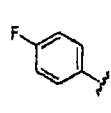
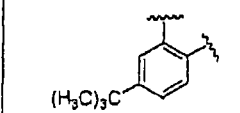
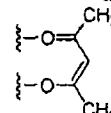
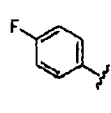
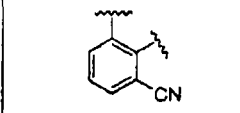
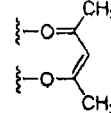
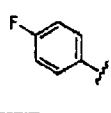
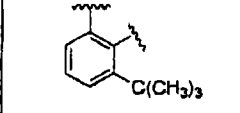
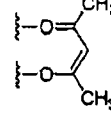
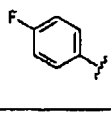
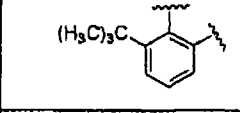
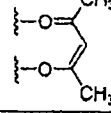
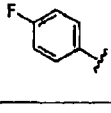
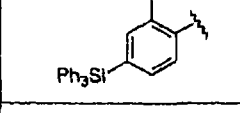
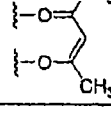
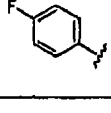
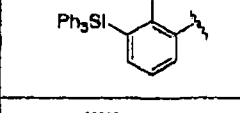
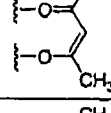
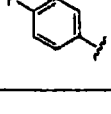
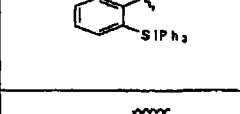
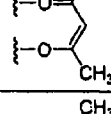
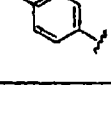
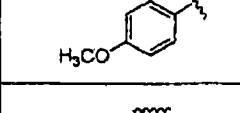
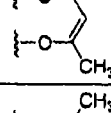
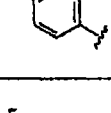
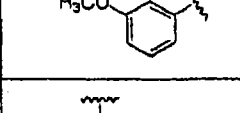
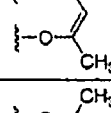
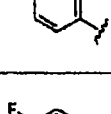
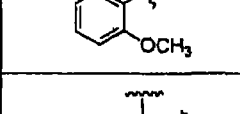
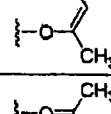
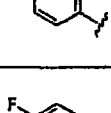
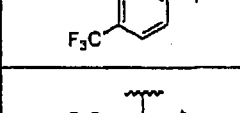
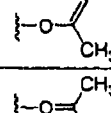
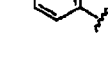

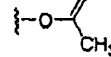
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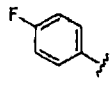
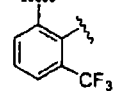
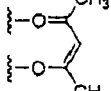
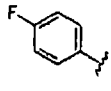
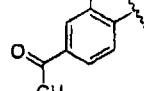
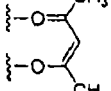
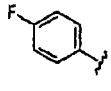
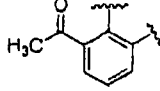
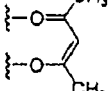
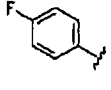
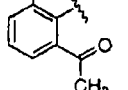
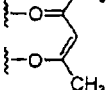
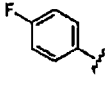
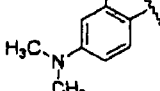
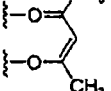
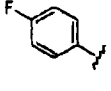
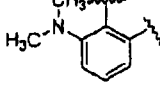
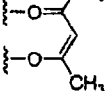
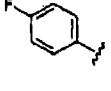
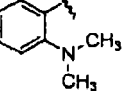
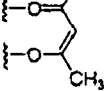
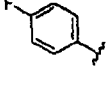
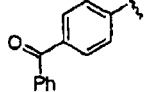
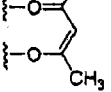
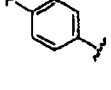
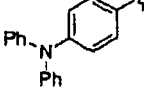
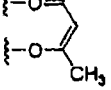
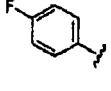
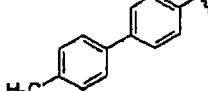
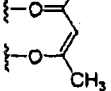
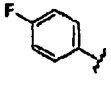
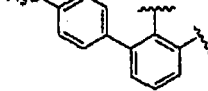
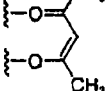
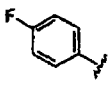
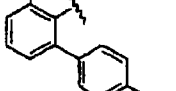
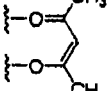


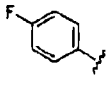
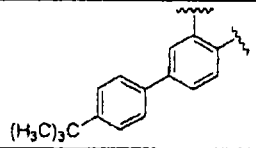
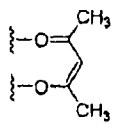
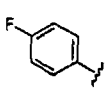
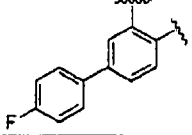
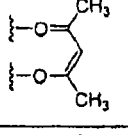
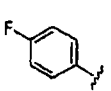
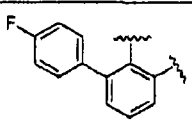
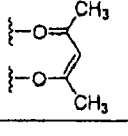
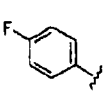
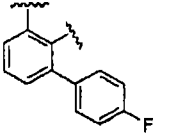
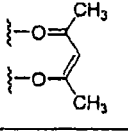
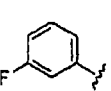
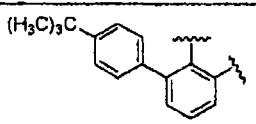
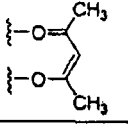
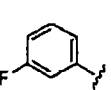
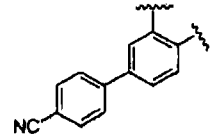
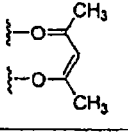
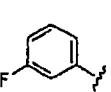
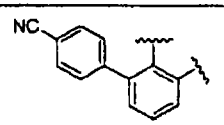
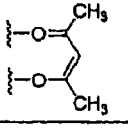
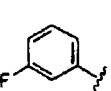
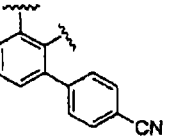
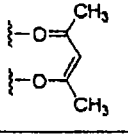
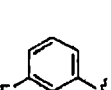
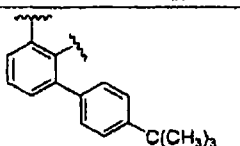
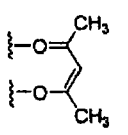

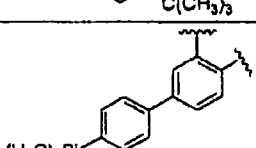
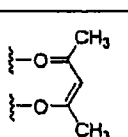

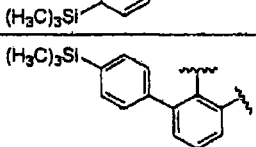
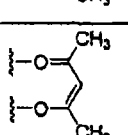
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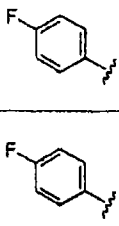
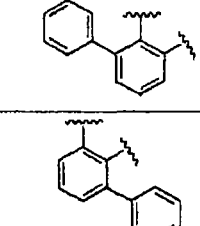
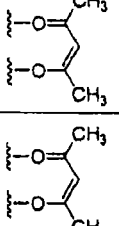
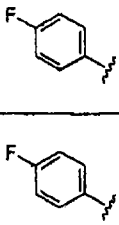
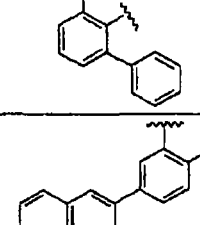
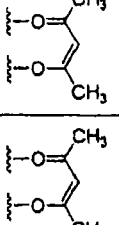
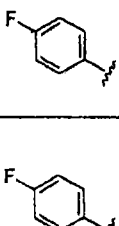
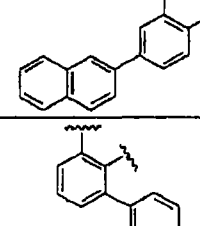
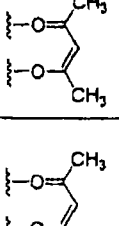
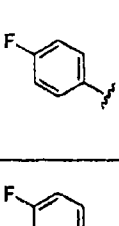
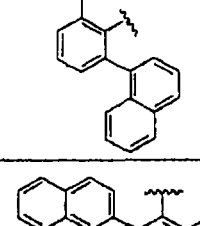
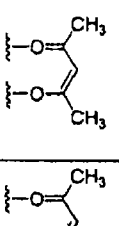
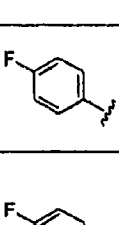
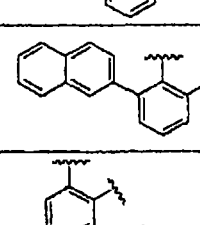
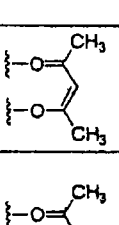
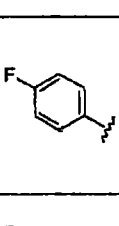
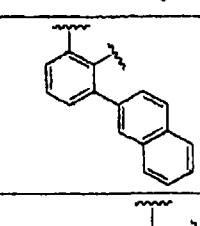
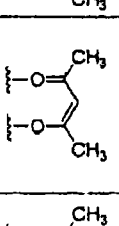
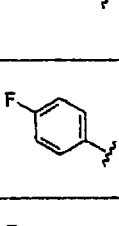
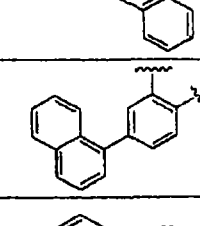
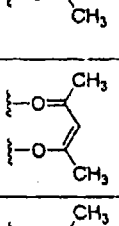
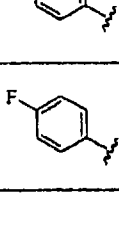
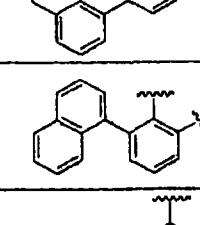
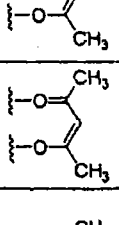
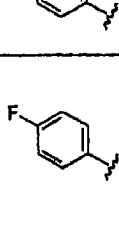
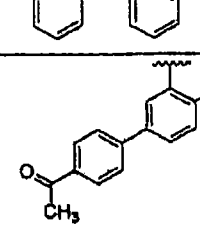
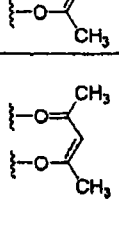
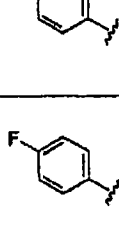
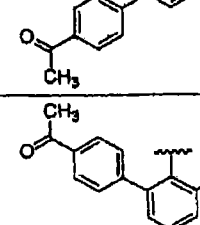
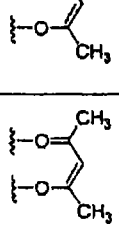
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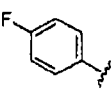
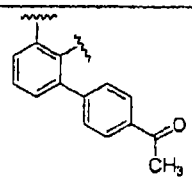
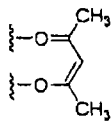
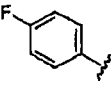
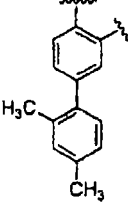
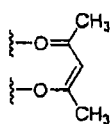
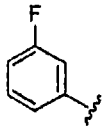
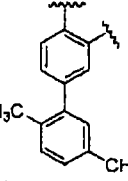
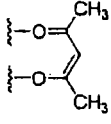
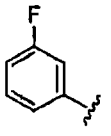
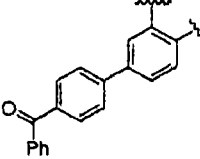
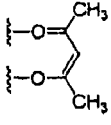
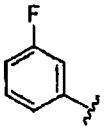
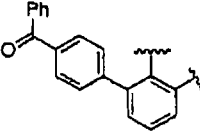
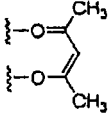
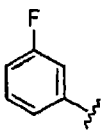
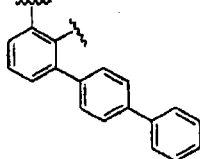
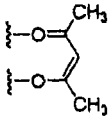
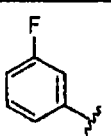
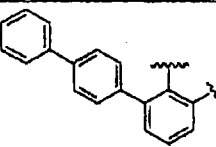
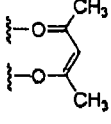
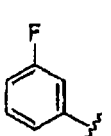
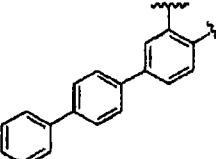
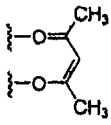
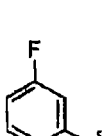
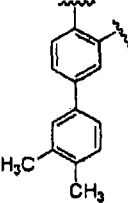
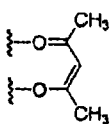
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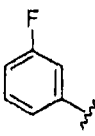
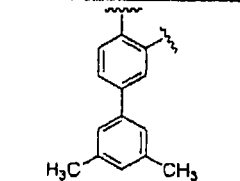
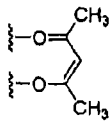
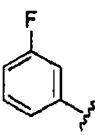
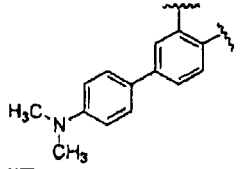
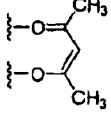
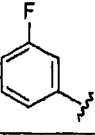
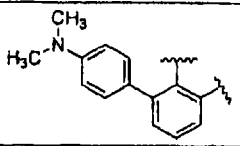
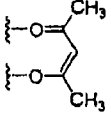
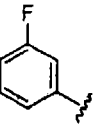
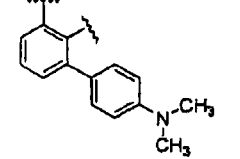
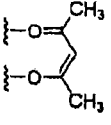
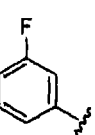
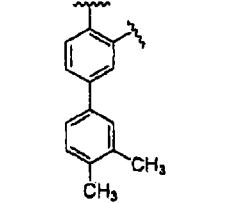
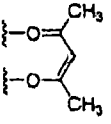
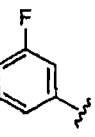
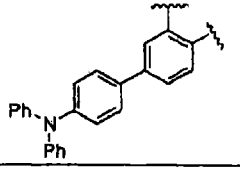
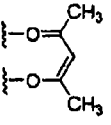
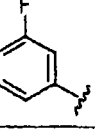
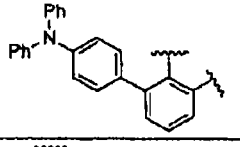
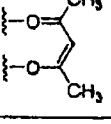
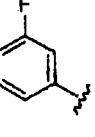
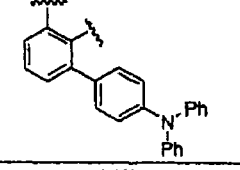
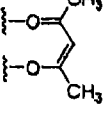
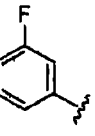
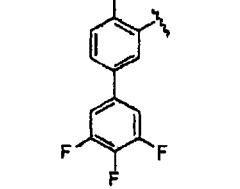
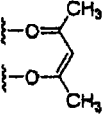
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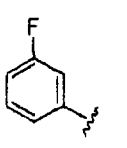
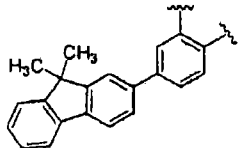
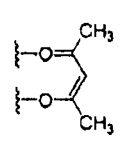
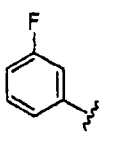
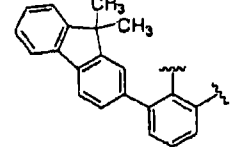
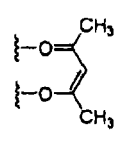
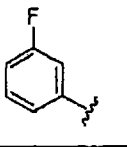
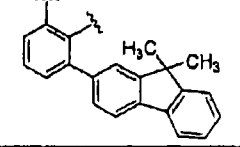
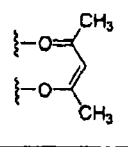
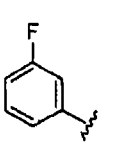
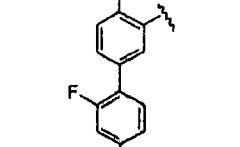
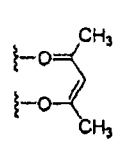
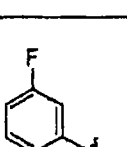
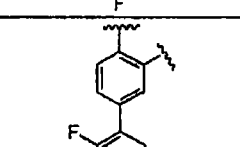
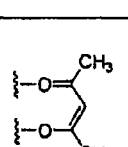
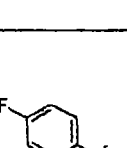
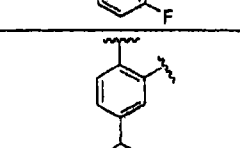
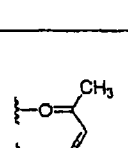
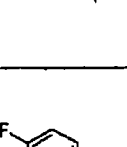
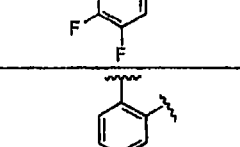
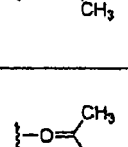
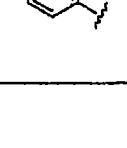
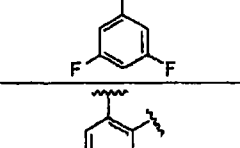
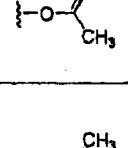
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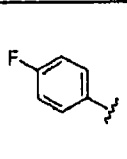
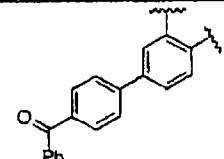
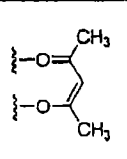
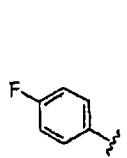
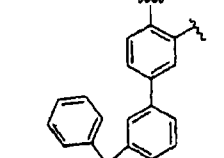
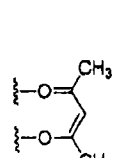

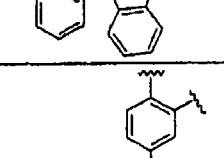
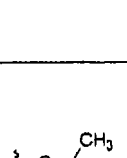
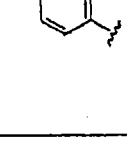
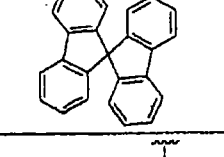
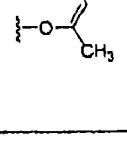
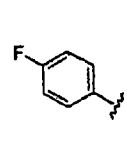
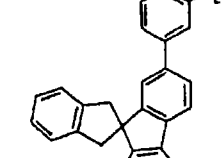
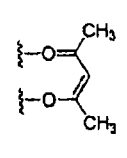
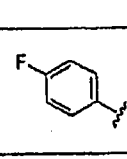
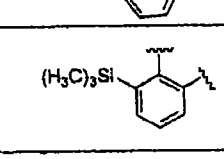
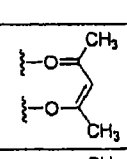
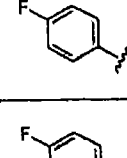
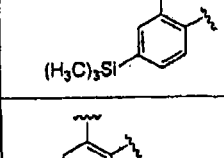
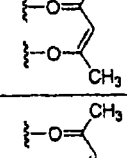
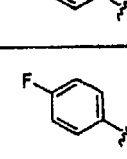
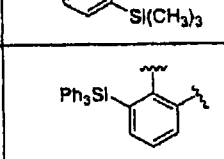
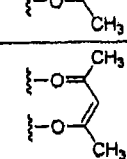
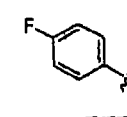
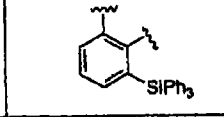
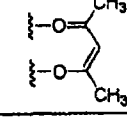
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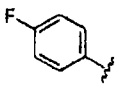
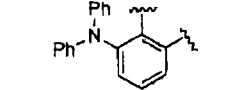
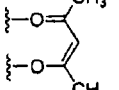
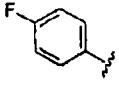
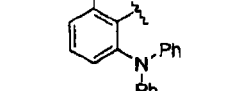
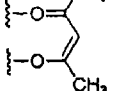
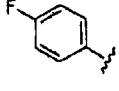
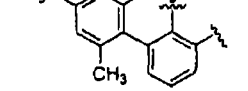
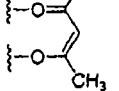
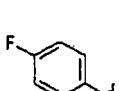
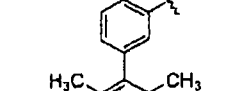
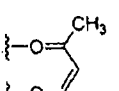
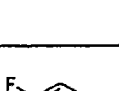
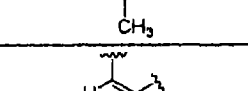
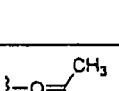
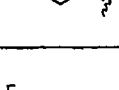
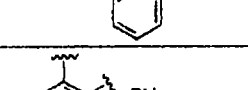
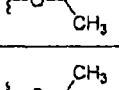
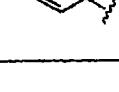
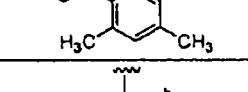
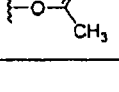
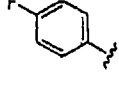
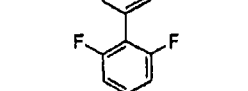
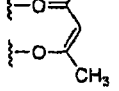
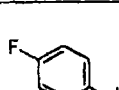
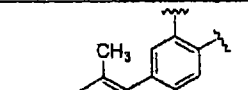
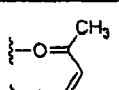
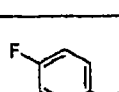
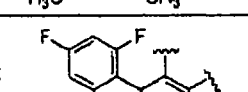
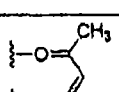


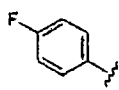
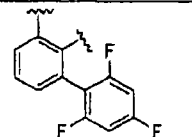
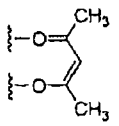
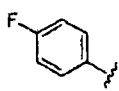
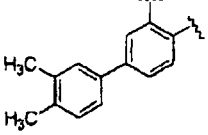
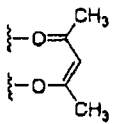
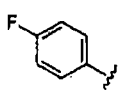
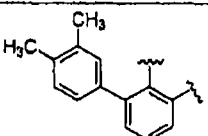
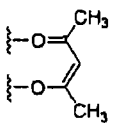
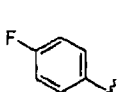
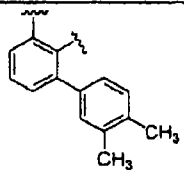
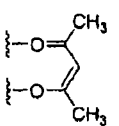
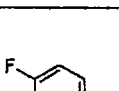
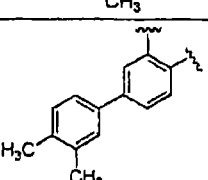
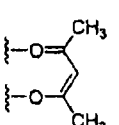
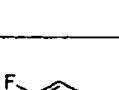
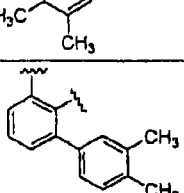
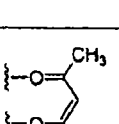
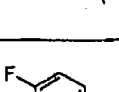
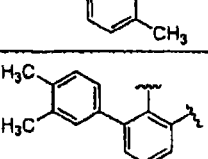
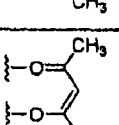
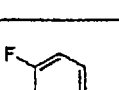
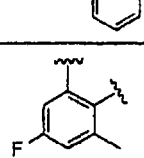
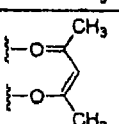
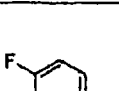
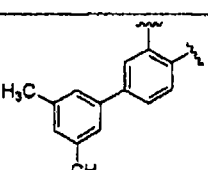
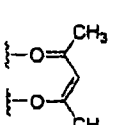
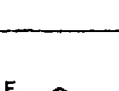
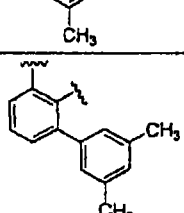
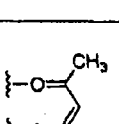
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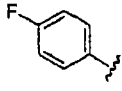
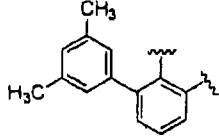
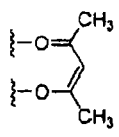
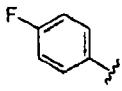
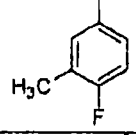
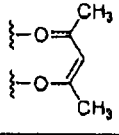
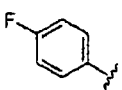
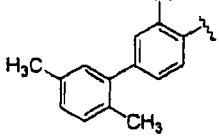
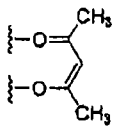
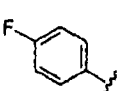
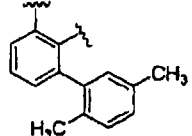
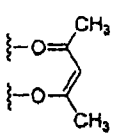
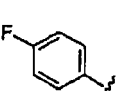
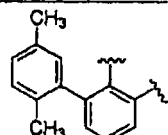
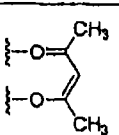
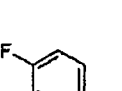
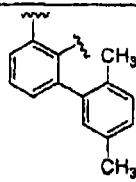
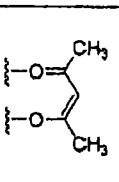
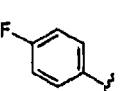
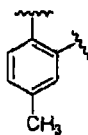
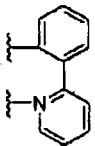
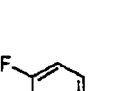
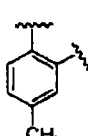
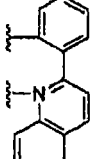
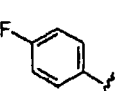
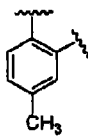
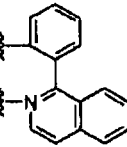
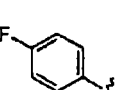
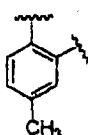
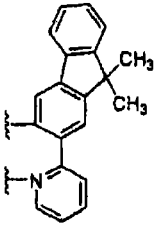
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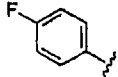
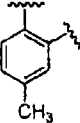
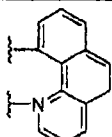
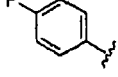
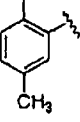
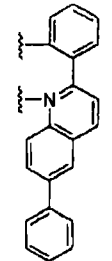
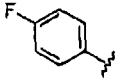
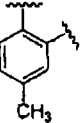
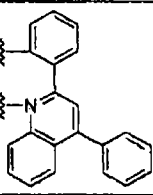
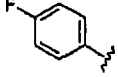
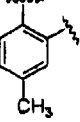
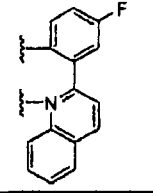
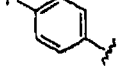
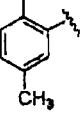
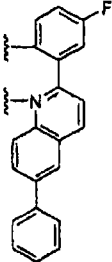
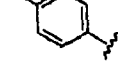
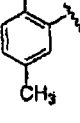
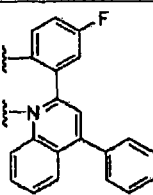
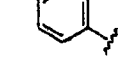
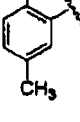
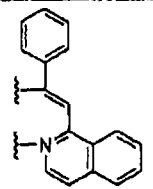
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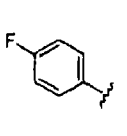
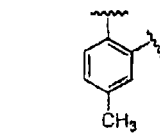
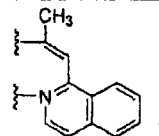
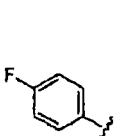
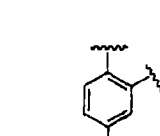
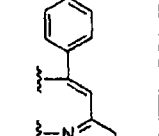

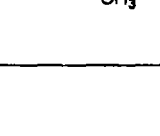
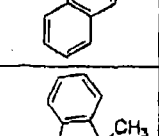
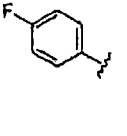
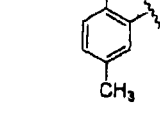
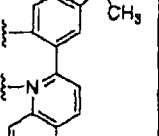
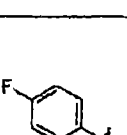
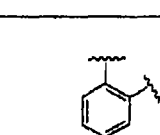
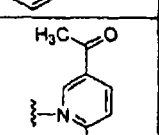
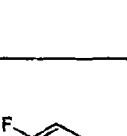
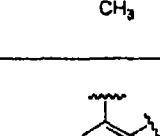
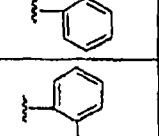
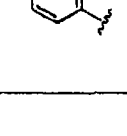
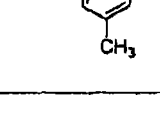
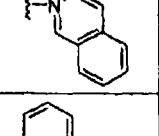
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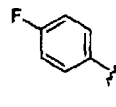
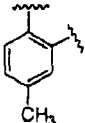
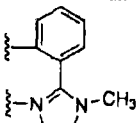
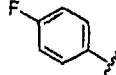
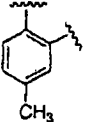
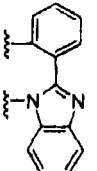
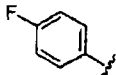
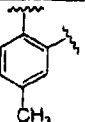
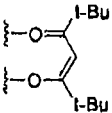
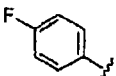
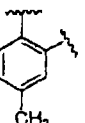
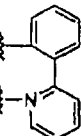
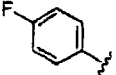
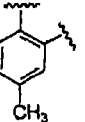
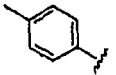
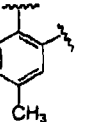
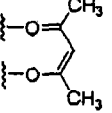
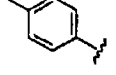
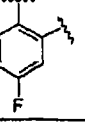
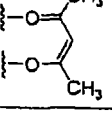
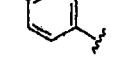
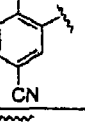
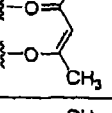
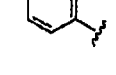
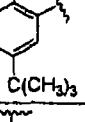
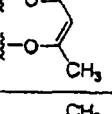
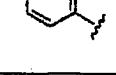
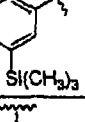
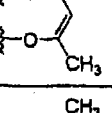
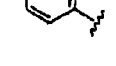

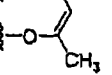
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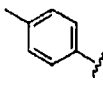
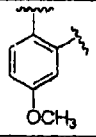
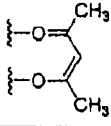
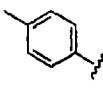
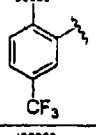
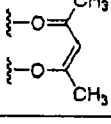
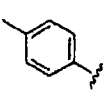
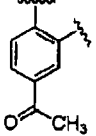
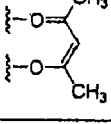
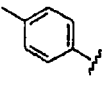
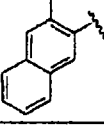
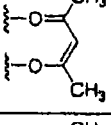
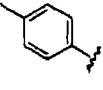
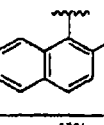
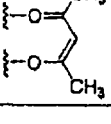
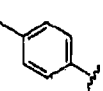
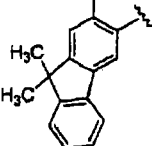
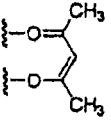
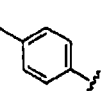
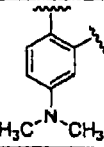
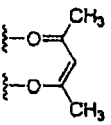
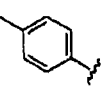
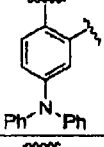
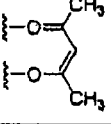
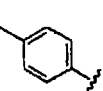
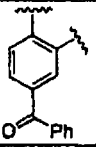
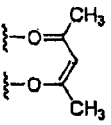
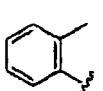
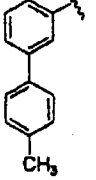
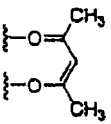
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
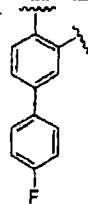
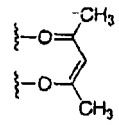

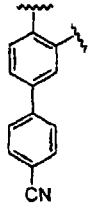
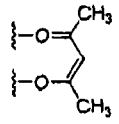

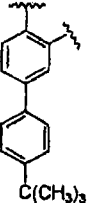
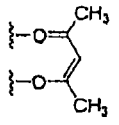

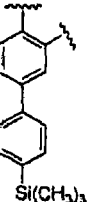
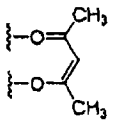

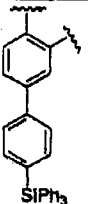
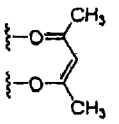

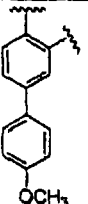
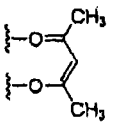

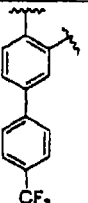
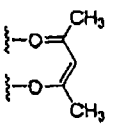
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
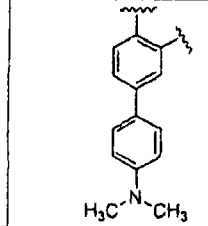
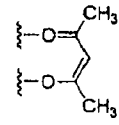

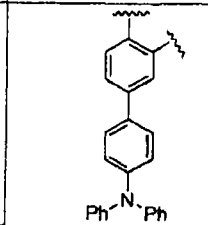
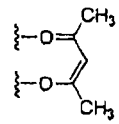

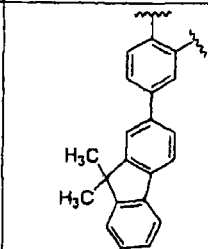
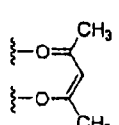

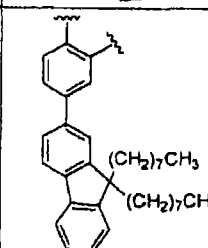
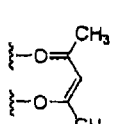

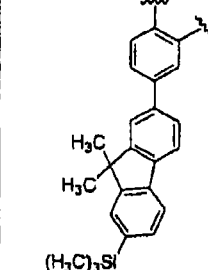
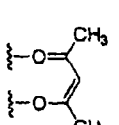

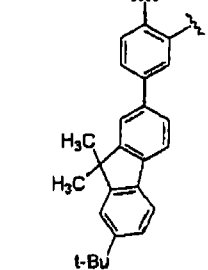
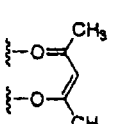
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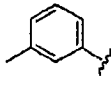
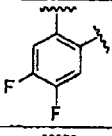
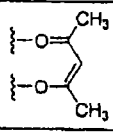
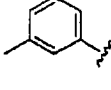
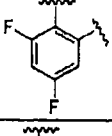
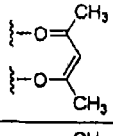
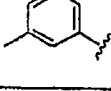
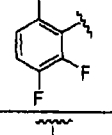
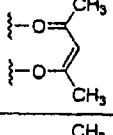
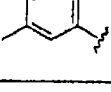
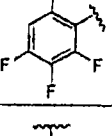
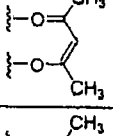
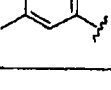
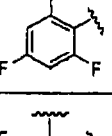
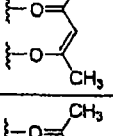
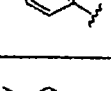
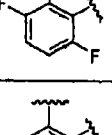
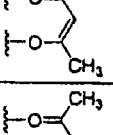
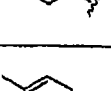
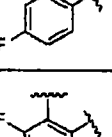
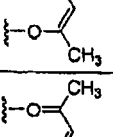
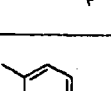
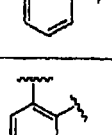
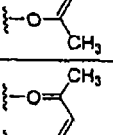
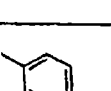
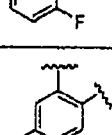
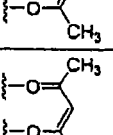
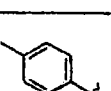
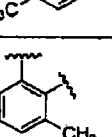
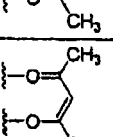
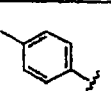
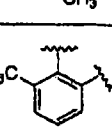
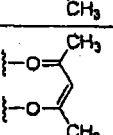



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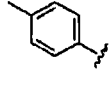

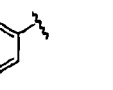
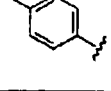

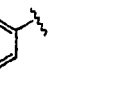
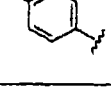
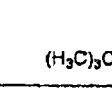
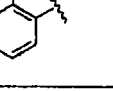
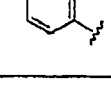
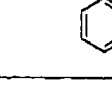
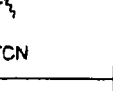
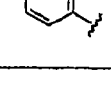
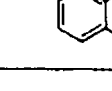
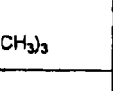
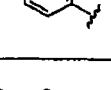
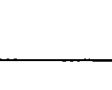
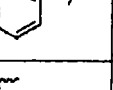
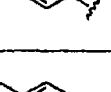
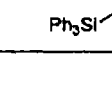
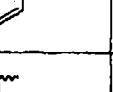
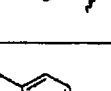
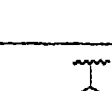
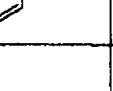
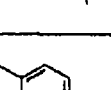
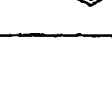
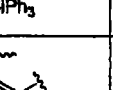
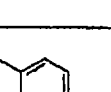
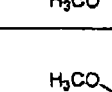
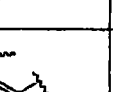
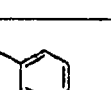
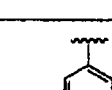
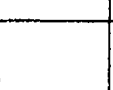

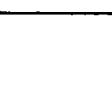
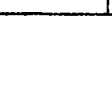
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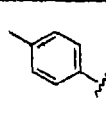
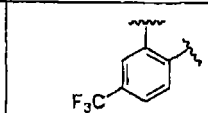
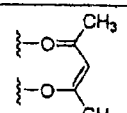
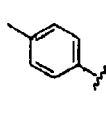
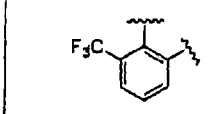
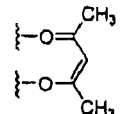
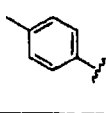
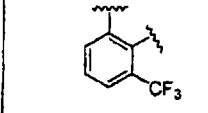
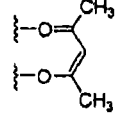
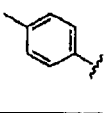
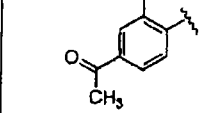
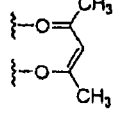
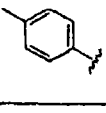
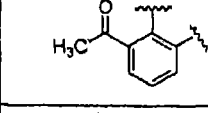
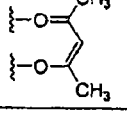
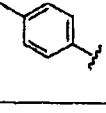
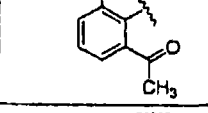
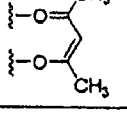
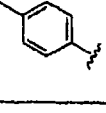
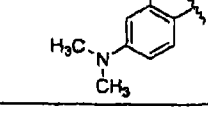
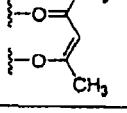
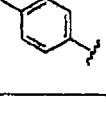
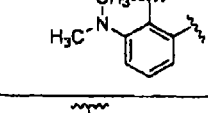
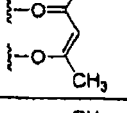
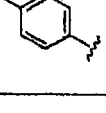
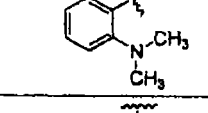
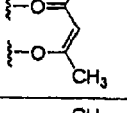
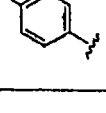
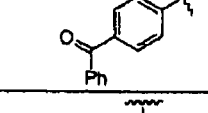
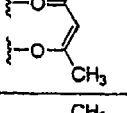
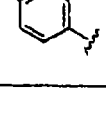
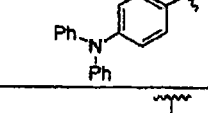
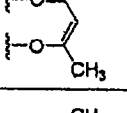
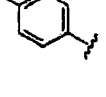
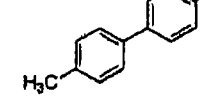
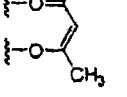
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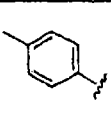
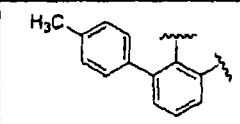
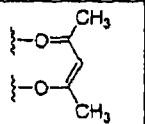
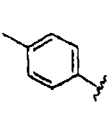
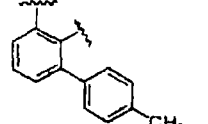
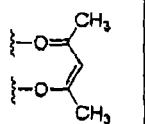
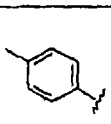
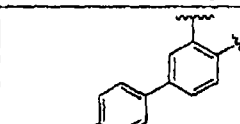
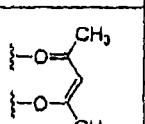
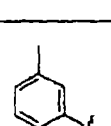
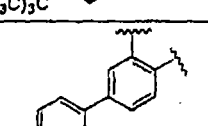
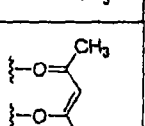
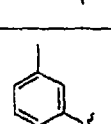
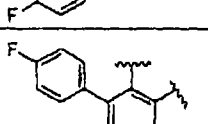
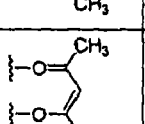
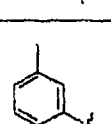
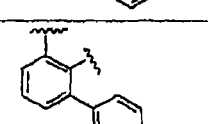
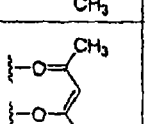
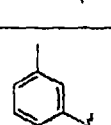
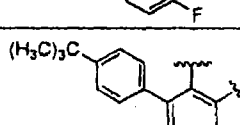
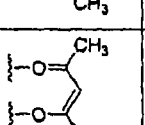
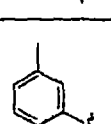
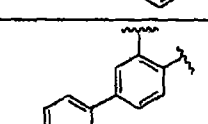
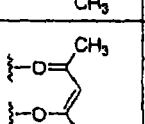
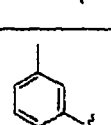
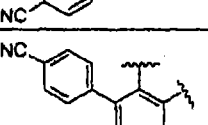
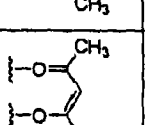
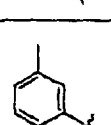
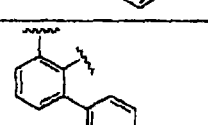
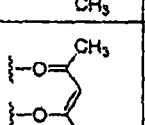
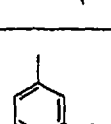
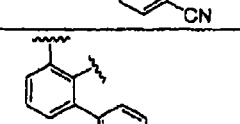
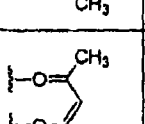
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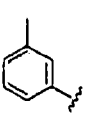
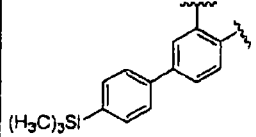
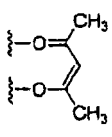
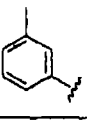
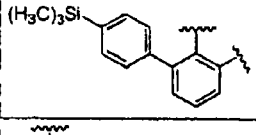
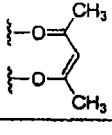
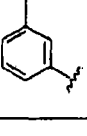
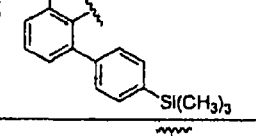
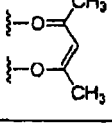
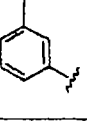
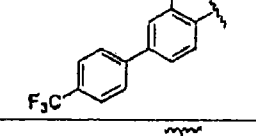
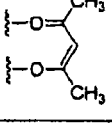
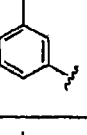
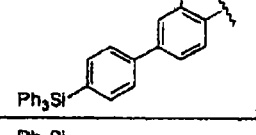
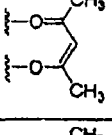
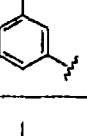
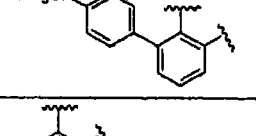
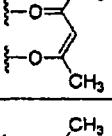
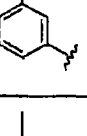
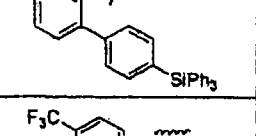
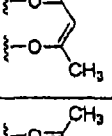
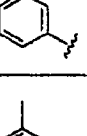
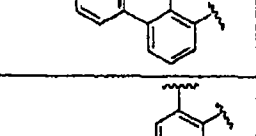
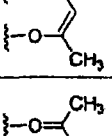

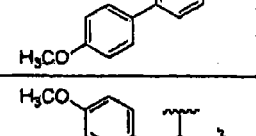
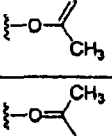
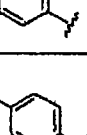
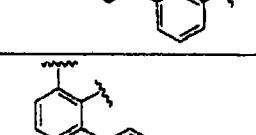
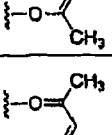
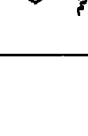
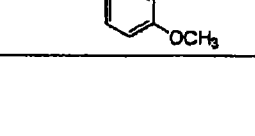
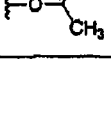
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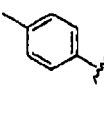
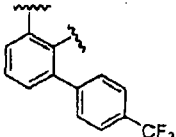
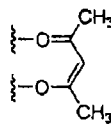
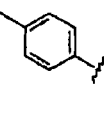
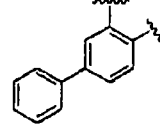
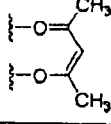
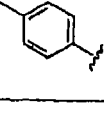
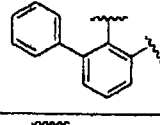
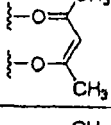
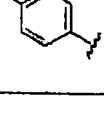
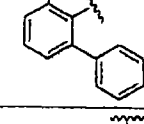
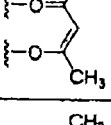
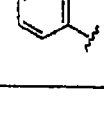
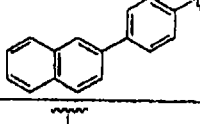
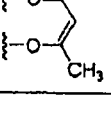
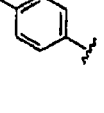
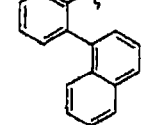
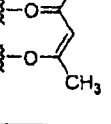
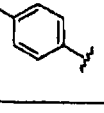
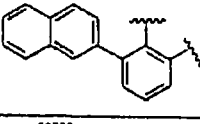
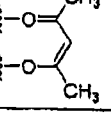
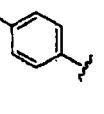
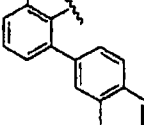
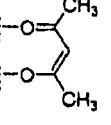
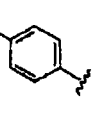
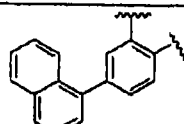
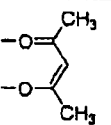
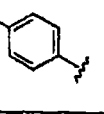
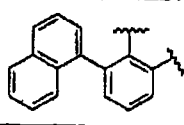
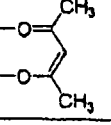
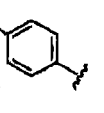
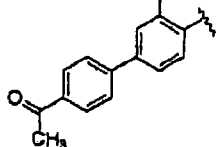
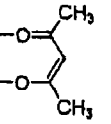


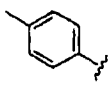
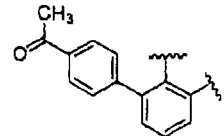
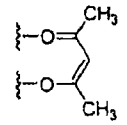
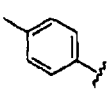
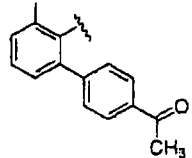
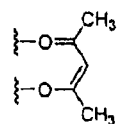
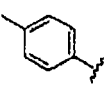
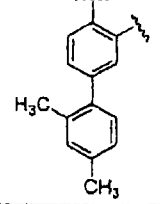
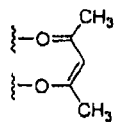
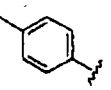
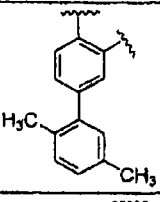
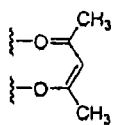
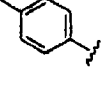
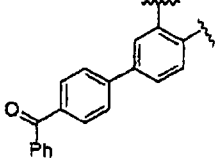
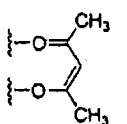
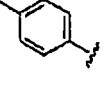
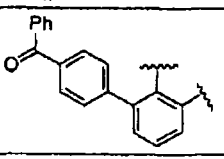
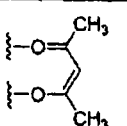
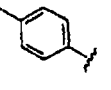
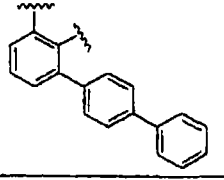
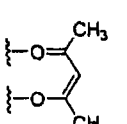
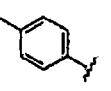
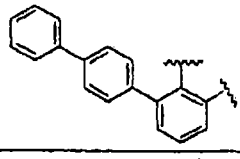
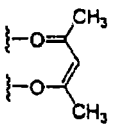
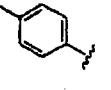
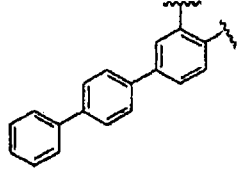
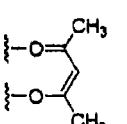
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
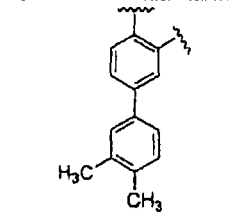
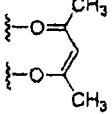

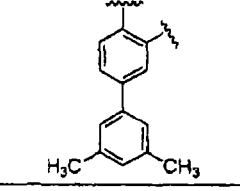
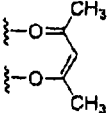

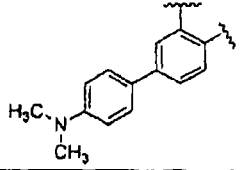
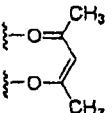

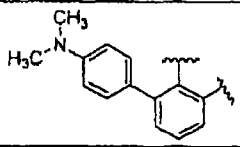
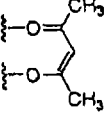

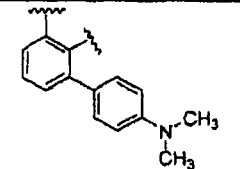
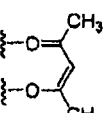

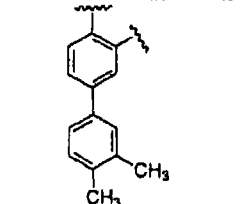
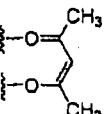

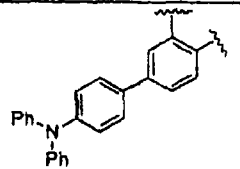
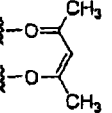

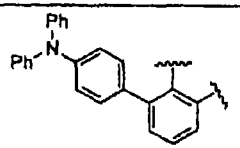
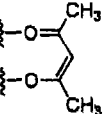

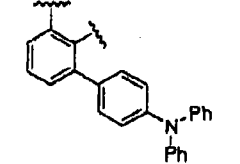
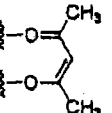
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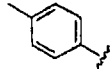
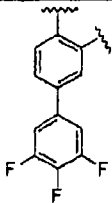
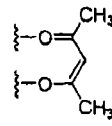
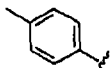
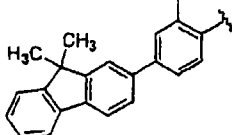
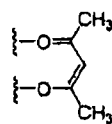
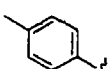
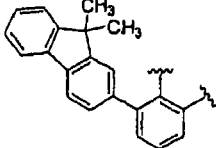
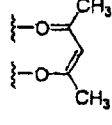
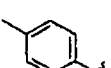
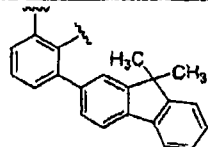
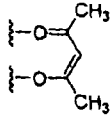
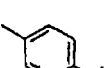
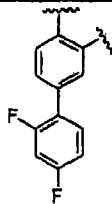
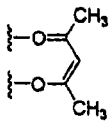
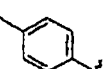
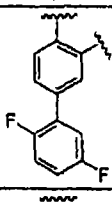
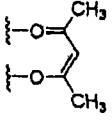
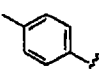
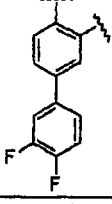
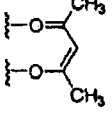
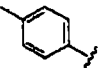
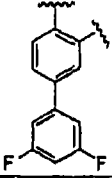
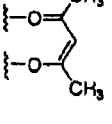
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
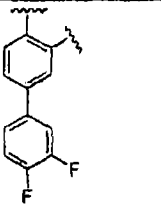
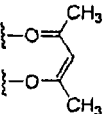

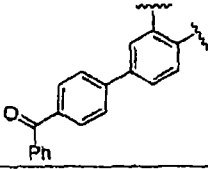
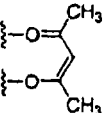

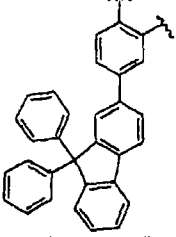
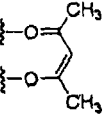

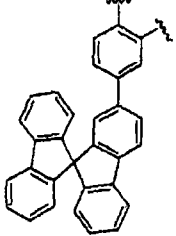
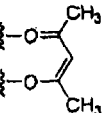

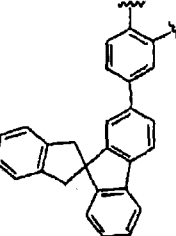
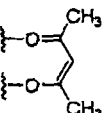

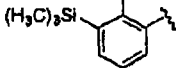
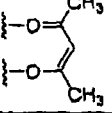

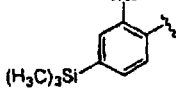
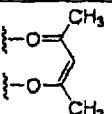

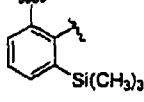
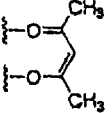
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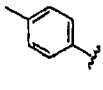
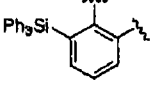
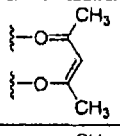
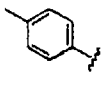
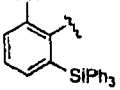
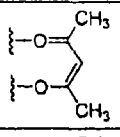
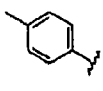
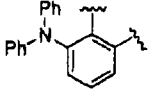
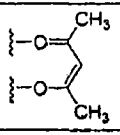
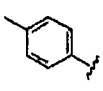
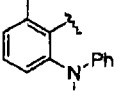
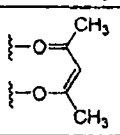
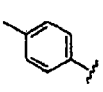
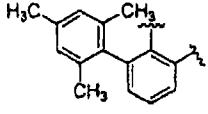
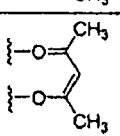
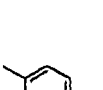
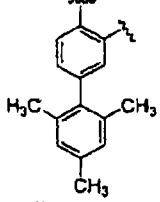
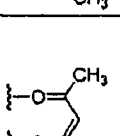

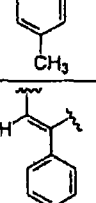
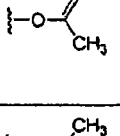
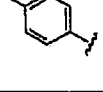
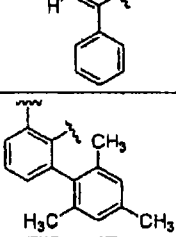
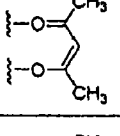
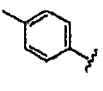
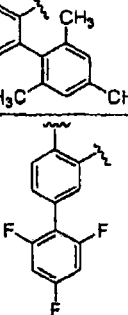
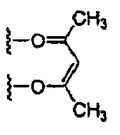
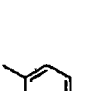
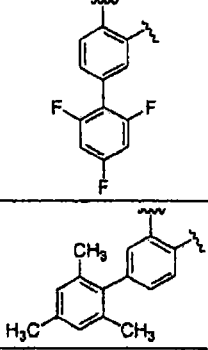
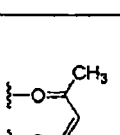
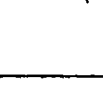
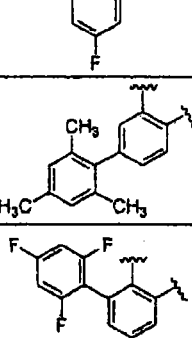
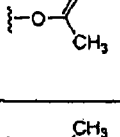
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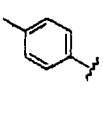
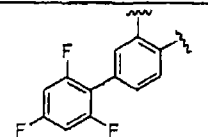
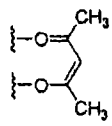
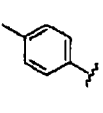
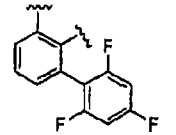
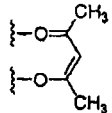
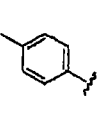
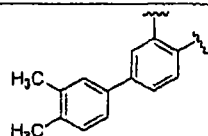
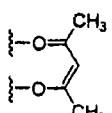
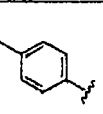
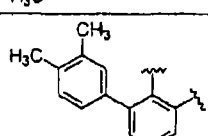
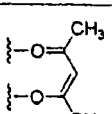
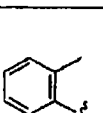
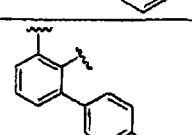
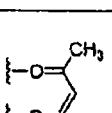
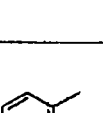
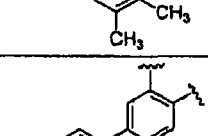
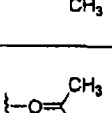
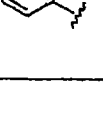
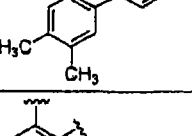
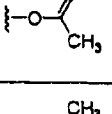
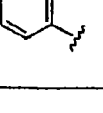
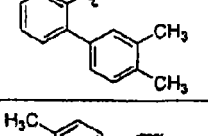
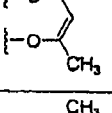
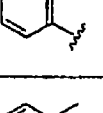
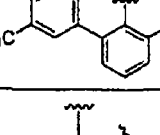
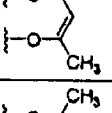
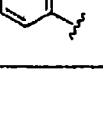
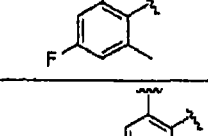
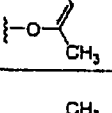
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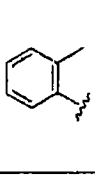
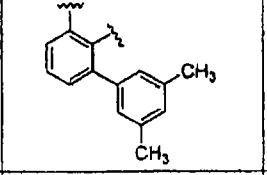
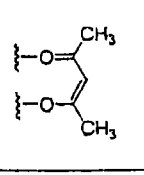
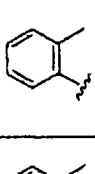
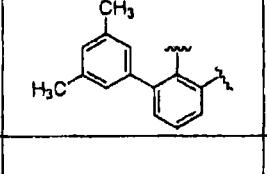
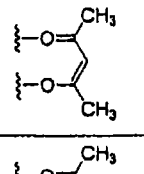
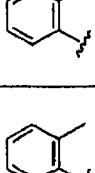
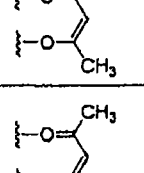
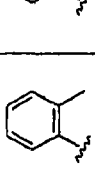
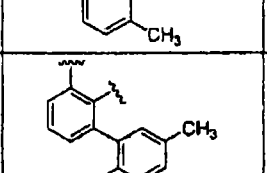
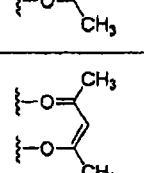
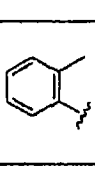
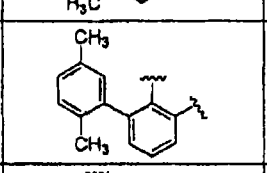
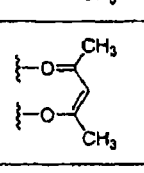
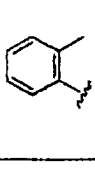
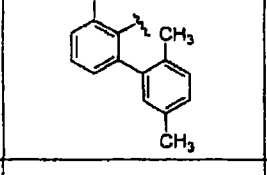
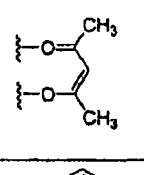
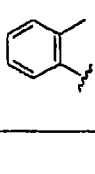
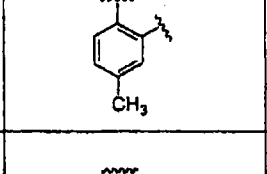
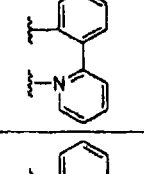
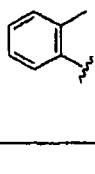
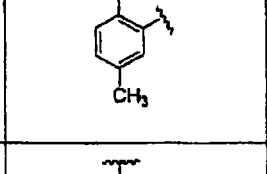
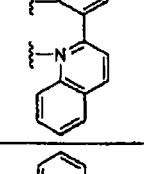
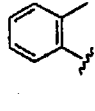
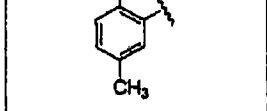
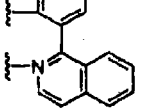



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
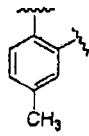
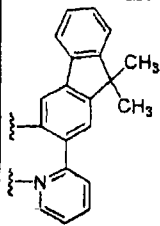
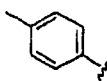
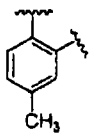
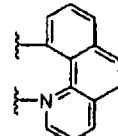
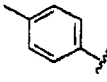
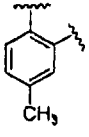
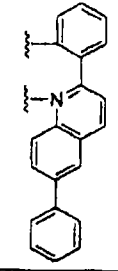
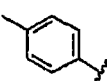
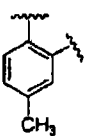
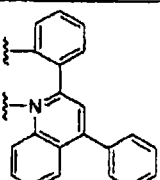
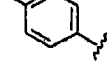
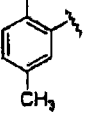
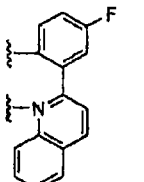
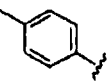
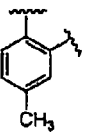
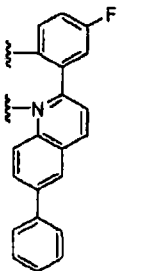
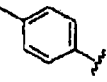
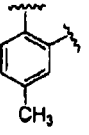
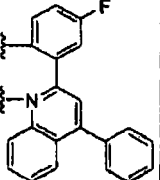


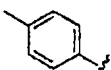
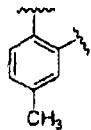
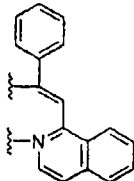
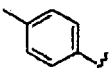
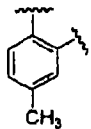
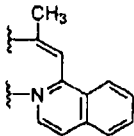
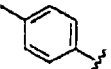
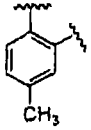
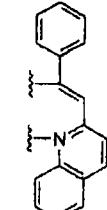
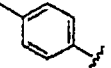
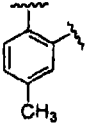
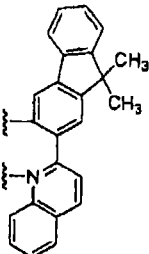
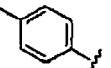
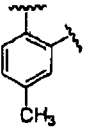
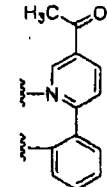
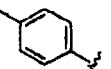
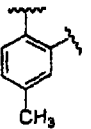
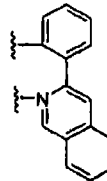
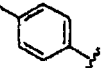
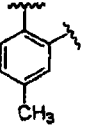
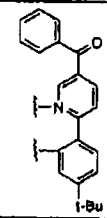
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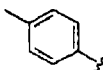
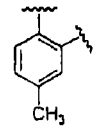
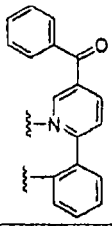
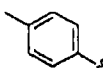
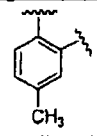
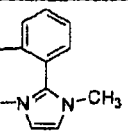
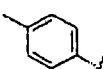
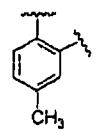
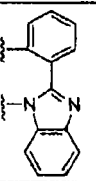
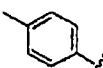
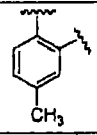
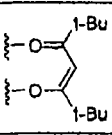
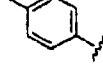
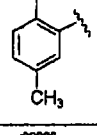
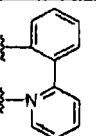
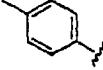
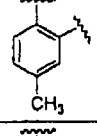
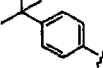
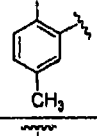
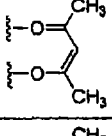
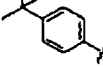
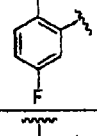
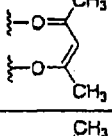
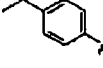
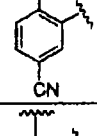
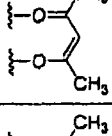
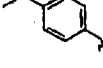

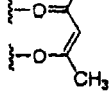
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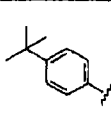
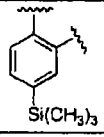
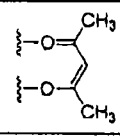
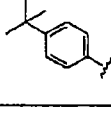
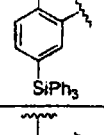
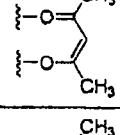
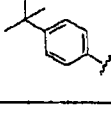
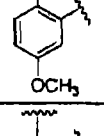
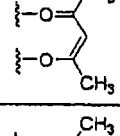
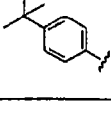
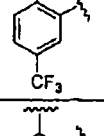
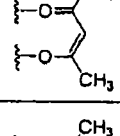
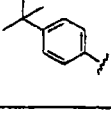
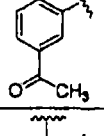
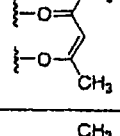
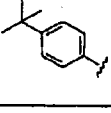
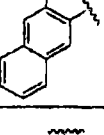
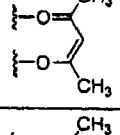
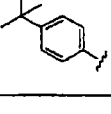
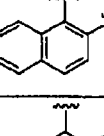
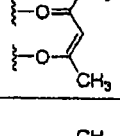
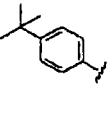
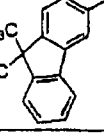
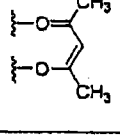
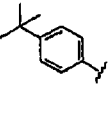
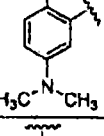
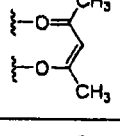
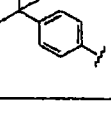
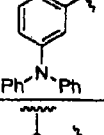
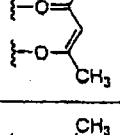
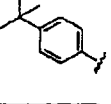
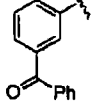
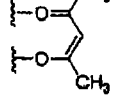
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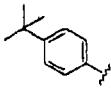
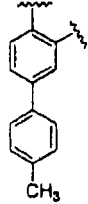
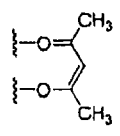
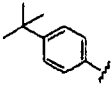
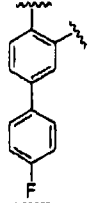
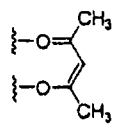
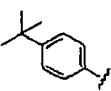
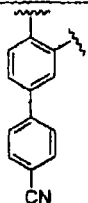
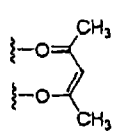
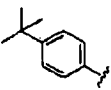
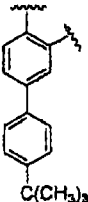
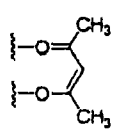
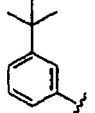
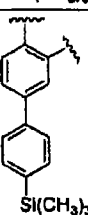
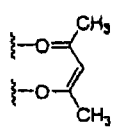
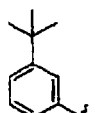
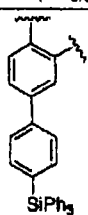
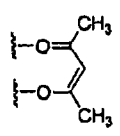
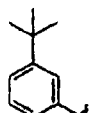
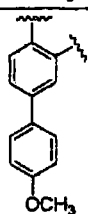
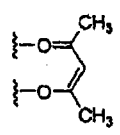
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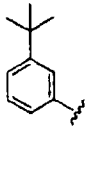
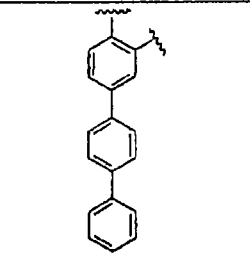
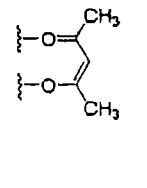
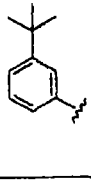
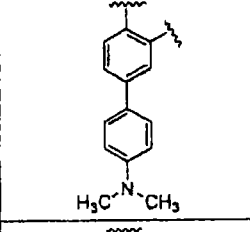
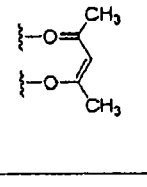
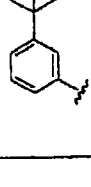
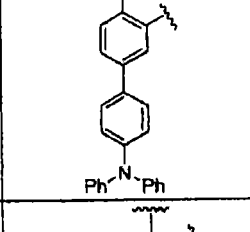
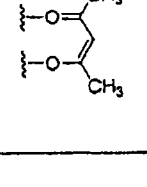
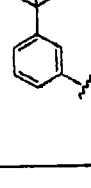
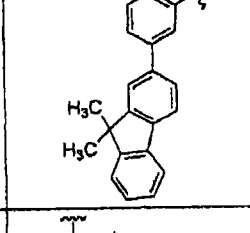
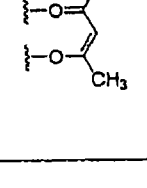
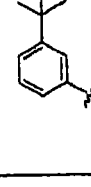
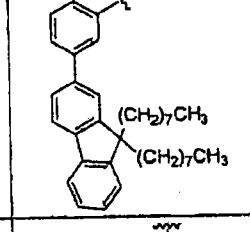
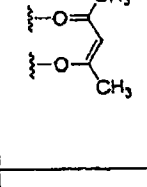
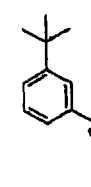
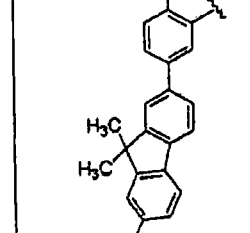
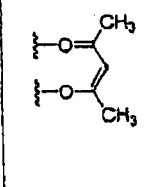
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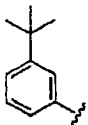
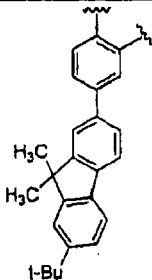
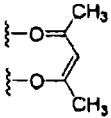
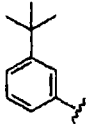
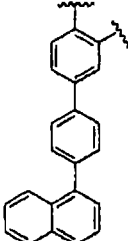
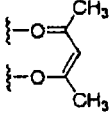
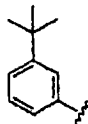
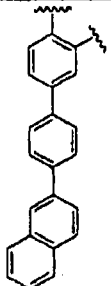
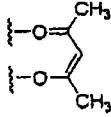
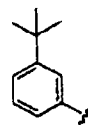
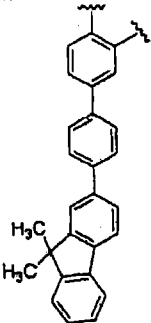
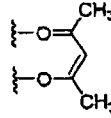
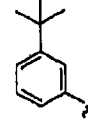
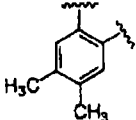
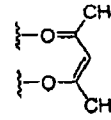
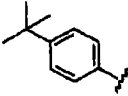
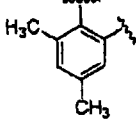
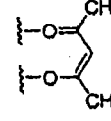
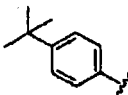
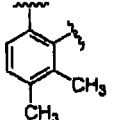
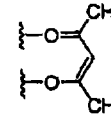
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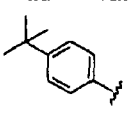
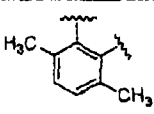
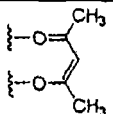
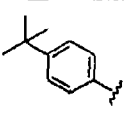
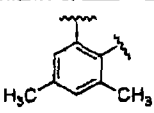
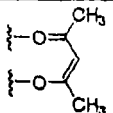
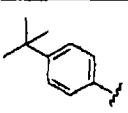
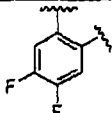
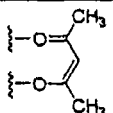
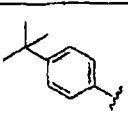
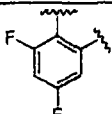
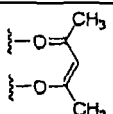
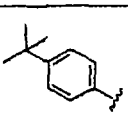
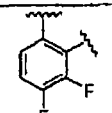
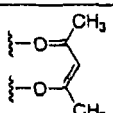
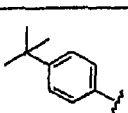
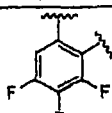
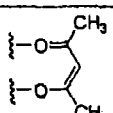
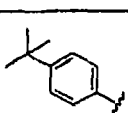
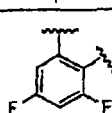
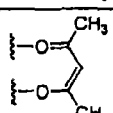
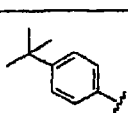
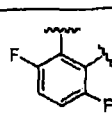
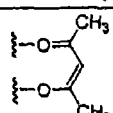
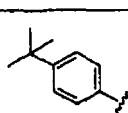
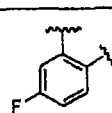
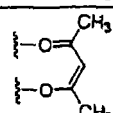
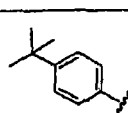
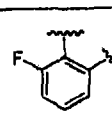
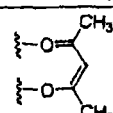
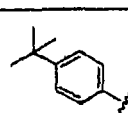
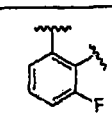
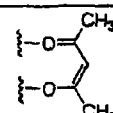
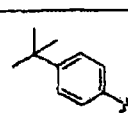
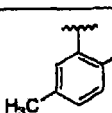
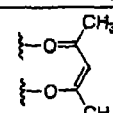


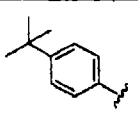
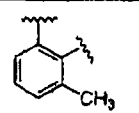
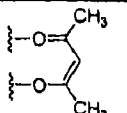
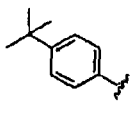
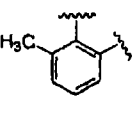
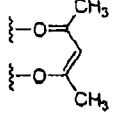
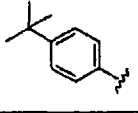
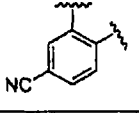
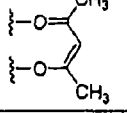
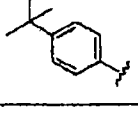
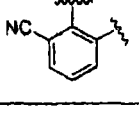
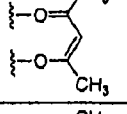
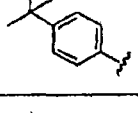
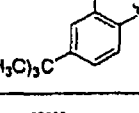
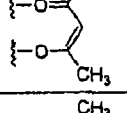
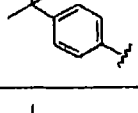
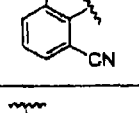
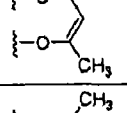
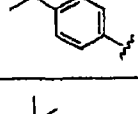
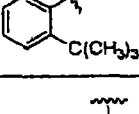
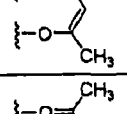
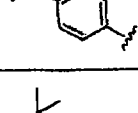
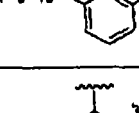
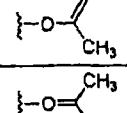
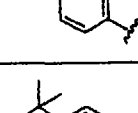
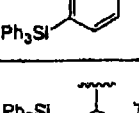
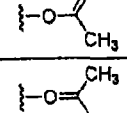
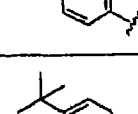
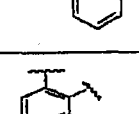
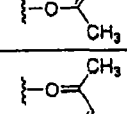
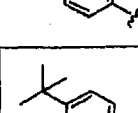
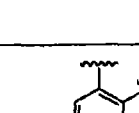
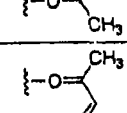

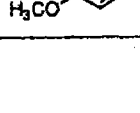
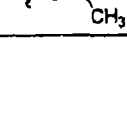
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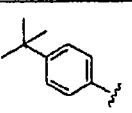
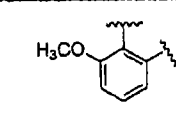
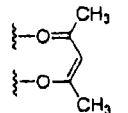
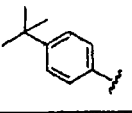
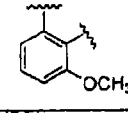
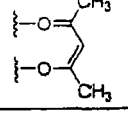
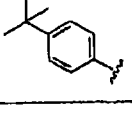
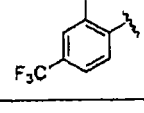
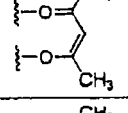
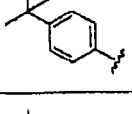
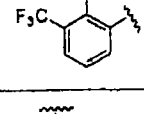
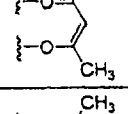
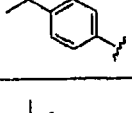
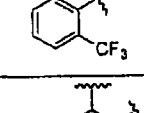
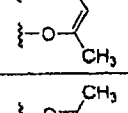
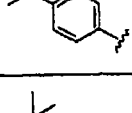
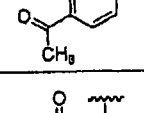
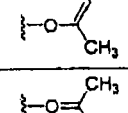
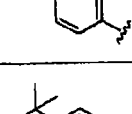
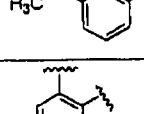
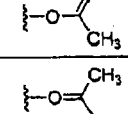
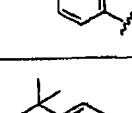
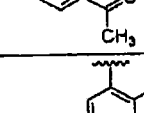
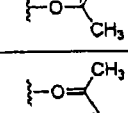
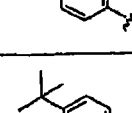
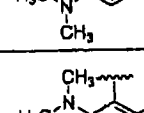
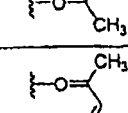
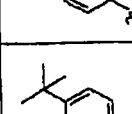
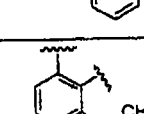
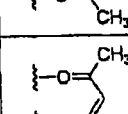
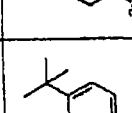
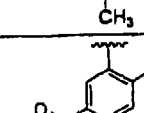
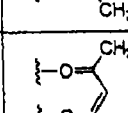
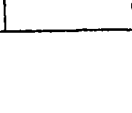
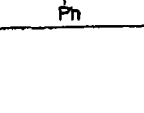
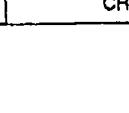
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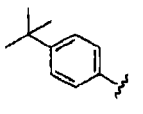
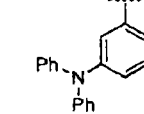
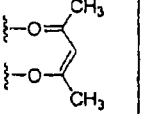
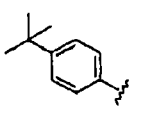
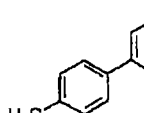
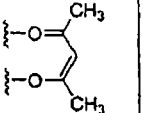
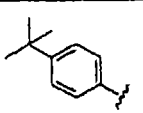
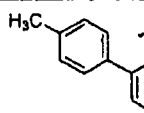
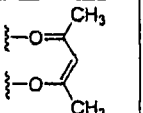
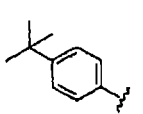
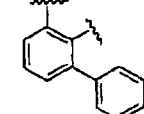
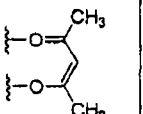
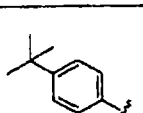

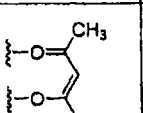
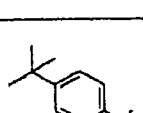
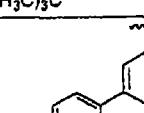
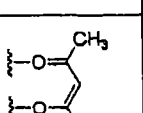
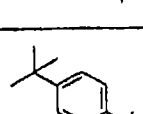
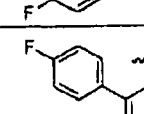
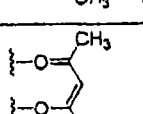
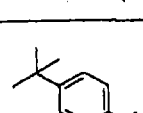
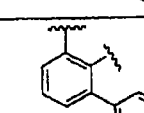
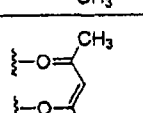
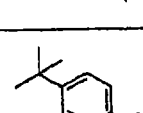
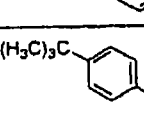
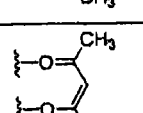
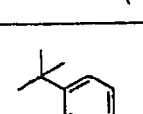
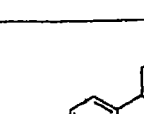
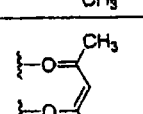
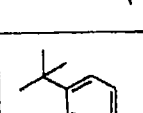
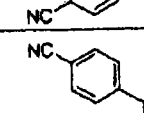
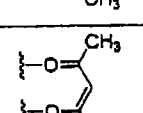
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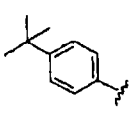
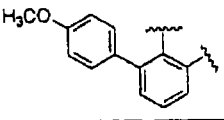
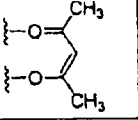
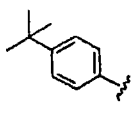
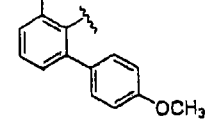
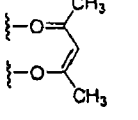
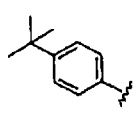
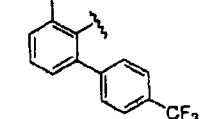
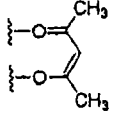
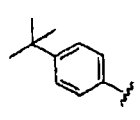
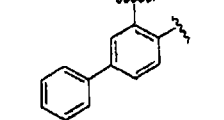
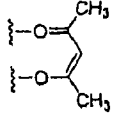
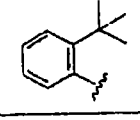
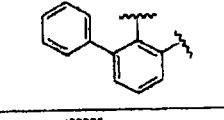
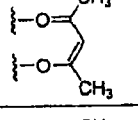
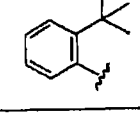
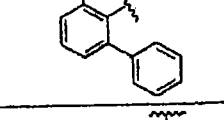
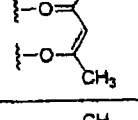
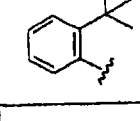
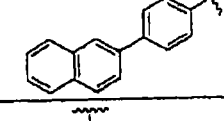
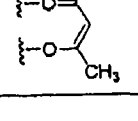
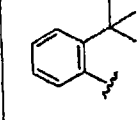
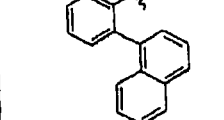
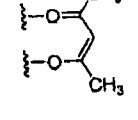
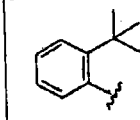
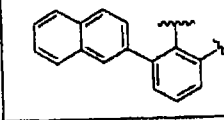
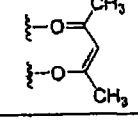
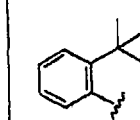
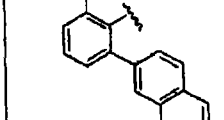
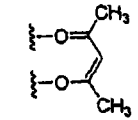
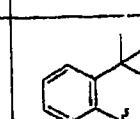
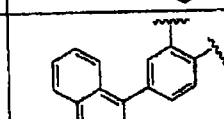
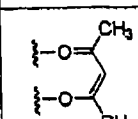
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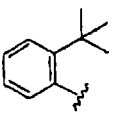
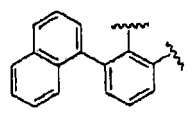
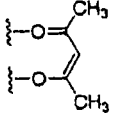
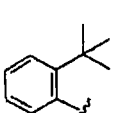
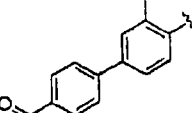
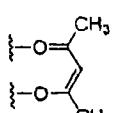
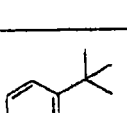
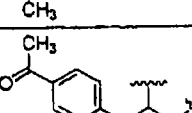
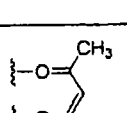
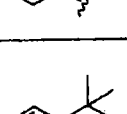
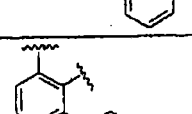
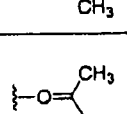
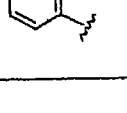
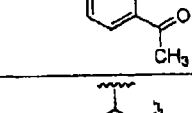
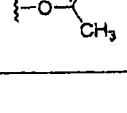
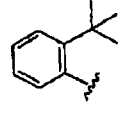
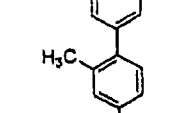
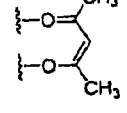
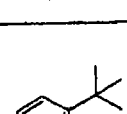
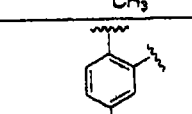
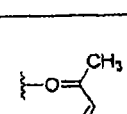
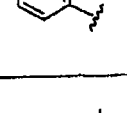
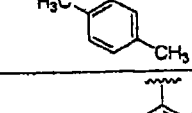
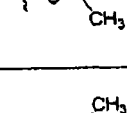
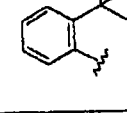
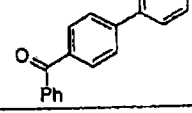
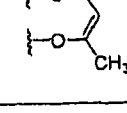
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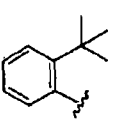
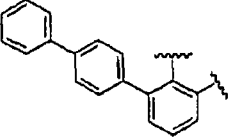
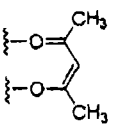
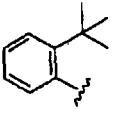
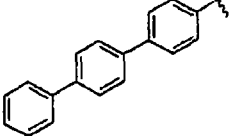
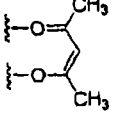
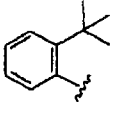
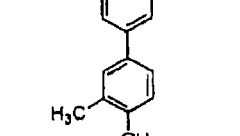
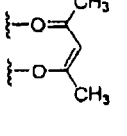
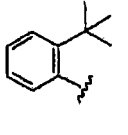
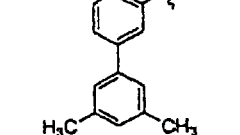
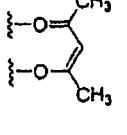
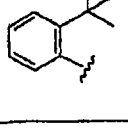
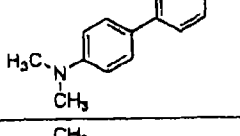
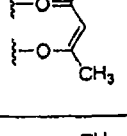
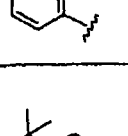
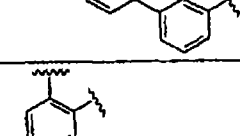
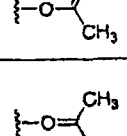
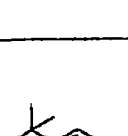
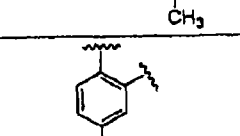
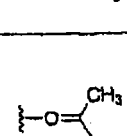
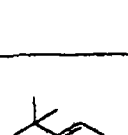
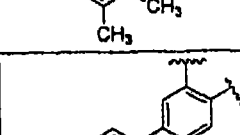
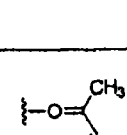
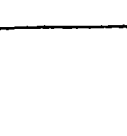
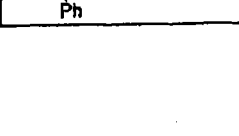
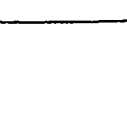
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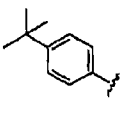
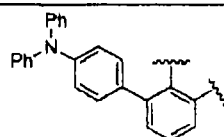
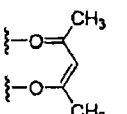
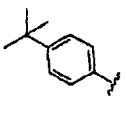
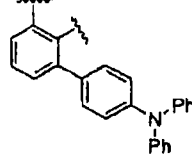
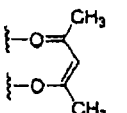
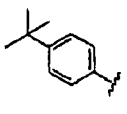
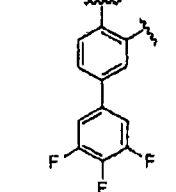
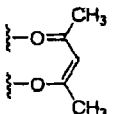
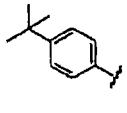
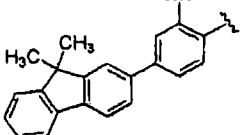
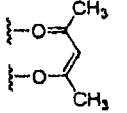
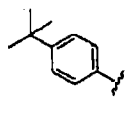
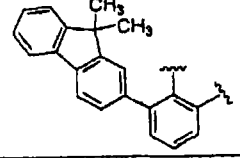
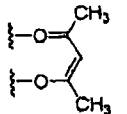
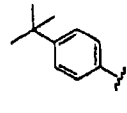
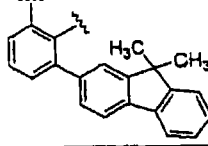
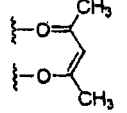
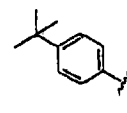
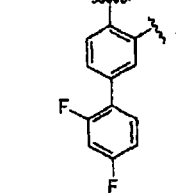
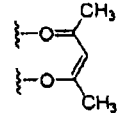
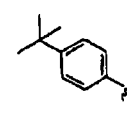
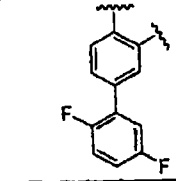
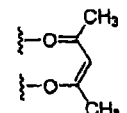
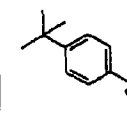
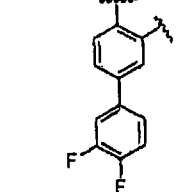
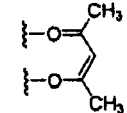


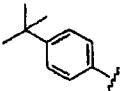
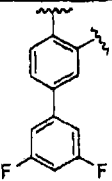
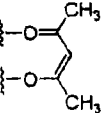
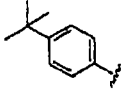
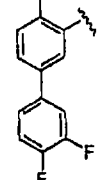
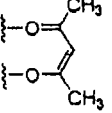
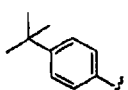
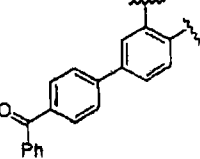
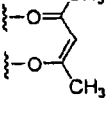
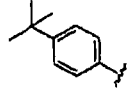
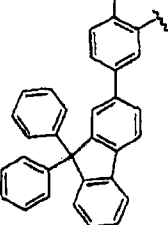
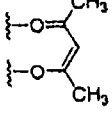
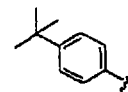
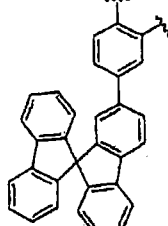
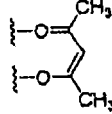
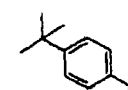
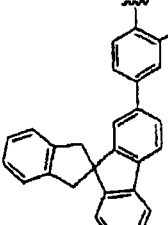
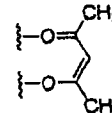
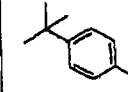
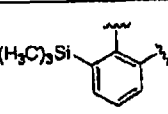
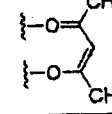
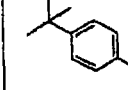
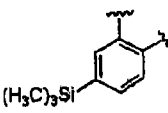
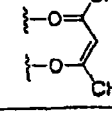
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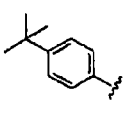
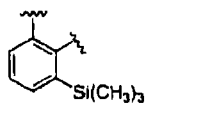
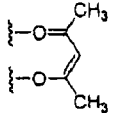
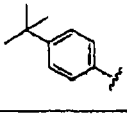
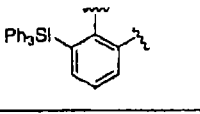
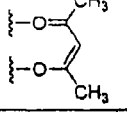
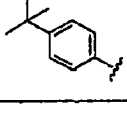
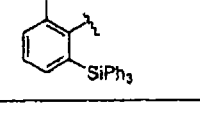
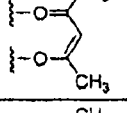
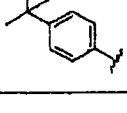
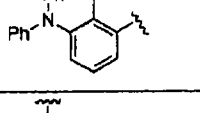
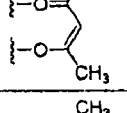
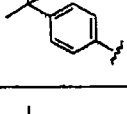
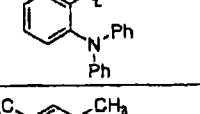
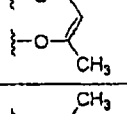
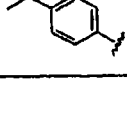
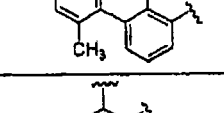
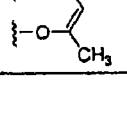
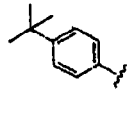
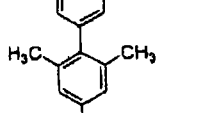
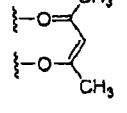
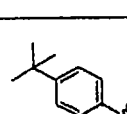
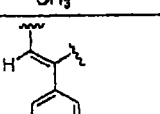
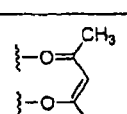
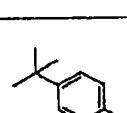
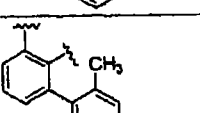
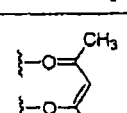
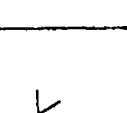
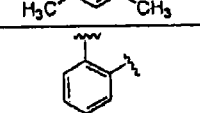
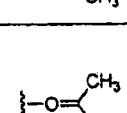
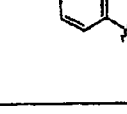
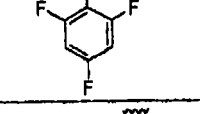
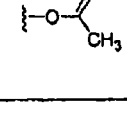
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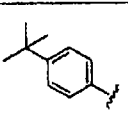
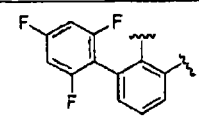
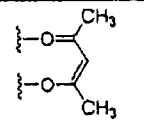
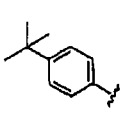
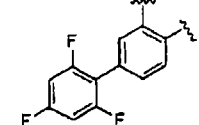
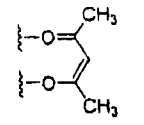
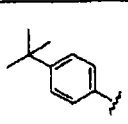
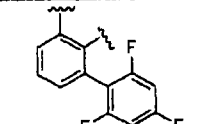
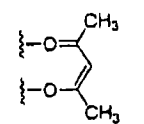
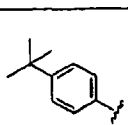
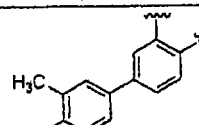
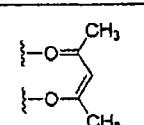
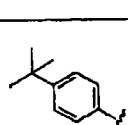
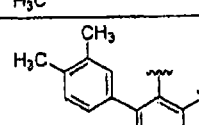
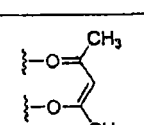
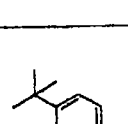
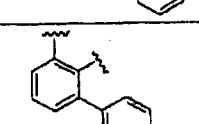
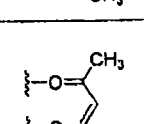
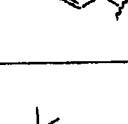
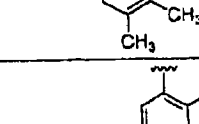
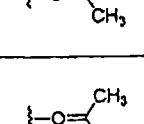
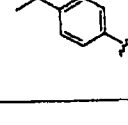
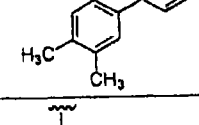
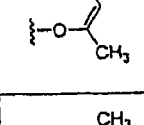
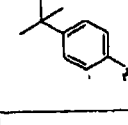
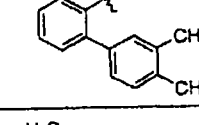
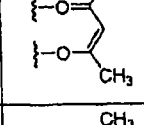
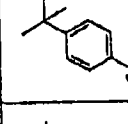
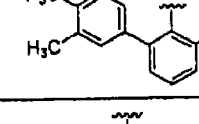
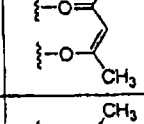
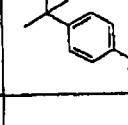
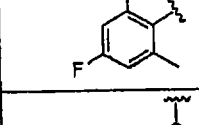
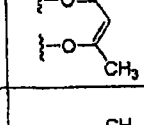
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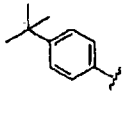
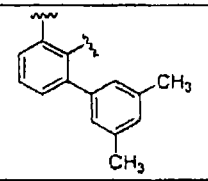
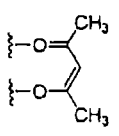
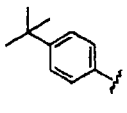
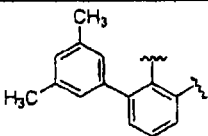
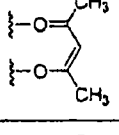
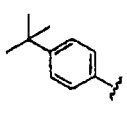
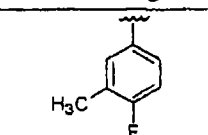
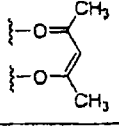
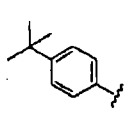
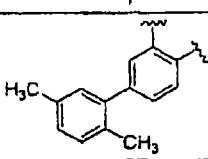
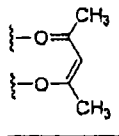
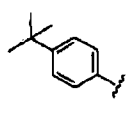
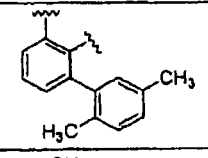
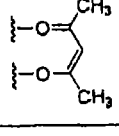
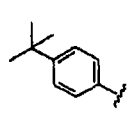
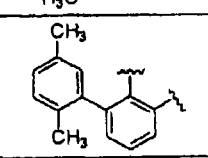
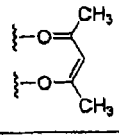
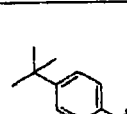
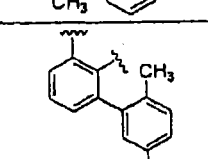
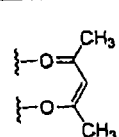
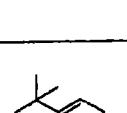
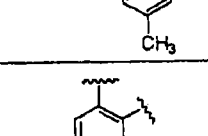
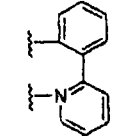
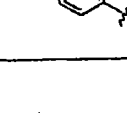
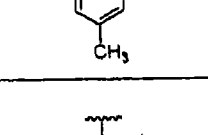
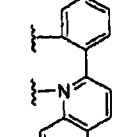
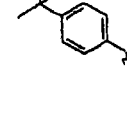
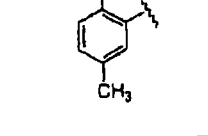
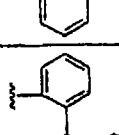
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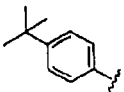
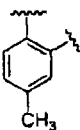
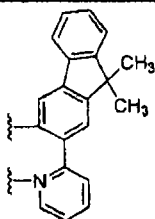
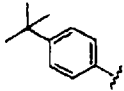
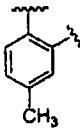
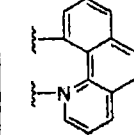
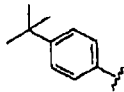
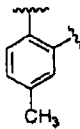
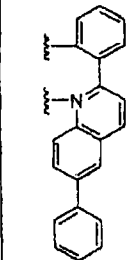
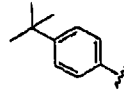
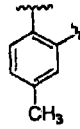
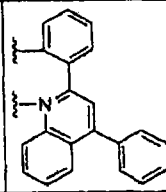
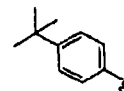
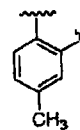
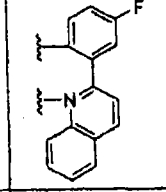
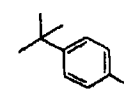
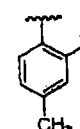
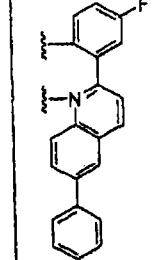
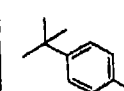
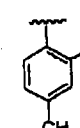
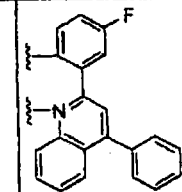
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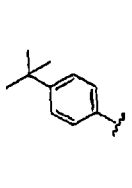
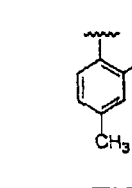
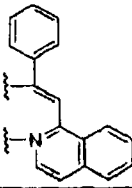
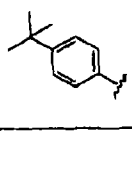
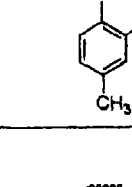
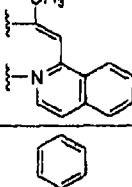
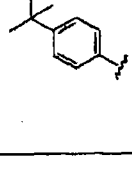
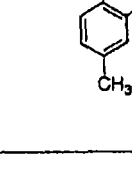
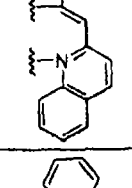
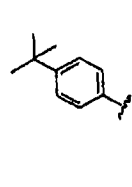
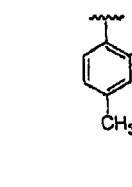
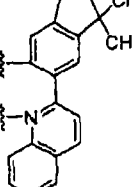
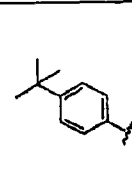
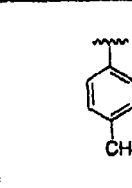
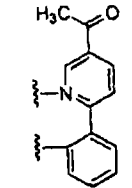
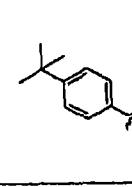
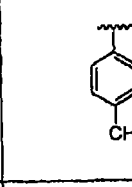
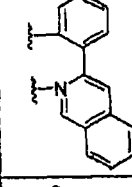
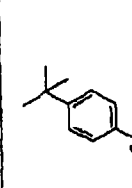
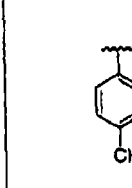
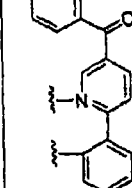
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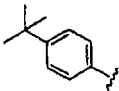
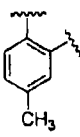
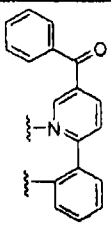
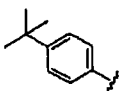
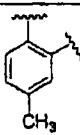
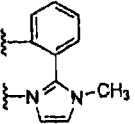
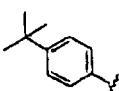
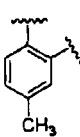
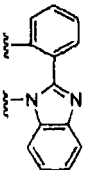
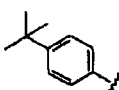
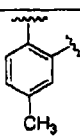
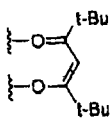
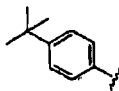
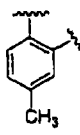
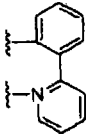
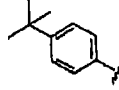
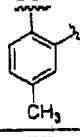
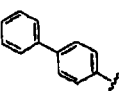
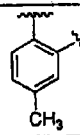
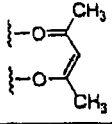
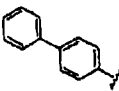
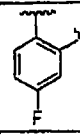
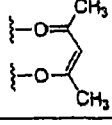
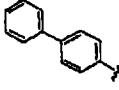
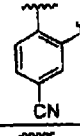
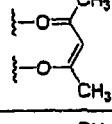
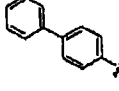
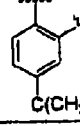
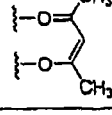
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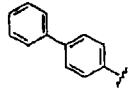
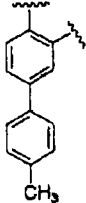
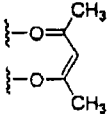
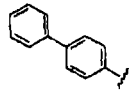
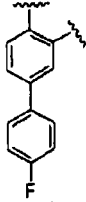
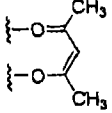
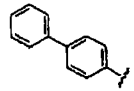
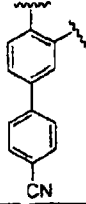
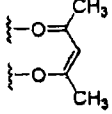
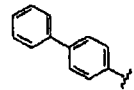
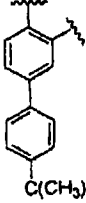
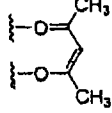
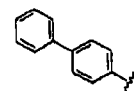
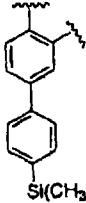
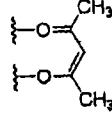
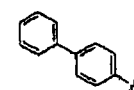
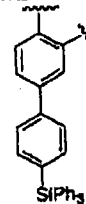
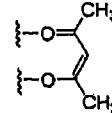
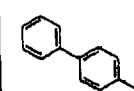
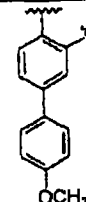
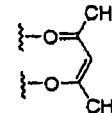
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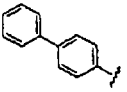
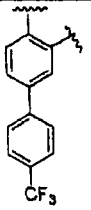
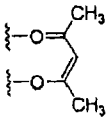
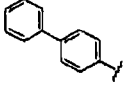
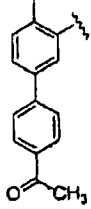
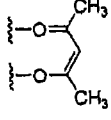
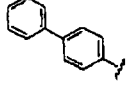
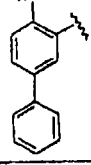
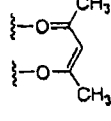
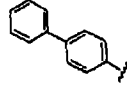
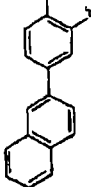
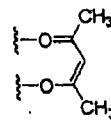
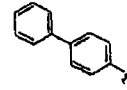
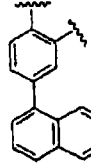
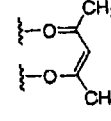
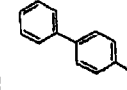
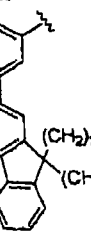
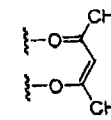
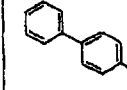
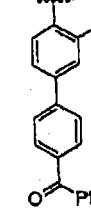
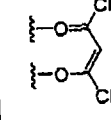
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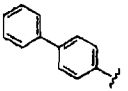
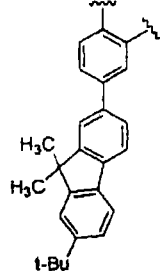
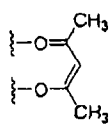
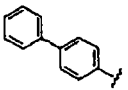
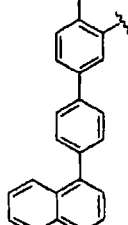
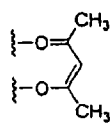
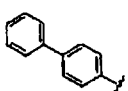
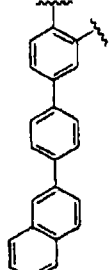
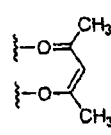
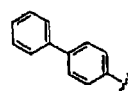
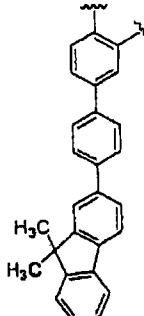
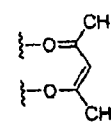
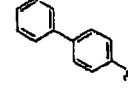
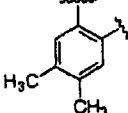
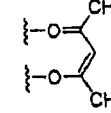
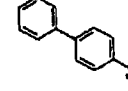
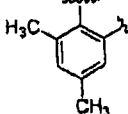
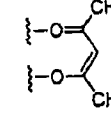
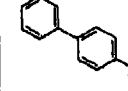
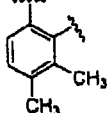
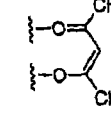
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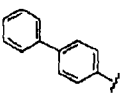
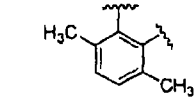
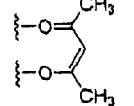
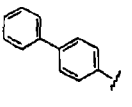
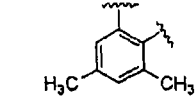
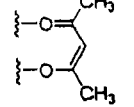
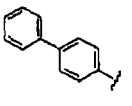
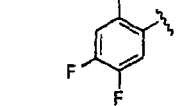
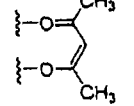
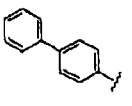
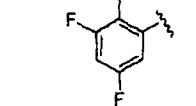
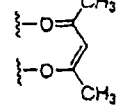
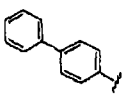
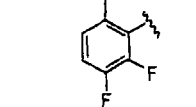
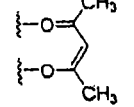
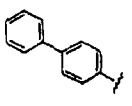
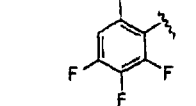
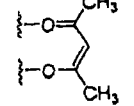
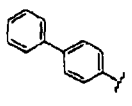
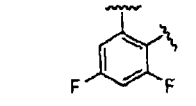
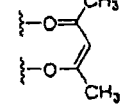
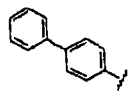
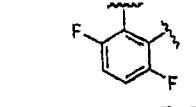
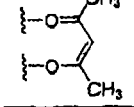
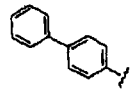
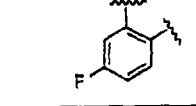
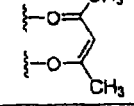
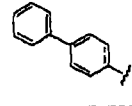
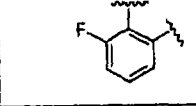
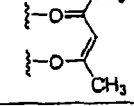
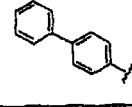
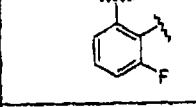
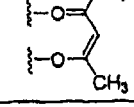
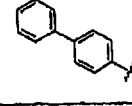
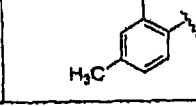
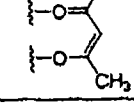
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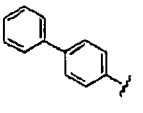
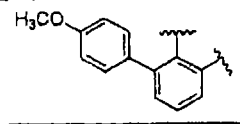
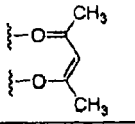
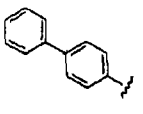
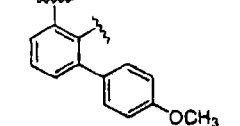
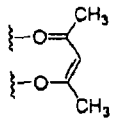
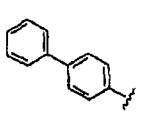
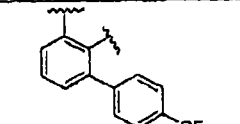
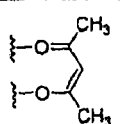
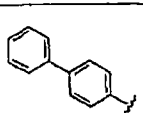
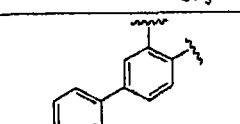
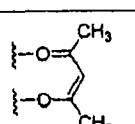
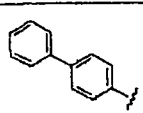
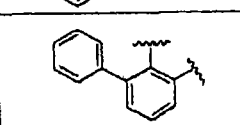
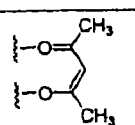
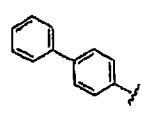
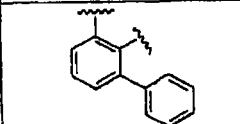
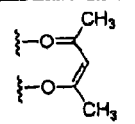
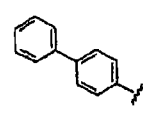
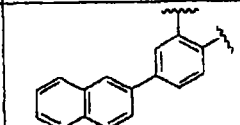
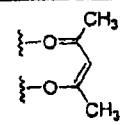
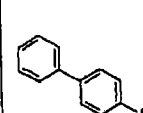
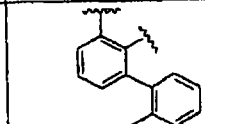
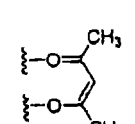
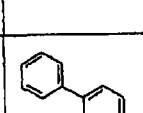
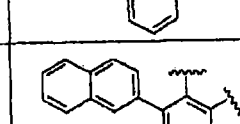
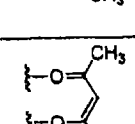
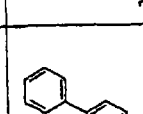
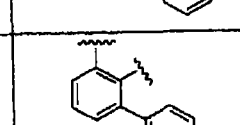
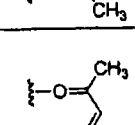

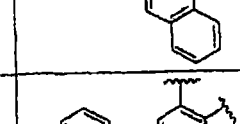
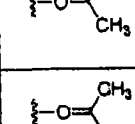
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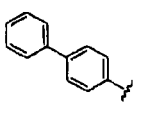
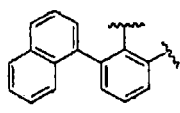
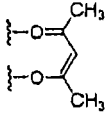
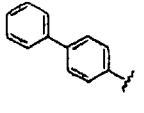
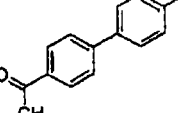
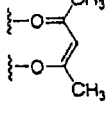
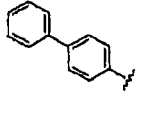
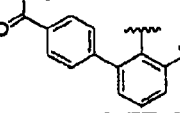
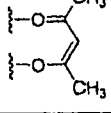
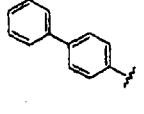
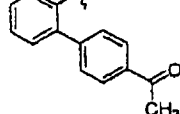
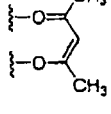
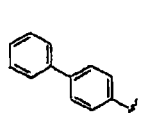
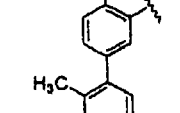
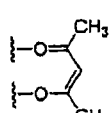
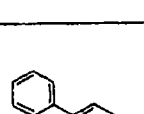
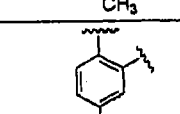
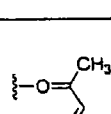
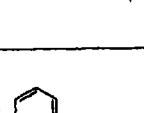
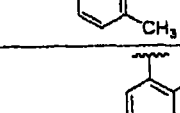
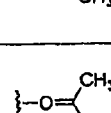
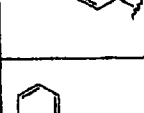
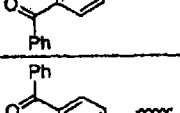
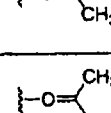
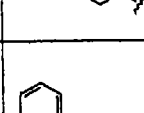
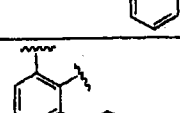
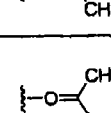
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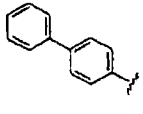
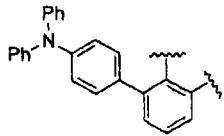
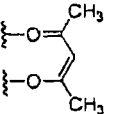
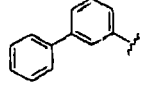
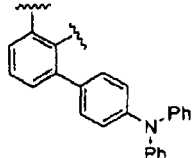
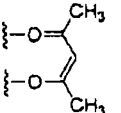
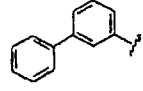
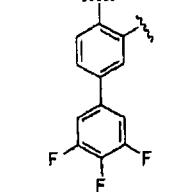
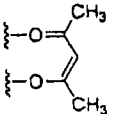
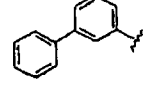
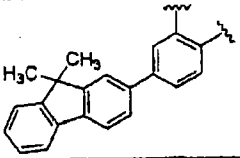
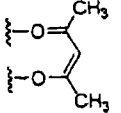
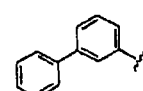
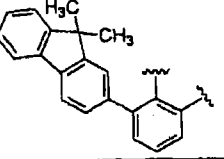
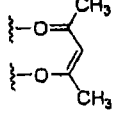
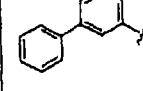
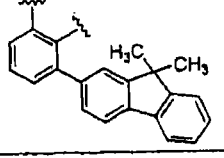
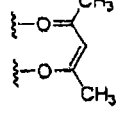
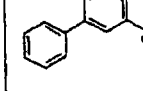
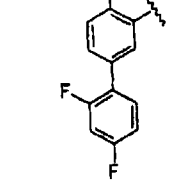
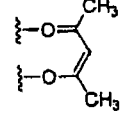
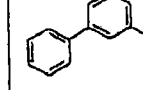
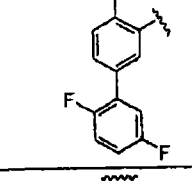
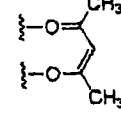
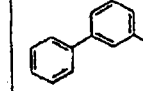
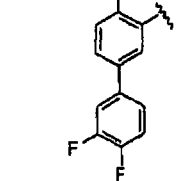
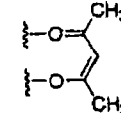
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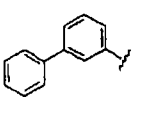
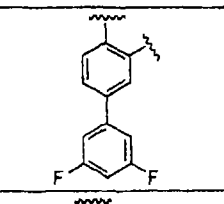
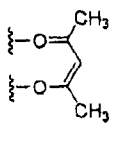
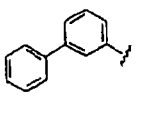
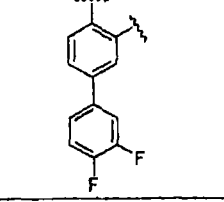
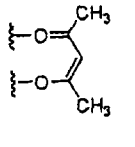
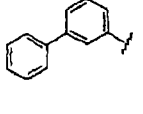
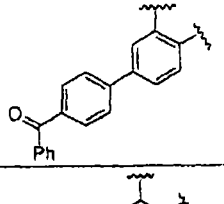
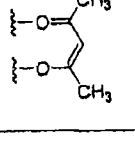
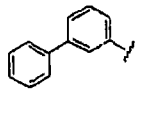
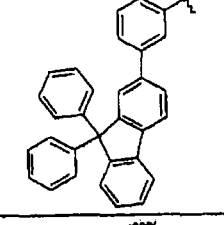
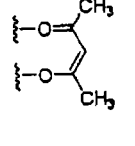
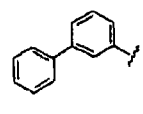
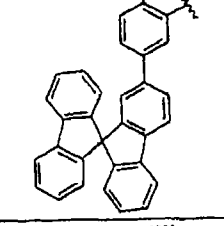
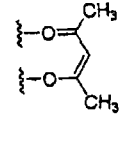
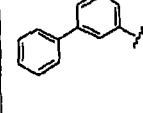
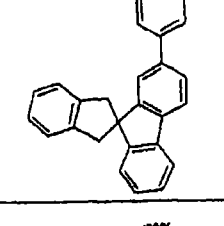
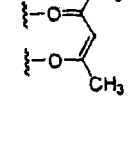
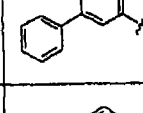
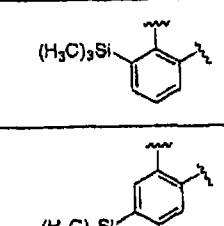
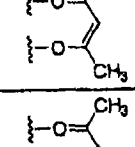
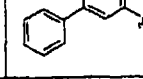
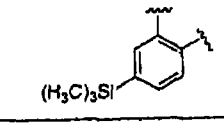
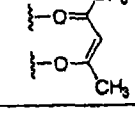
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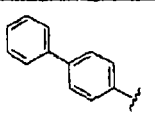
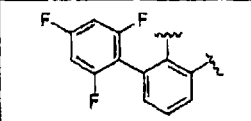
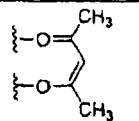
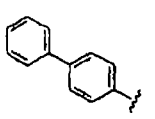
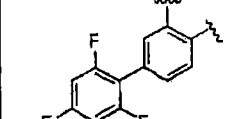
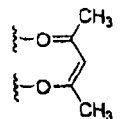
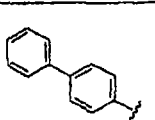
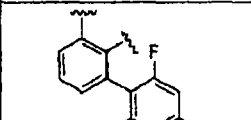
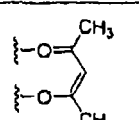
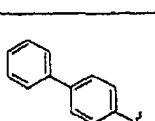
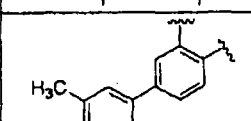
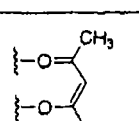
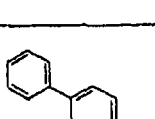
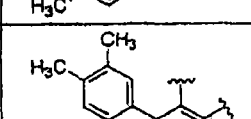
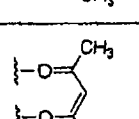
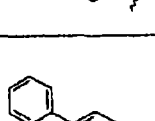
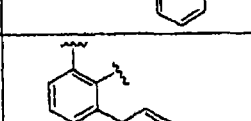
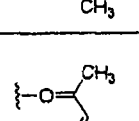
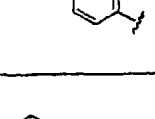
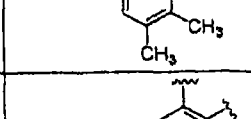
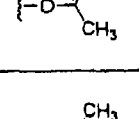
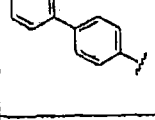
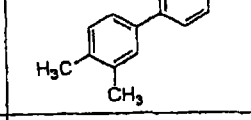
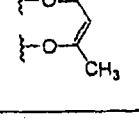
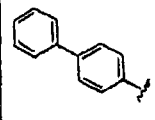
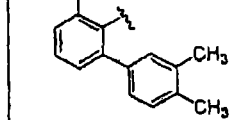
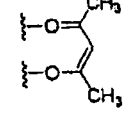
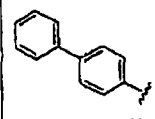
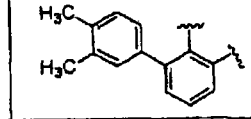
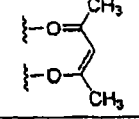
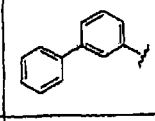
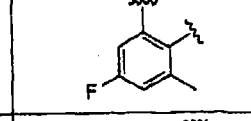
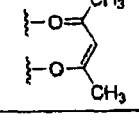


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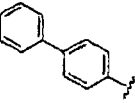
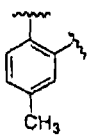
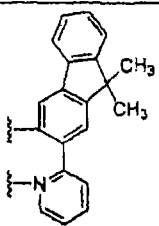
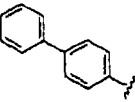
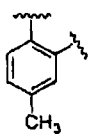
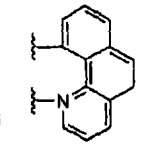
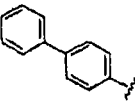
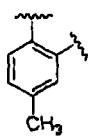
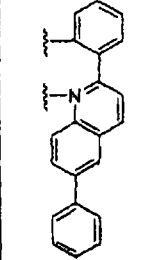
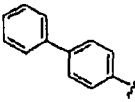
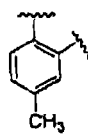
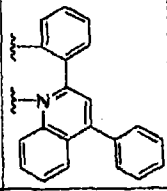
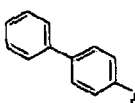
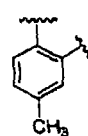
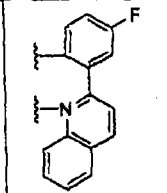
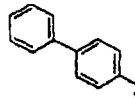
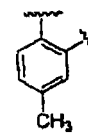
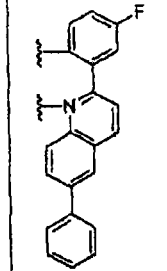
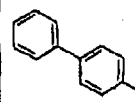
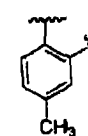
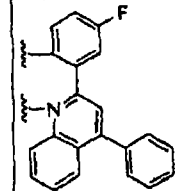
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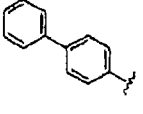
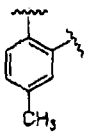
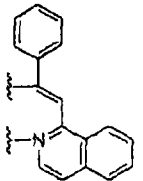
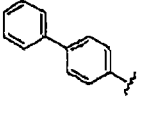
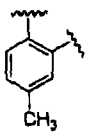
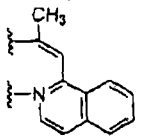
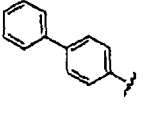
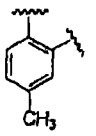
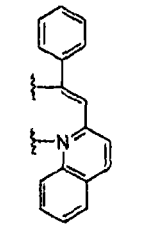
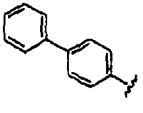
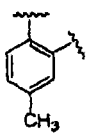
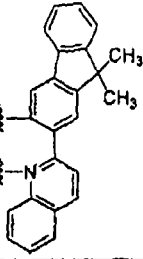
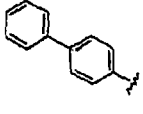
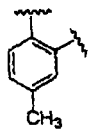
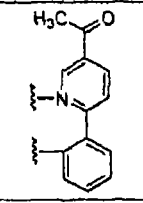
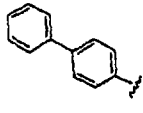
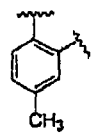
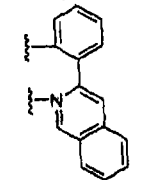
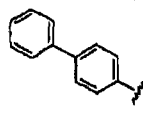
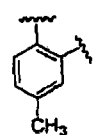
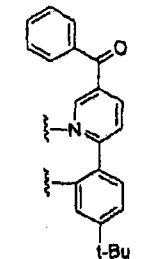
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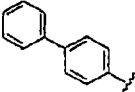
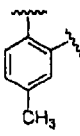
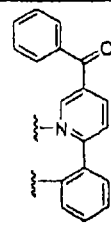
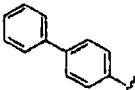
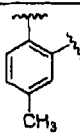
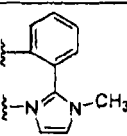
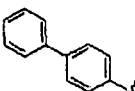
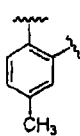
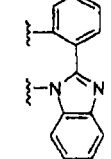
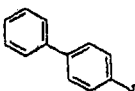
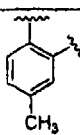
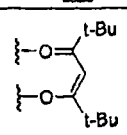
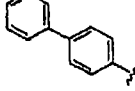
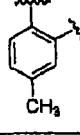
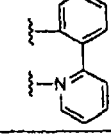
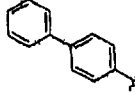
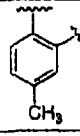

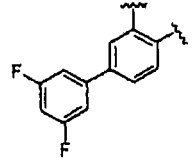
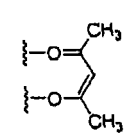

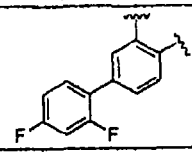
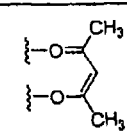

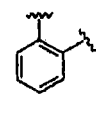
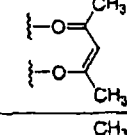
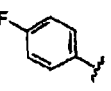

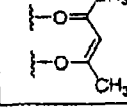
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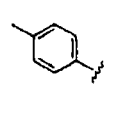
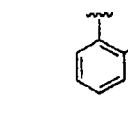

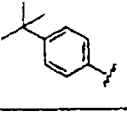
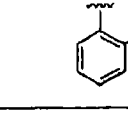
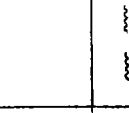
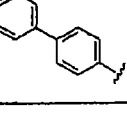
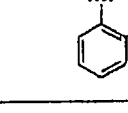
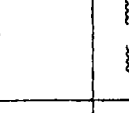
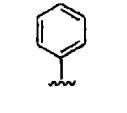
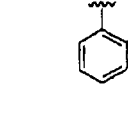
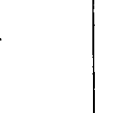
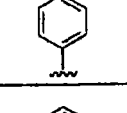
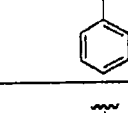
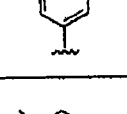
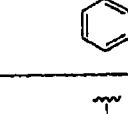

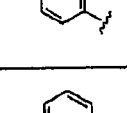
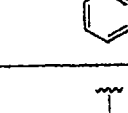
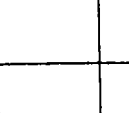
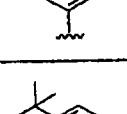
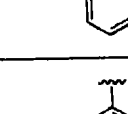
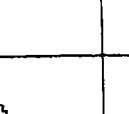
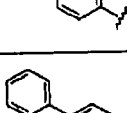
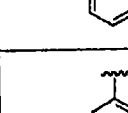
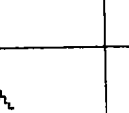
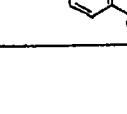
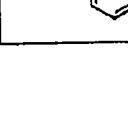
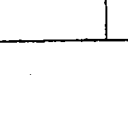
995	H	H	H	H				2
996	H	H	H	H				2
997	H	H	H	H				2
998	H	H	H	H				2
999	H	H	H	H			-	3
1000	-CH <sub>3</sub>	H	H	H				2
1001	H	-CH <sub>3</sub>	H	H				2
1002	H	H	F	H				2
1003	H	H	H	H				2
1004	-CH <sub>3</sub>	H	H	H				2

表2

化合物 编号	<sup>1</sup> H NMR(CDCl <sub>3</sub> , 200 MHz)	MS/FAB	
		测量值	计算值
1	δ = 8.07(m, 2H), 7.87(m, 2H), 7.65-7.57(m, 4H), 7.48-7.42(m, 6H), 7.32(m, 4H), 7.22-7.15(m, 6H), 4.59(s, 1H), 2.32(s, 6H), 2.35(s, 6H), 2.09(s, 6H)	908	908.3
4	δ = 8.07(m, 2H), 7.01(m, 2H), 7.65-7.57(m, 4H), 7.48-7.32(m, 14H), 7.22(m, 2H), 4.60(s, 1H), 2.33(s, 6H), 2.09(s, 6H), 1.34(s, 18H)	992	992.39
11	δ = 8.06(m, 2H), 7.69-7.57(m, 10H), 7.48-7.32(m, 16H), 7.22(m, 2H), 4.58(s, 1H), 2.32(s, 6H), 2.10(s, 6H)	980	980.3
33	δ = 8.81(m, 2H), 8.03-7.87(m, 12H), 7.77-7.74(m, 4H), 7.63-7.41(m, 17H), 7.38(m, 2H), 7.28(m, 2H), 2.31(s, 6H), 2.09(s, 6H), 1.72(s, 12H)	1264	1264.45
43	δ = 8.06(m, 2H), 7.65(m, 2H), 7.57(m, 2H), 7.48-7.42(m, 6H), 7.32(m, 4H), 7.22(m, 2H), 7.03(m, 2H), 6.96(m, 2H), 4.59(s, 1H), 2.35(s, 12H), 2.32(s, 6H), 2.09(s, 6H)	936	936.33
50	δ = 8.06(m, 2H), 7.65-7.57(m, 4H), 7.48-7.42(m, 6H), 7.32(m, 4H), 7.22(m, 2H), 7.04-6.97(m, 4H), 4.58(s, 1H), 2.32(s, 6H), 2.08(s, 6H)	952	952.23
69	δ = 8.18(d, 2H), 8.06(m, 2H), 7.65-7.57(m, 4H), 7.48-7.42(m, 8H), 7.32-7.22(m, 8H), 4.60(s, 1H), 2.33(s, 6H), 2.09(s, 6H)	1016	1016.24
104	δ = 8.21(m, 2H), 8.03-7.99(m, 4H), 7.74(m, 2H), 7.60-7.41(m, 26H), 4.59(s, 1H), 2.31(s, 6H), 2.09(s, 6H)	1032	1032.33
117	δ = 8.06-8.05(m, 4H), 7.65-7.57(m, 8H), 7.48-7.42(m, 6H), 7.32(m, 4H), 7.22-7.16(m, 4H), 7.00(m, 2H), 6.90(m, 2H), 4.58(s, 1H), 2.32(s, 6H), 2.35(s, 12H), 2.09(s, 6H)	1088	1088.39
177	δ = 8.30(m, 1H), 8.18(m, 2H), 8.10-7.98(m, 7H), 7.78-7.74(m, 3H), 7.60-7.32(m, 21H), 2.34(s, 6H), 2.31(s, 6H)	1013	1013.33
184	δ = 8.21-8.18(m, 3H), 8.10-7.99(m, 7H), 7.90(m, 1H), 7.74(m, 2H), 7.59-7.51(m, 15H), 7.41-7.35(m, 8H), 7.26(m, 1H), 2.34(s, 6H), 2.31(s, 6H)	1107	1107.35
192	δ = 8.64(m, 1H), 8.34(m, 1H), 8.22-8.18(m, 3H), 8.03-7.99(m, 4H), 7.89-7.87(m, 3H), 7.74-7.51(m, 15H), 7.41(m, 4H), 7.32(m, 4H), 2.34(s, 6H), 2.31(s, 6H), 1.35(s, 9H)	1123	1123.41
198	δ = 8.18(m, 3H), 8.03-7.99(m, 6H), 7.74(m, 3H), 7.59(m, 18H), 7.32(m, 6H), 2.34(s, 9H), 2.31(s, 9H)	1117	1117.39
241	δ = 8.06(m, 2H), 7.65(m, 2H), 7.57(m, 2H), 7.46-7.42(m, 6H), 7.03-7.96(m, 8H), 4.58(s, 1H), 2.35(s, 12H), 2.32(s, 6H), 2.09(s, 6H)	972	972.31
244	δ = 8.03-7.99(m, 4H), 7.74-7.71(m, 6H), 7.59(m, 2H), 7.49(m, 2H), 7.28(m, 2H), 7.10(m, 2H), 6.77(m, 2H), 4.60(s, 1H), 2.31(s, 6H), 2.09(s, 6H)	988	988.21
309	δ = 8.21(m, 2H), 8.06(m, 2H), 7.67-7.32(m, 28H), 7.03(m, 4H), 4.58(s, 1H), 2.33(s, 6H), 2.09(s, 6H)	1168	1168
406	δ = 8.85(m, 2H), 8.03-7.95(m, 10H), 7.74(m, 2H), 7.59(m, 6H), 7.33-7.29(m, 8H), 4.59(s, 1H), 2.34(s, 6H), 2.31(s, 6H), 2.09(s, 6H)	1008	1008.33
437	δ = 8.06-7.99(m, 4H), 7.79-7.74(m, 4H), 7.59(m, 2H), 7.39(m, 4H), 7.19-7.13(m, 6H), 4.59(s, 1H), 2.59(s, 6H), 2.34(s, 12H), 2.31(s, 6H), 2.09(s, 6H)	964	964.36

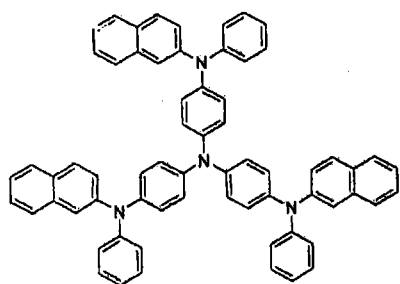
620	$\delta = 8.81(\text{m}, 2\text{H}), 8.03-7.92(\text{m}, 16\text{H}), 7.74-7.73(\text{m}, 4\text{H}), 7.59-7.58(\text{m}, 8\text{H}), 7.43-7.42(\text{m}, 4\text{H}), 7.32(\text{m}, 2\text{H}), 4.59(\text{s}, 1\text{H}), 2.31(\text{s}, 6\text{H}), 2.09(\text{s}, 6\text{H}), 1.35(\text{s}, 18\text{H})$	1244	1244.48
648	$\delta = 8.30(\text{m}, 2\text{H}), 8.03-7.99(\text{m}, 4\text{H}), 7.74(\text{m}, 2\text{H}), 7.59(\text{m}, 2\text{H}), 7.42-7.37(\text{m}, 10\text{H}), 7.25(\text{m}, 2\text{H}), 4.59(\text{s}, 1\text{H}), 2.34(\text{s}, 6\text{H}), 2.31(\text{s}, 6\text{H}), 2.09(\text{s}, 6\text{H}), 1.35(\text{s}, 18\text{H})$	1020	1020.42
766	$\delta = 8.21(\text{m}, 2\text{H}), 8.06(\text{m}, 2\text{H}), 7.65-7.50(\text{m}, 6\text{H}), 7.42-7.35(\text{m}, 12\text{H}), 7.16(\text{s}, 2\text{H}), 7.00(\text{m}, 2\text{H}), 6.90(\text{m}, 2\text{H}), 4.62(\text{s}, 1\text{H}), 2.37(\text{s}, 12\text{H}), 2.34(\text{s}, 6\text{H}), 2.08(\text{s}, 6\text{H}), 1.35(\text{s}, 18\text{H})$	1200	1200.51
838	$\delta = 8.03-7.99(\text{m}, 4\text{H}), 7.74(\text{m}, 2\text{H}), 7.59-7.41(\text{m}, 12\text{H}), 7.25(\text{m}, 8\text{H}), 7.10(\text{m}, 2\text{H}), 6.77(\text{m}, 2\text{H}), 4.59(\text{s}, 1\text{H}), 2.31(\text{s}, 6\text{H}), 2.09(\text{s}, 6\text{H})$	1104	1104.29
842	$\delta = 8.03-7.99(\text{m}, 4\text{H}), 7.74(\text{m}, 2\text{H}), 7.59-7.41(\text{m}, 12\text{H}), 7.31-7.21(\text{m}, 12\text{H}), 4.59(\text{s}, 1\text{H}), 2.31(\text{s}, 6\text{H}), 2.09(\text{s}, 6\text{H})$	1104	1104.29
938	$\delta = 8.21(\text{m}, 2\text{H}), 8.03-7.99(\text{m}, 4\text{H}), 7.74-7.70(\text{m}, 4\text{H}), 7.59-7.41(\text{m}, 22\text{H}), 4.59(\text{s}, 1\text{H}), 2.31(\text{s}, 6\text{H}), 2.09(\text{s}, 6\text{H}), 0.25(\text{s}, 18\text{H})$	1176	1176.41
993	$\delta = 8.03-7.94(\text{m}, 6\text{H}), 7.74(\text{m}, 2\text{H}), 7.59-7.41(\text{m}, 18\text{H}), 4.59(\text{s}, 1\text{H}), 2.31(\text{s}, 6\text{H}), 2.09(\text{s}, 6\text{H})$	880	880.26
994	$\delta = 8.03-7.94(\text{m}, 6\text{H}), 7.74(\text{m}, 2\text{H}), 7.59-7.47(\text{m}, 8\text{H}), 7.39-7.30(\text{m}, 8\text{H}), 4.59(\text{s}, 1\text{H}), 2.31(\text{s}, 6\text{H}), 2.09(\text{s}, 6\text{H})$	916	916.25
999	$\delta = 8.03-7.99(\text{m}, 9\text{H}), 7.74(\text{m}, 3\text{H}), 7.59-7.47(\text{m}, 27\text{H}), 2.31(\text{s}, 9\text{H})$	1075	1075.35

### [实施例 1] OLED (1) 的制造

通过使用根据本发明的红色磷光化合物制造 OLED 装置。

首先, 由 OLED 玻璃 (由三星康宁公司 (Samsung Corning) 生产) (1) 制备的透明电极 ITO 薄膜 ( $15\Omega/\square$ ) (2) 依次使用三氯乙烯、丙酮、乙醇和蒸馏水进行超声波洗涤, 在使用前储存在异丙醇中。

然后, 将 ITO 基材装配到真空气相沉积装置的基材夹具 (substrate folder) 中, 并在真空气相沉积装置的室中放入 4,4',4''-三(N,N-(2-萘基)-苯氨基)三苯基胺 (2-TNATA), 其然后被通风到  $10^{-6}$  托室内真空度。在室内应用电流以蒸发 2-TNATA, 从而提供空穴注入层的气相沉积, 所述空穴注入层在 ITO 基材上具有 60 nm 的厚度。



2-TNATA

然后向真空气相沉积装置的另一个室中充入 N,N'-双( $\alpha$ -萘基)-N,N'-二苯基



上气相沉积电致发光层。向所述真空气相沉积装置的另一个室中充入 H-2 作为根据本发明的电致发光基质材料，还在另一个室中充入根据本发明的有机电致发光化合物（化合物 177）。两种材料以不同的速率蒸发进行掺杂，以在空穴传输层上气相沉积厚度为 30 nm 的电致发光层（5）。适当的掺杂浓度为 4 至 10mol %，以基质计。然后根据实施例 1 的步骤气相沉积空穴阻挡层、电子传输层和电子注入层，然后通过使用另一个真空气相沉积装置气相沉积 150 nm 厚度的 Al 阴极从而制造得 OLED。

### [实施例 3] OLED (3) 的制造

按照实施例 2 相同的步骤形成空穴注入层、空穴传输层和电致发光层，然后气相沉积电子传输层和电子注入层。其后，通过使用另一个真空气相沉积装置气相沉积 150 nm 厚度的 Al 阴极从而制造得 OLED。

为了证实根据实施例 1 至 3 制备的 OLED 的性能，在  $10 \text{ mA/cm}^2$  测定 OLED 的发光效率。表 3 中显示出不同特性。

表 3

	材料	基质	空穴阻挡层	EL 颜色	操作电压	最大发光效率 (cd/A)
实施例 1	化合物 1	CBP	BAlq	红色	7.8	10.1
	化合物 44	CBP	BAlq	红色	8.0	10.5
	化合物 49	CBP	BAlq	红色	8.1	11.0
	化合物 177	CBP	BAlq	红色	8.2	10.8
	化合物 241	CBP	BAlq	红色	8.2	9.4
	化合物 303	CBP	BAlq	红色	7.9	8.8
	化合物 340	CBP	BAlq	红色	8.0	9.6
	化合物 374	CBP	BAlq	红色	7.9	10.4
	化合物 379	CBP	BAlq	红色	8.0	9.2
	化合物 432	CBP	BAlq	红色	7.8	10.0
	化合物 578	CBP	BAlq	红色	8.2	9.8
	化合物 584	CBP	BAlq	红色	7.9	11.1

	化合物 589	CBP	BAIq	红色	8.0	11.3
	化合物 645	CBP	BAIq	红色	8.2	9.4
	化合物 780	CBP	BAIq	红色	7.9	10.2
	化合物 790	CBP	BAIq	红色	8.3	9.3
	化合物 932	CBP	BAIq	红色	8.0	10.0
实施例	化合物 177	H-2	BAIq	红色	8.0	10.6
2	化合物 375	H-7	BAIq	红色	7.8	9.9
	化合物 780	H-40	BAIq	红色	7.8	10.0
实施例	化合物 49	H-8	-	红色	7.0	10.8
3	化合物 303	H-12	-	红色	7.4	8.9
	化合物 780	H-40	-	红色	7.1	10.2
	化合物 790	H-64	-	红色	7.0	9.6

对于化合物 (44)，二甲基的引入提供了提高的效率和色坐标。对于化合物 (49)，在主要配体上引入 F 影响了 LUMO 水平，并且提供了与引入 F 前的化合物相比降低的色坐标但升高的发光效率。化合物 (177)、(584) 和 (589)，其中引入 2-苯基喹啉、2-苯乙烯喹啉和苯基(6-苯基吡啶-3-基)甲醇作为辅助配体，分别地，在根据本发明化合物中表现出最高效率(分别为 10.8 cd/A、11.1 cd/A 和 11.3 cd/A)。引入 ppy 或 1-苯乙烯喹啉作为辅助配体的化合物显示出不低于 10 cd/A 的高效率。因此，发现辅助配体例如 2-苯基喹啉、2-苯乙烯喹啉、苯基(6-苯基吡啶-3-基)甲醇、ppy 和 1-苯乙烯喹啉对于提高化合物的发光效率起着重要作用。

用同一装置结构，使用根据本发明的基质替代 EL 装置中的 CBP 并不能够提供相对于 CBP 在效率、色坐标和操作电压方面的显著变化。因此，表明那些基质可以用作磷光基质，当和本发明的掺杂剂一起使用室，替代 CBP 作为常规的电致发光基质。当应用本发明的基质而不使用空穴阻挡层时，与使用常规基质的装置相比，该装置表现出类似的或更高的发光效率，并且由于降低了至少 0.8V 的操作电压提供了降低的 OLED 功率消耗。如果本发明应用于 OLED 的大

规模生产，大规模生产的时间还可以缩短从而获得商业上更大的效益。



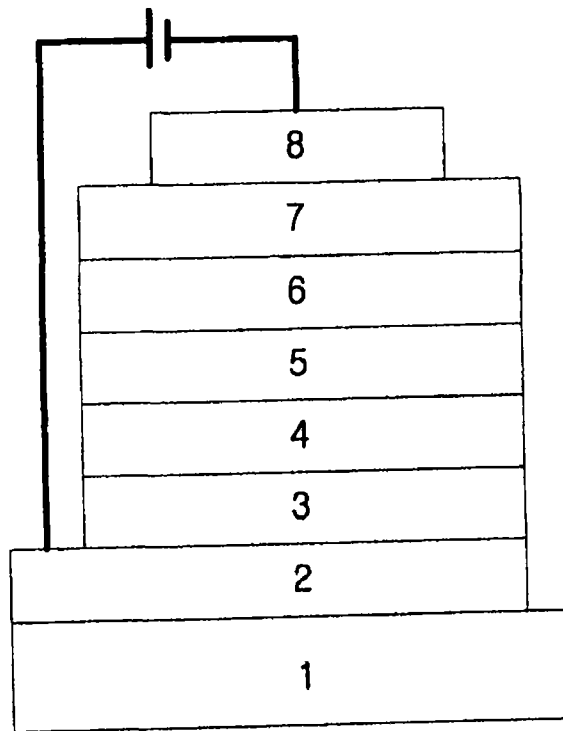


图1