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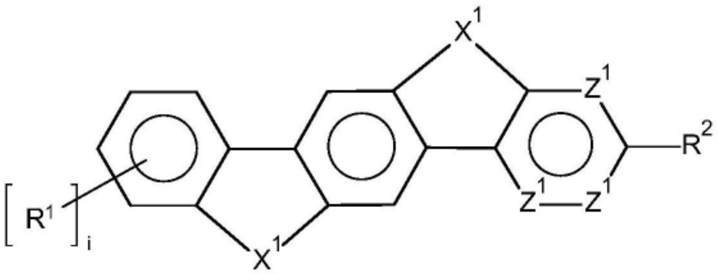
(54)发明名称

用于电子器件的材料

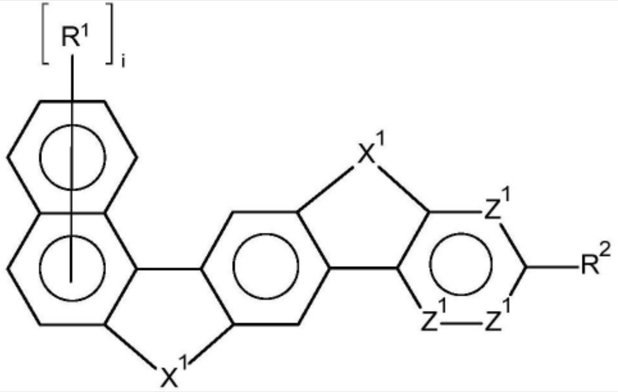
(57)摘要

本申请涉及式(I)化合物、其制备方法以及其在电子器件中的用途。

1.一种化合物,所述化合物对应于下式(I-1)和(I-3)中的任一者:



式(I-1)



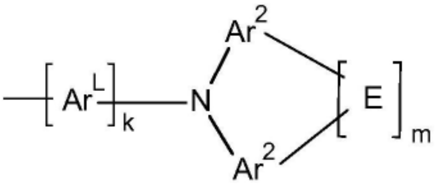
式(I-3)

其中出现的变量如下:

Z^1在每种情况下相同或不同,并且选自CR^1和CR^3;

X^1在每种情况下相同或不同,并且是选自$-C(R^4)_2-$的二价基团;

R^1在每种情况下相同或不同,并且是式(N)的基团



式(N),

Ar^L选自具有6至40个芳族环原子并且被一个或多个R^5基团取代的芳族环系;

Ar^2在每种情况下相同或不同,并且选自苯基、联苯基、三联苯基、四联苯基、萘基、芴基、螺二芴基,其中提及的基团各自被一个或多个R^5基团取代;

R^2选自H和D;

R^3在每种情况下相同或不同,并且选自H和D;

R^4在每种情况下相同或不同,并且选自具有1至20个碳原子的直链的烷基和具有3至20个碳原子的支链或环状的烷基;

R^5在每种情况下相同或不同,并且选自H、D、具有1至20个碳原子的直链的烷基、具有3至20个碳原子的支链或环状的烷基、具有6至40个芳族环原子的芳族环系和具有5至40个芳族环原子的杂芳族环系;

R^6在每种情况下相同或不同,并且选自H和D;

k是0或1,其中在k＝0的情况下,Ar^L基团不存在,并且所述式(N)的基团的氮原子构成连接位置;

m是0;

i是0或1,其中在i＝0的情况下,所述R^1基团不存在;

其中存在至少一个是CR^1的Z^1基团;并且

其中所述化合物各自在芳族环上的未被占用的位置处被R^3或R^6基团取代。

2.根据权利要求1所述的化合物,其特征在于i)一个Z^1基团是CR^1,并且两个其它Z^1基团是CR^3,或ii)两个Z^1基团是CR^1,并且另一个Z^1基团是CR^3。

3.根据权利要求1或2所述的化合物,其特征在于在与X^1相连的键的间位上的Z^1基团是CR^1。

4.根据权利要求1或2所述的化合物,其特征在于Ar^2是被一个或多个R^5基团取代的苯基。

5.根据权利要求1或2所述的化合物,其特征在于R^2是H。

6.根据权利要求1或2所述的化合物,其特征在于R^6是H。

7.一种用于制备根据权利要求1至6中的任一项所述的式(I-1)或(I-3)的化合物的方法,其特征在于带有两个羧酸酯基团、芳族或杂芳族环系和反应性基团的苯化合物在Suzuki反应中与含有硼酸基团和选自反应性基团、二芳基氨基、二芳基氨基芳基和二芳基氨基杂芳基的基团的苯化合物进行反应。

8.一种聚合物,所述聚合物含有一种或多种根据权利要求1至6中的任一项所述的式(I-1)、(I-3)的化合物,其中一个或多个连接到所述聚合物的键位于式(I-1)、(I-3)中被R^1、R^2、R^3、R^4或R^5取代的任何所需的位置处。

9.一种低聚物,所述低聚物含有一种或多种根据权利要求1至6中的任一项所述的式(I-1)、(I-3)的化合物,其中一个或多个连接到所述低聚物的键位于式(I-1)、(I-3)中被R^1、R^2、R^3、R^4或R^5取代的任何所需的位置处。

10.一种树枝状大分子,所述树枝状大分子含有一种或多种根据权利要求1至6中的任一项所述的式(I-1)、(I-3)的化合物,其中一个或多个连接到所述树枝状大分子的键位于式(I-1)、(I-3)中被R^1、R^2、R^3、R^4或R^5取代的任何所需的位置处。

11.一种制剂,所述制剂包含至少一种根据权利要求1至6中的任一项所述的化合物或根据权利要求8所述的聚合物或根据权利要求9所述的低聚物或根据权利要求10所述的树枝状大分子,和至少一种溶剂。

12.一种电子器件,所述电子器件包含至少一种根据权利要求1至6中的任一项所述的化合物或根据权利要求8所述的聚合物或根据权利要求9所述的低聚物或根据权利要求10所述的树枝状大分子。

13.根据权利要求12所述的电子器件,其特征在于所述电子器件是包含阳极、阴极和至少一个发光层的有机电致发光器件,其中器件的选自发光层和空穴传输层的至少一个有机层包含所述至少一种化合物。

14.根据权利要求13所述的有机电致发光器件,所述有机电致发光器件包含阳极、阴极和至少一个发光层,其特征在于所述至少一种化合物存在于电子阻挡层中。

15.根据权利要求1至6中的任一项所述的化合物在电子器件中的用途。

用于电子器件的材料

[0001] 本申请涉及根据以下定义的式(I)的含有选自氨基、桥连氨基和咔唑基的基团的芳族化合物。这些化合物适用于电子器件。

[0002] 在本申请的上下文中，电子器件应理解为是指所谓的有机电子器件，其含有有机半导体材料作为功能材料。更具体地说，这些被理解为是指OLED(有机电致发光器件)。术语OLED被理解为是指具有一个或多个包含有机化合物的层并在施加电压时发光的电子器件。OLED的构造和功能的一般原理是本领域技术人员已知的。

[0003] 在电子器件中，尤其是在OLED中，人们对改善性能数据(尤其是寿命、效率和工作电压)非常感兴趣。在这些方面，尚未找到任何完全令人满意的解决方案。

[0004] 另外，还寻求具有高玻璃化转变温度、低结晶趋势和高折射率的材料，尤其是用于OLED的空穴传输层中的材料。

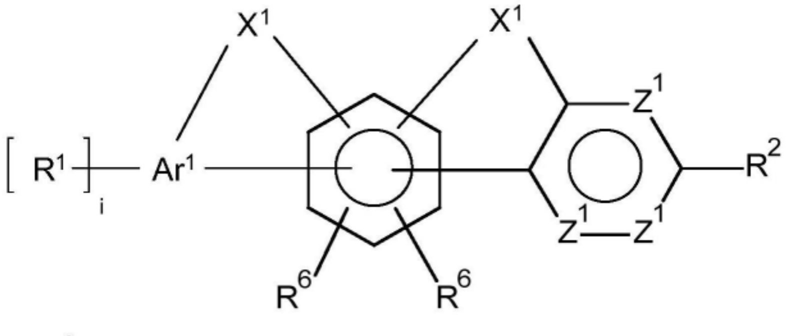
[0005] 发光层和具有空穴传输功能的层对电子器件的性能数据有很大的影响。还正在寻求在这些层中使用的新型化合物，尤其是空穴传输化合物和可以用作发光层中的基质材料、尤其是用于磷光发光体的基质材料的化合物。

[0006] 含有选自氨基、桥连氨基和咔唑基的基团的多种芳族化合物在现有技术中已知为电子器件中的空穴传输材料和/或基质材料。

[0007] 然而，仍然需要适用于电子器件的替代化合物。还需要改进在电子器件中使用的性能数据，尤其是在寿命、工作电压和效率方面更是情况如此。

[0008] 现已发现，来自上述结构类别的特定化合物非常适合用于电子器件，尤其是用于OLED，甚至更尤其用作空穴传输材料和用作磷光发光体的基质材料。所述化合物优选导致器件的高寿命、高效率和低工作电压。进一步优选地，所述化合物具有低结晶趋势、高玻璃化转变温度和高折射率。

[0009] 所述化合物符合下式(I)：

[0010] 

式(I)，

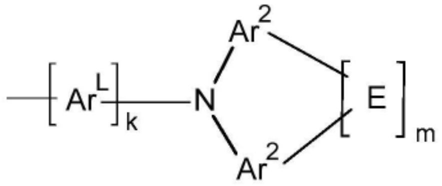
[0011] 其中出现的变量如下：

[0012] Z^1在每种情况下相同或不同，并且选自CR^1和CR^3；

[0013] Ar^1是具有6至20个芳族环原子并且可以被一个或多个R^3基团取代的芳基，或具有5至20个芳族环原子并且可以被一个或多个R^3基团取代的杂芳基；

[0014] X^1在每种情况下相同或不同，并且是选自以下的二价基团：$-C(R^4)_2-$、$-C(R^4)_2-C(R^4)_2-$、$-CR^4=CR^4-$和$-Si(R^4)_2-$；

[0015] R^1在每种情况下相同或不同，并且是式(N)的基团

[0016] 

式(N)，

[0017] Ar^L选自具有6至40个芳族环原子并且可以被一个或多个R^5基团取代的芳族环系，和具有5至40个芳族环原子并且可以被一个或多个R^5基团取代的杂芳族环系；

[0018] Ar^2在每种情况下相同或不同，并且选自具有6至40个芳族环原子并且可以被一个或多个R^5基团取代的芳族环系，和具有5至40个芳族环原子并且可以被一个或多个R^5基团取代的杂芳族环系；

[0019] E是单键或选自以下的二价基团：$C(R^5)_2$、$Si(R^5)_2$、$N(R^5)$、O和S；

[0020] R^2选自H、D、F、$C(=O)R^7$、CN、$Si(R^7)_3$、$N(R^7)_2$、$P(=O)(R^7)_2$、OR^7、$S(=O)R^7$、$S(=O)_2R^7$、具有1至20个碳原子的直链的烷基或烷氧基、具有3至20个碳原子的支链或环状的烷基或烷氧基、具有2至20个碳原子的烯基或炔基、具有6至40个芳族环原子的芳族环系和具有5至40个芳族环原子的杂芳族环系；其中所提及的烷基、烷氧基、烯基和炔基以及所提及的芳族环系和杂芳族环系可以各自被一个或多个R^7基团取代；并且其中所提及的烷基、烷氧基、烯基和炔基中的一个或多个CH_2基团可以被以下基团替代：$-R^7C=CR^7-$、$-C≡C-$、$Si(R^7)_2$、$C=O$、$C=NR^7$、$-C(=O)O-$、$-C(=O)NR^7-$、$P(=O)(R^7)$、-O-、-S-、SO或SO_2；

[0021] R^3、R^4、R^5在每种情况下相同或不同，并且选自H、D、F、$C(=O)R^7$、CN、$Si(R^7)_3$、$N(R^7)_2$、$P(=O)(R^7)_2$、OR^7、$S(=O)R^7$、$S(=O)_2R^7$、具有1至20个碳原子的直链的烷基或烷氧基、具有3至20个碳原子的支链或环状的烷基或烷氧基、具有2至20个碳原子的烯基或炔基、具有6至40个芳族环原子的芳族环系和具有5至40个芳族环原子的杂芳族环系；其中两个或更多个R^3或R^4或R^5基团可以彼此连接并且可以形成环；其中所提及的烷基、烷氧基、烯基和炔基以及所提及的芳族环系和杂芳族环系可以各自被一个或多个R^7基团取代；并且其中所提及的烷基、烷氧基、烯基和炔基中的一个或多个CH_2基团可以被以下基团替代：$-R^7C=CR^7-$、$-C≡C-$、$Si(R^7)_2$、$C=O$、$C=NR^7$、$-C(=O)O-$、$-C(=O)NR^7-$、NR^7、$P(=O)(R^7)$、-O-、-S-、SO或SO_2；

[0022] R^6在每种情况下相同或不同，并且选自H、D、F、$C(=O)R^7$、CN、$Si(R^7)_3$、$P(=O)(R^7)_2$、OR^7、$S(=O)R^7$、$S(=O)_2R^7$、具有1至20个碳原子的直链的烷基或烷氧基、具有3至20个碳原子的支链或环状的烷基或烷氧基、具有2至20个碳原子的烯基或炔基、具有6至40个芳族环原子的芳族环系和具有5至40个芳族环原子的杂芳族环系；其中两个或更多个R^6基团可以彼此连接并且可以形成环；其中所提及的烷基、烷氧基、烯基和炔基以及所提及的芳族环系和杂芳族环系可以各自被一个或多个R^7基团取代；并且其中所提及的烷基、烷氧基、烯基和炔基中的一个或多个CH_2基团可以被以下基团替代：$-R^7C=CR^7-$、$-C≡C-$、$Si(R^7)_2$、$C=O$、$C=NR^7$、$-C(=O)O-$、$-C(=O)NR^7-$、NR^7、$P(=O)(R^7)$、-O-、-S-、SO或SO_2；

[0023] R^7在每种情况下相同或不同，并且选自H、D、F、$C(=O)R^8$、CN、$Si(R^8)_3$、$N(R^8)_2$、$P(=O)(R^8)_2$、OR^8、$S(=O)R^8$、$S(=O)_2R^8$、具有1至20个碳原子的直链的烷基或烷氧基、具有3至20个碳原子的支链或环状的烷基或烷氧基、具有2至20个碳原子的烯基或炔基、具有6至40个

芳族环原子的芳族环系和具有5至40个芳族环原子的杂芳族环系；其中两个或更多个R^7基团可以彼此连接并且可以形成环；其中所提及的烷基、烷氧基、烯基和炔基以及所提及的芳族环系和杂芳族环系可以各自被一个或多个R^8基团取代；并且其中所提及的烷基、烷氧基、烯基和炔基中的一个或多个CH_2基团可以被以下基团替代：$-R^8C=CR^8-$、$-C\equiv C-$、$Si(R^8)_2$、$C=O$、$C=NR^8$、$-C(=O)O-$、$-C(=O)NR^8-$、NR^8、$P(=O)(R^8)$、$-O-$、$-S-$、SO或SO_2；

[0024] R^8在每种情况下相同或不同，并且选自H、D、F、CN、具有1至20个碳原子的烷基或烷氧基、具有2至20个碳原子的烯基或炔基、具有6至40个芳族环原子的芳族环系和具有5至40个芳族环原子的杂芳族环系；其中两个或更多个R^8基团可以彼此连接并且可以形成环；并且其中所提及的烷基、烷氧基、烯基和炔基、芳族环系和杂芳族环系可以被F或CN取代；

[0025] k是0或1，其中在k＝0的情况下，所述Ar^L基团不存在，并且所述式(N)的基团的氮原子构成连接位置；

[0026] m是0或1，其中在m＝0的情况下，所述E基团不存在，并且所述Ar^2基团不彼此键合；

[0027] i是0或1，其中在i＝0的情况下，所述R^1基团不存在；并且

[0028] 其中存在至少一个是CR^1的Z^1基团。

[0029] 式(I)的六元环中画出的圆圈表示所讨论的六元环具有芳香性。引入苯环的键表示所讨论的键可以位于苯环上的任何位置。更具体地说，X^1桥连基不仅可以在彼此反式的位置而且可以在彼此顺式的位置来排列。

[0030] 在本发明的上下文中，芳基含有6至40个芳族环原子，其中没有一个是杂原子。在本发明的上下文中，芳基应理解为是指简单的芳族环，即苯，或稠合的芳族多环，例如萘、菲或蒽。在本申请的上下文中，稠合的芳族多环由彼此稠合的两个或更多个简单的芳族环组成。环之间的稠合在这里被理解为是指环彼此共享至少一个边。

[0031] 在本发明的上下文中，杂芳基含有5至40个芳族环原子，其中至少一个是杂原子。杂芳基的杂原子优选选自N、O和S。在本发明的上下文中，杂芳基应理解为是指简单的杂芳族环，例如吡啶、嘧啶或噻吩，或稠合的杂芳族多环，例如喹啉或咔唑。在本申请的上下文中，稠合的杂芳族多环由彼此稠合的两个或更多个简单的杂芳族环组成。环之间的稠合在这里被理解为是指环彼此共享至少一个边。

[0032] 各自可以被上述基团取代并且可以通过任何所需的位置与芳族或杂芳族系统连接的芳基或杂芳基，尤其应理解为是指衍生自以下物质的基团：苯、萘、蒽、菲、芘、二氢芘、䓛、苝、联三苯叉、荧蒽、苯并蒽、苯并菲、并四苯、并五苯、苯并芘、呋喃、苯并呋喃、异苯并呋喃、二苯并呋喃、噻吩、苯并噻吩、异苯并噻吩、二苯并噻吩、吡咯、吲哚、异吲哚、咔唑、吡啶、喹啉、异喹啉、吖啶、菲啶、苯并-5,6-喹啉、苯并-6,7-喹啉、苯并-7,8-喹啉、吩噻嗪、吩噁嗪、吡唑、吲唑、咪唑、苯并咪唑、萘并咪唑、菲并咪唑、吡啶并咪唑、吡嗪并咪唑、喹喔啉并咪唑、噁唑、苯并噁唑、萘并噁唑、蒽并噁唑、菲并噁唑、异噁唑、1,2-噻唑、1,3-噻唑、苯并噻唑、哒嗪、苯并哒嗪、嘧啶、苯并嘧啶、喹喔啉、吡嗪、吩嗪、萘啶、氮杂咔唑、苯并咔啉、菲咯啉、1,2,3-三唑、1,2,4-三唑、苯并三唑、1,2,3-噁二唑、1,2,4-噁二唑、1,2,5-噁二唑、1,3,4-噁二唑、1,2,3-噻二唑、1,2,4-噻二唑、1,2,5-噻二唑、1,3,4-噻二唑、1,3,5-三嗪、1,2,4-三嗪、1,2,3-三嗪、四唑、1,2,4,5-四嗪、1,2,3,4-四嗪、1,2,3,5-四嗪、嘌呤、蝶啶、吲哚嗪和苯并噻二唑。

[0033] 在本发明的上下文中，芳族环系在环系中含有6至40个碳原子，并且不包括任何杂原子作为芳族环原子。因此，在本发明的上下文中，芳族环系不含有任何杂芳基。在本发明的上下文中，芳族环系应理解为是指以下体系，其不必仅含有芳基，而是其中多个芳基也可以通过单键或非芳族单元(例如一个或多个任选取代的C、Si、N、O或S原子)键合。在这种情况下，基于体系中除H以外的原子的总数，非芳族单元优选包含少于10％的除H以外的原子。例如，在本发明的上下文中，诸如9,9'-螺二芴、9,9'-二芳基芴、三芳基胺、二芳基醚和二苯乙烯的体系也被认为是芳族环系，并且其中两个或更多个芳基例如通过直链或环状的烷基、烯基或炔基或通过甲硅烷基连接的体系同样如此。另外，在本发明的上下文中，其中两个或更多个芳基经由单键彼此连接的体系，例如，诸如联苯和三联苯的体系，也被视为芳族环系。

[0034] 优选地，芳族环系应理解为是指其中存在的芳基彼此共轭的化学基团。这意味着存在的芳基必须经由单键或经由具有可参与共轭的自由π电子对的连接单元而彼此键合。在此，连接单元优选选自氮原子、单个C＝C单元、单个C≡C单元、彼此共轭和/或与C≡C单元共轭的多个C＝C单元、-O-和-S-。

[0035] 在本发明的上下文中，杂芳族环系含有5至40个芳族环原子，其中至少一个是杂原子。杂芳族环系的杂原子优选选自N、O和/或S。杂芳族环系对应于上述芳族环系的定义，但是具有至少一个杂原子作为芳族环原子之一。以这种方式，就本申请的定义而言，它不同于芳族环系，根据该定义，芳族环系不能含有任何杂原子作为芳族环原子。

[0036] 具有6至40个芳族环原子的芳族环系或具有5至40个芳族环原子的杂芳族环系尤其应理解为是指衍生自上述在芳基和杂芳基下的基团的基团，以及衍生自联苯、三联苯、四联苯、芴、螺二芴、二氢菲、二氢芘、四氢芘、茚并芴、三聚茚、异三聚茚、螺三聚茚、螺异三聚茚、茚并咔唑或这些基团的组合的基团。

[0037] 在本发明的上下文中，其中个别氢原子或CH_2基团也可以被基团定义中的上述基团取代的具有1至20个碳原子的直链烷基和具有3至20个碳原子的支链或环状的烷基和具有2至40个碳原子的烯基或炔基，优选理解为是指甲基、乙基、正丙基、异丙基、正丁基、异丁基、仲丁基、叔丁基、2-甲基丁基、正戊基、仲戊基、环戊基、新戊基、正己基、环己基、新己基、正庚基、环庚基、正辛基、环辛基、2-乙基己基、三氟甲基、五氟乙基、2,2,2-三氟乙基、乙烯基、丙烯基、丁烯基、戊烯基、环戊烯基、己烯基、环己烯基、庚烯基、环庚烯基、辛烯基、环辛烯基、乙炔基、丙炔基、丁炔基、戊炔基、己炔基或辛炔基。

[0038] 其中个别氢原子或CH_2基团也可以被基团定义中的上述基团替代的具有1至20个碳原子的烷氧基或硫代烷基，优选理解为是指甲氧基、三氟甲氧基、乙氧基、正丙氧基、异丙氧基、正丁氧基、异丁氧基、仲丁氧基、叔丁氧基、正戊氧基、仲戊氧基、2-甲基丁氧基、正己氧基、环己氧基、正庚氧基、环庚氧基、正辛氧基、环辛氧基、2-乙基己氧基、五氟乙氧基、2,2,2-三氟乙氧基、甲硫基、乙硫基、正丙硫基、异丙氧基、正丁硫基、异丁硫基、仲丁硫基、叔丁硫基、正戊硫基、仲戊硫基、正己硫基、环己硫基、正庚硫基、环庚硫基、正辛硫基、环辛硫基、2-乙基己硫基、三氟甲硫基、五氟乙硫基、2,2,2-三氟乙硫基、乙烯硫基、丙烯硫基、丁烯硫基、戊烯硫基、环戊烯硫基、己烯硫基、环己烯硫基、庚烯硫基、环庚烯硫基、辛烯硫基、环辛烯硫基、乙炔硫基、丙炔硫基、丁炔硫基、戊炔硫基、己炔硫基、庚炔硫基或辛炔硫基。

[0039] 在本申请的上下文中，两个或更多个基团可以一起形成环的措词应被理解为尤其

是指两个基团通过化学键彼此连接。然而，另外，上述措辞还应理解为，如果两个基团之一是氢，那么第二个基团结合至氢原子键合的位置，从而形成环。

[0040] 式(I)化合物优选仅具有单个二芳基氨基。更优选仅具有单个氨基。

[0041] 优选地，一个Z^1基团是CR^1，并且两个其它Z^1基团是CR^3；或两个Z^1基团是CR^1，并且另一个Z^1基团是CR^3。更优选地，一个Z^1基团是CR^1，并且两个其它Z^1基团是CR^3。

[0042] 优选地，在与X^1相连的键的间位上的Z^1基团是CR^1。

[0043] 优选地，构成Z^1基团的R^3基团不会彼此形成环。

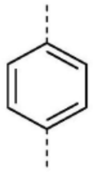
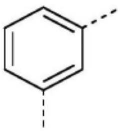
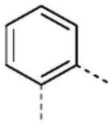
[0044] 优选地，Ar^1是具有6至14个芳族环原子并且可以被一个或多个R^3基团取代的芳基，更优选可以被一个或多个R^3基团取代的苯基或萘基，最优选可以被一个或多个R^3基团取代的苯基。

[0045] X^1优选在每种情况下相同或不同，并且选自$C(R^4)_2$和$Si(R^4)_2$；更优选地，X^1是$C(R^4)_2$。

[0046] Ar^L基团优选选自具有6至20个芳族环原子并且可以被一个或多个R^5基团取代的芳族环系，和具有5至20个芳族环原子并且可以被一个或多个R^5基团取代的杂芳族环系。特别优选的Ar^L基团选自衍生自苯、联苯、三联苯、萘、芴、茚并芴、螺二芴、二苯并呋喃、二苯并噻吩和咔唑的二价基团，它们各自可以被一个或多个R^5基团取代。最优选地，Ar^L是衍生自苯的二价基团，其在每种情况下可以被一个或多个R^5基团取代。Ar^L基团在每种情况下可以相同或不同地选择。

[0047] 优选的Ar^L基团符合以下式：

[0048]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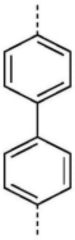	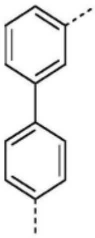	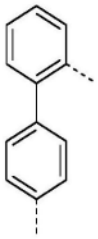
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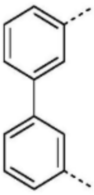	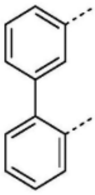	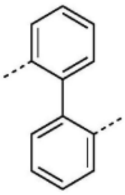
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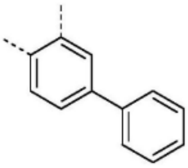	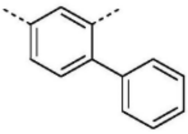	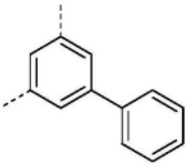
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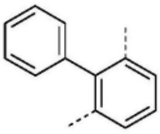	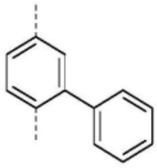	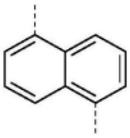
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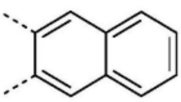	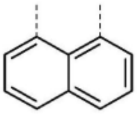	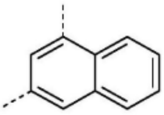
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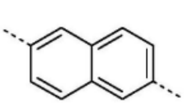
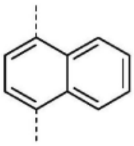
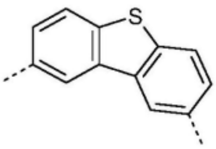
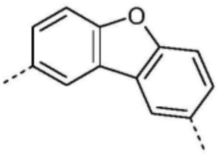
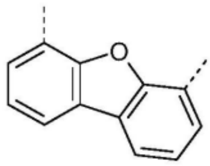
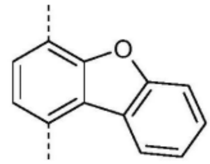
		
Ar^L-19	Ar^L-20	Ar^L-21

[0049]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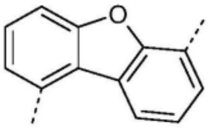	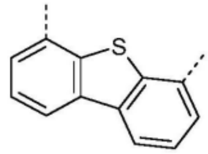	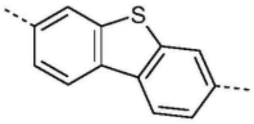
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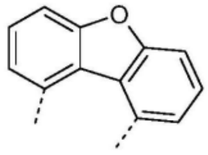	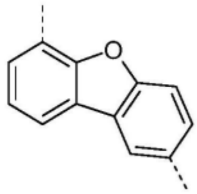	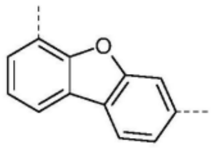
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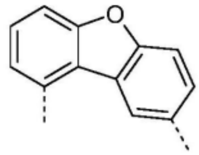	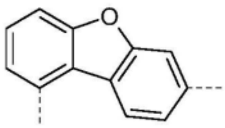	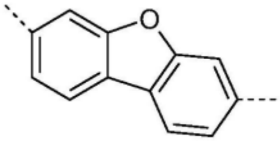
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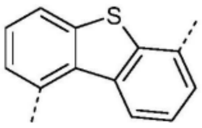	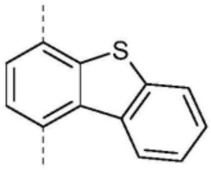	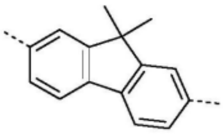
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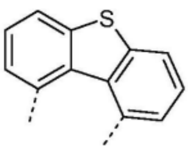	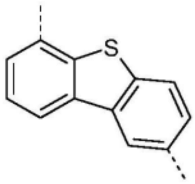	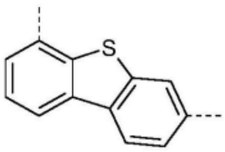
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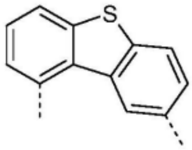	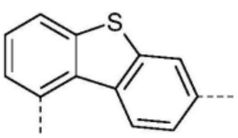	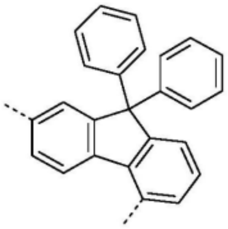
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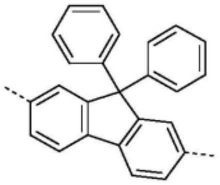
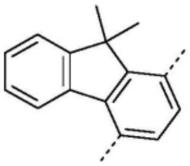
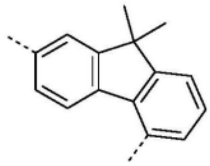
[0050]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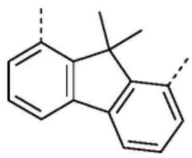	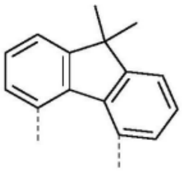	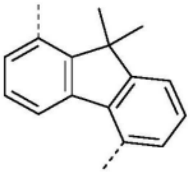
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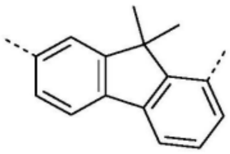	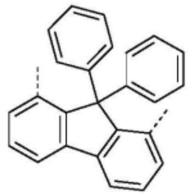	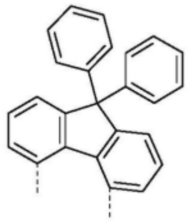
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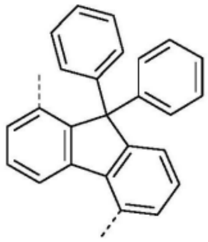	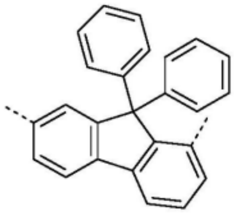	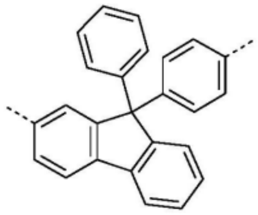
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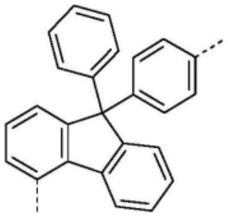	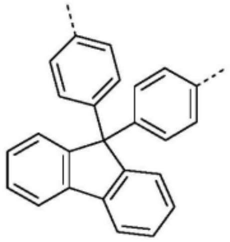	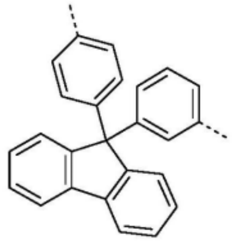
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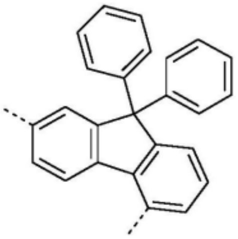	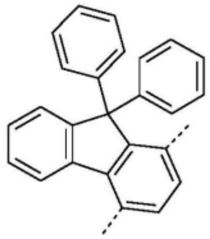	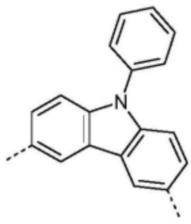
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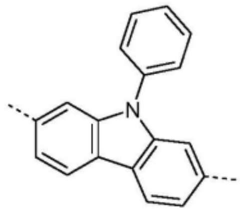
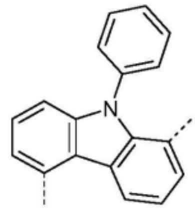
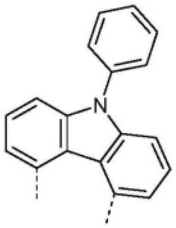
[0051]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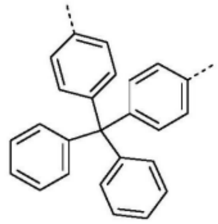	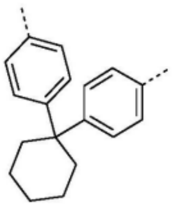	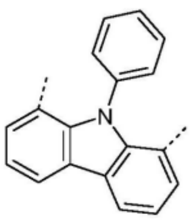
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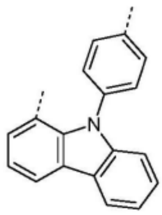	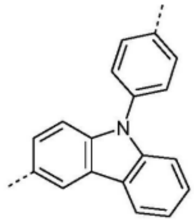	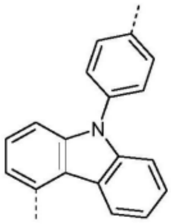
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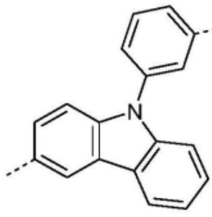
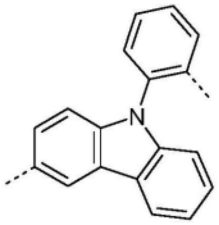
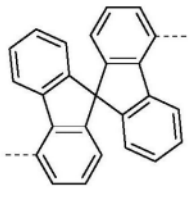
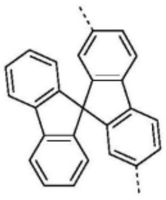
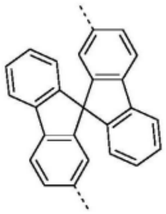
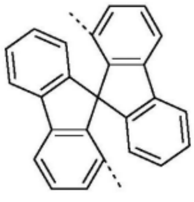
		
Ar^L-70	Ar^L-71	Ar^L-72
		
Ar^L-73	Ar^L-74	Ar^L-75

[0052]　其中虚线代表与式(I)的其余部分连接的键。

[0053]　优选地，Ar^2基团在每种情况下相同或不同，并且选自具有6至40个芳族环原子并且可以被一个或多个R^5基团取代的芳族环系，和具有5至40个芳族环原子并且可以被一个或多个R^5基团取代的杂芳族环系。

[0054]　在此通常优选的是Ar^2的直接与所述氮原子键合的基团是芳族环系。

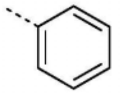
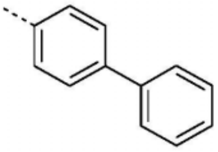
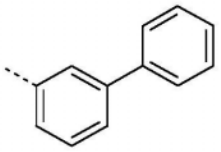
[0055]　优选地，Ar^2基团在每种情况下相同或不同，并且选自衍生自以下物质的单价基团：苯、联苯、三联苯、四联苯、萘、芴、尤其是9,9’-二甲基芴和9,9’-二苯基芴、苯并芴、螺二芴、茚并芴、二苯并呋喃、二苯并噻吩、苯并咔唑、咔唑、苯并呋喃、苯并噻吩、吲哚、喹啉、吡

啶、嘧啶、吡嗪、哒嗪和三嗪，其中单价基团可以各自被一个或多个R^5基团取代。或者，Ar^2基团在每种情况下可以优选相同或不同，并且选自衍生自以下的基团的组合：苯、联苯、三联苯、四联苯、萘、芴、尤其是9,9’-二甲基芴和9,9’-二苯基芴、苯并芴、螺二芴、茚并芴、二苯并呋喃、二苯并噻吩、咔唑、苯并呋喃、苯并噻吩、吲哚、喹啉、吡啶、嘧啶、吡嗪、哒嗪和三嗪，其中所述基团可以各自被一个或多个R^5基团取代。

[0056] 特别优选的Ar^2基团在每种情况下相同或不同，并且选自苯基、联苯基、三联苯基、四联苯基、萘基、芴基、尤其是9,9’-二甲基芴基和9,9’-二苯基芴基、苯并芴基、螺二芴基、茚并芴基、二苯并呋喃基、二苯并噻吩基、咔唑基、苯并呋喃基、苯并噻吩基、苯并稠合的二苯并呋喃基、苯并稠合的二苯并噻吩基、萘基取代的苯基、芴基取代的苯基、螺二芴基取代的苯基、二苯并呋喃基取代的苯基、二苯并噻吩基取代的苯基、咔唑基取代的苯基、吡啶基取代的苯基、嘧啶基取代的苯基和三嗪基取代的苯基，其中所提及的基团可以各自被一个或多个R^5基团取代。

[0057] 特别优选的Ar^2基团选自以下式：

[0058]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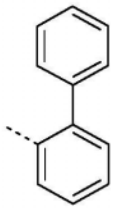	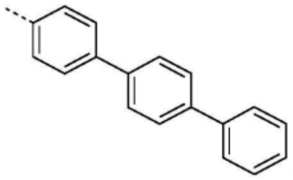	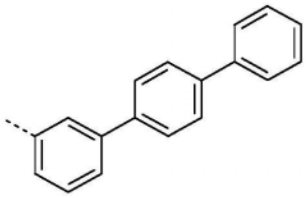
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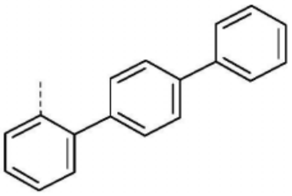	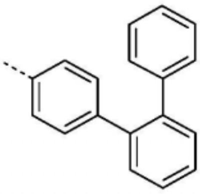	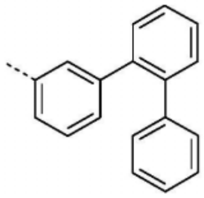
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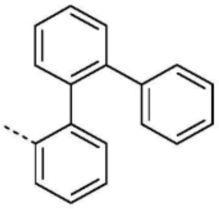	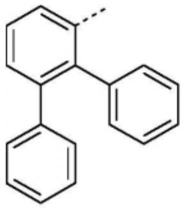	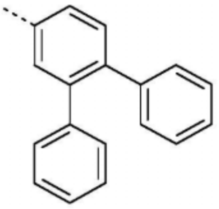
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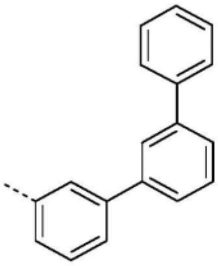	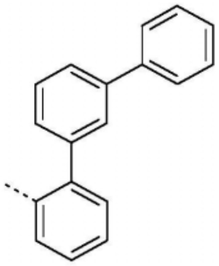	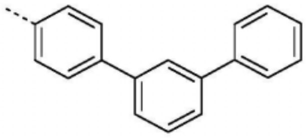
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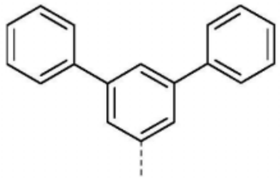	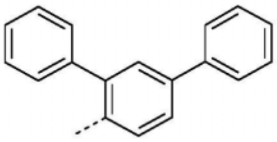	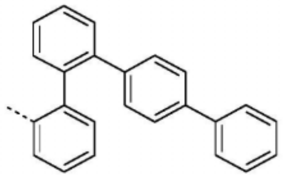
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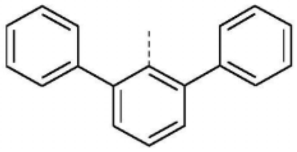
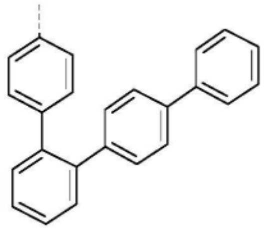
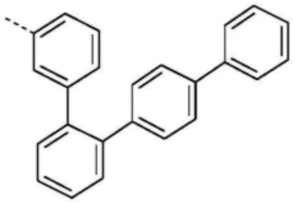
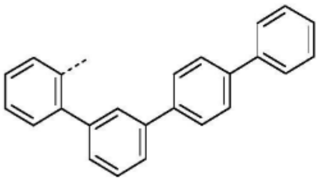
		
Ar-19		

[0059]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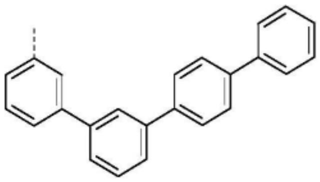	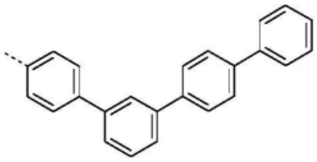	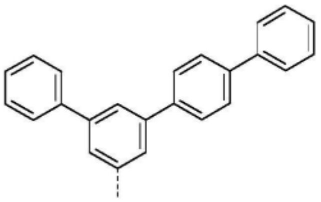
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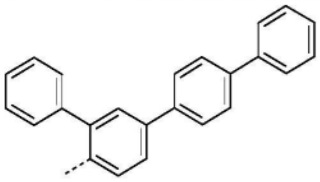	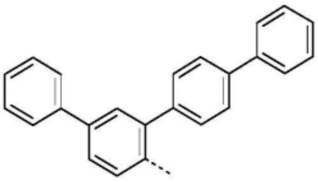	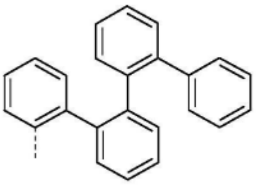
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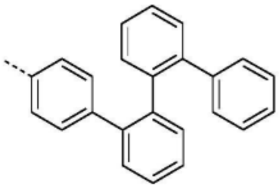	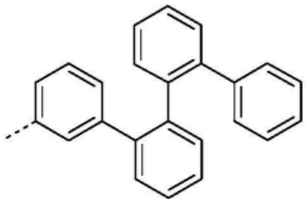	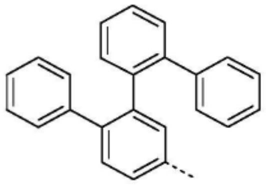
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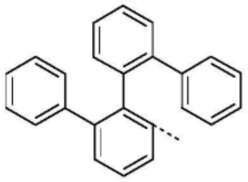	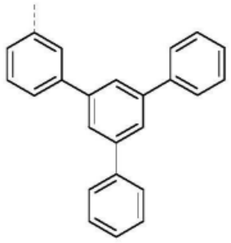	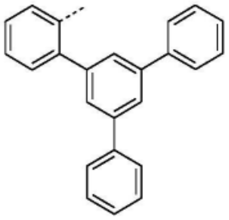
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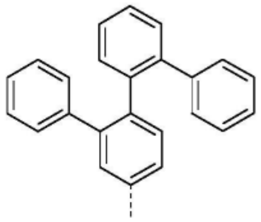	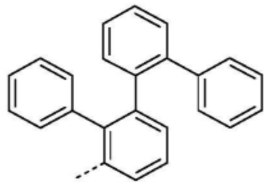	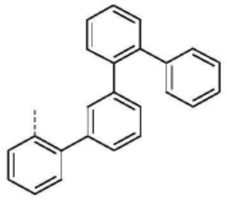
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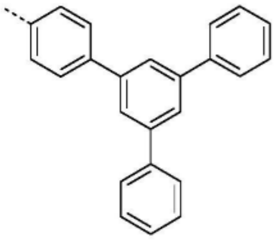
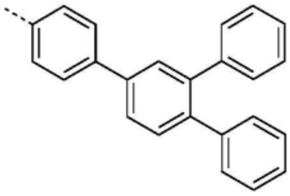
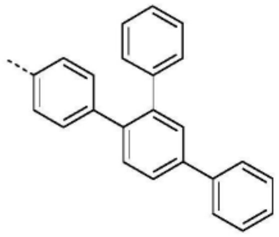
[0060]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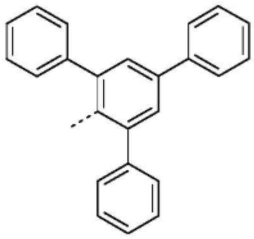	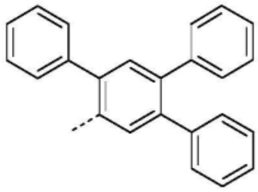	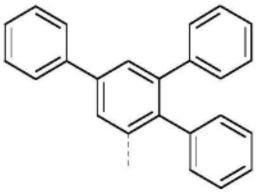
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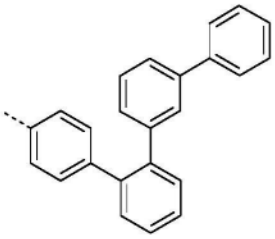	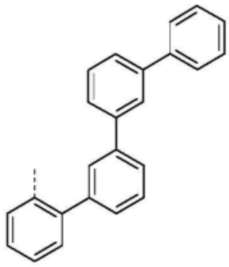	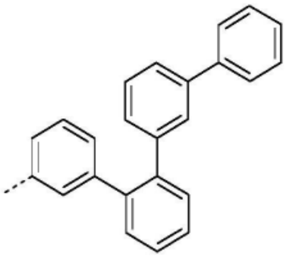
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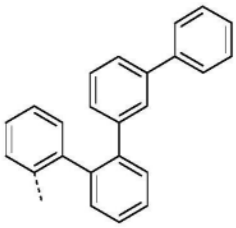		
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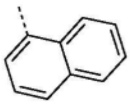	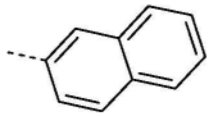	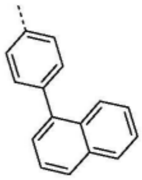
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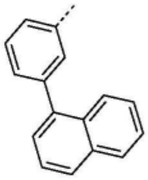	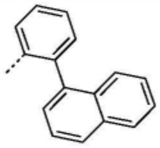	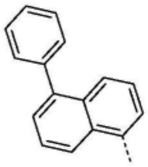
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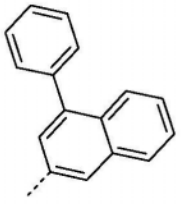	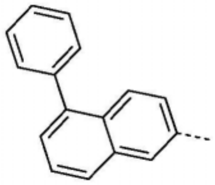	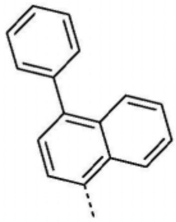
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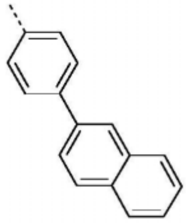	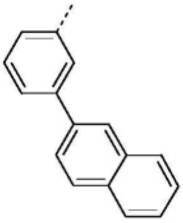	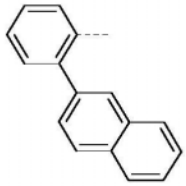
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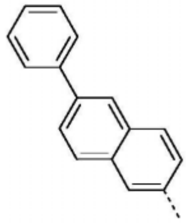	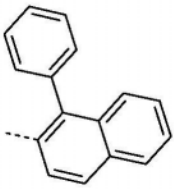	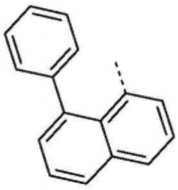
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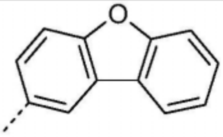
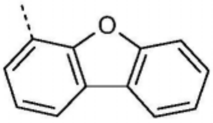
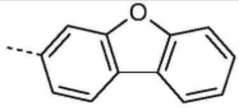
[0061]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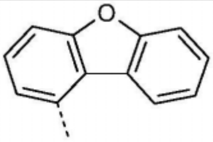	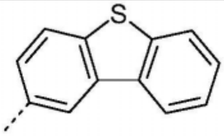	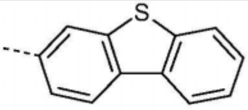
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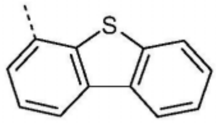	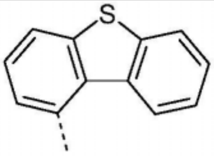	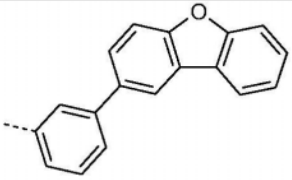
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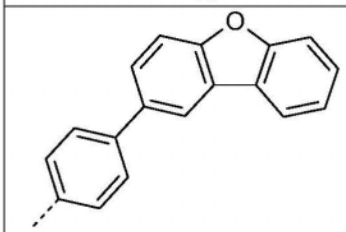
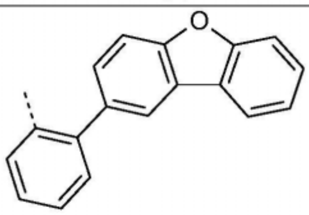
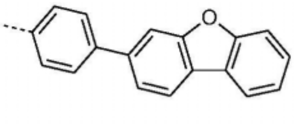
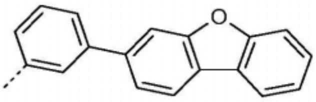
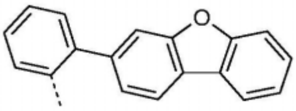
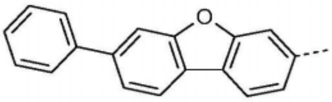
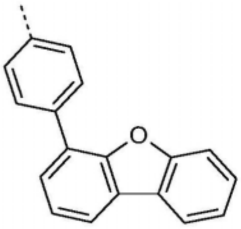
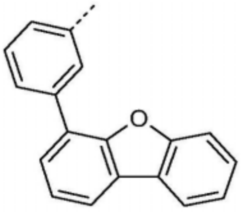
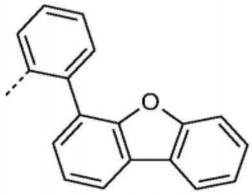
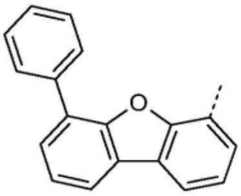
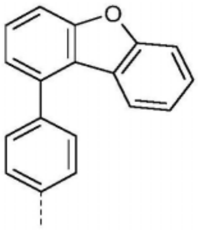
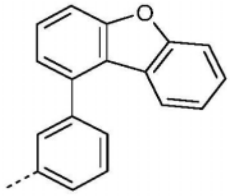
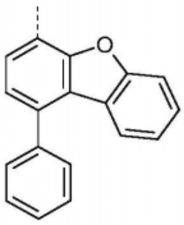
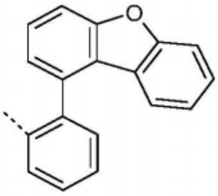
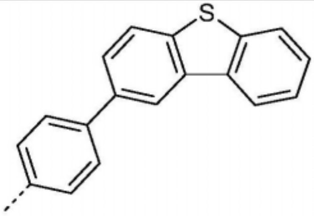
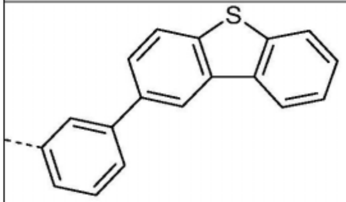
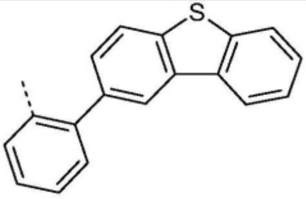
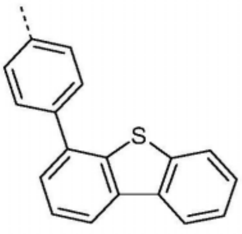
		
Ar-72	Ar-73	Ar-74

[0062]

		
Ar-75	Ar-76	Ar-77
		
Ar-78	Ar-79	Ar-80
		
Ar-81	Ar-82	Ar-83
		
Ar-84	Ar-85	Ar-86
		
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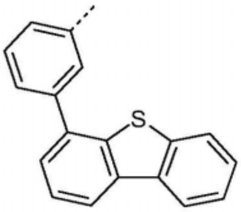	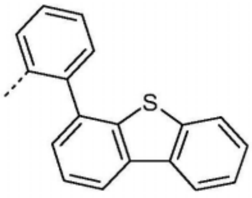	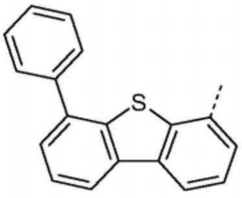
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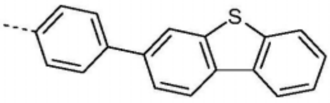	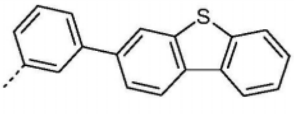	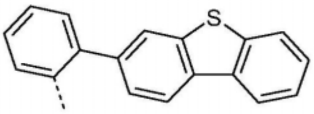
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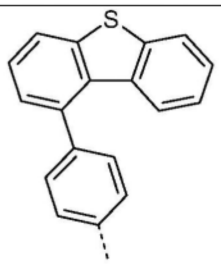	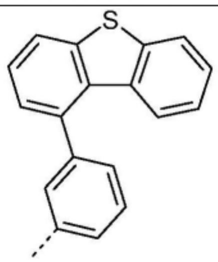	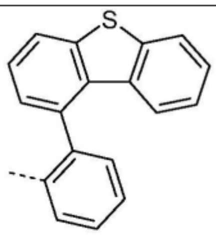
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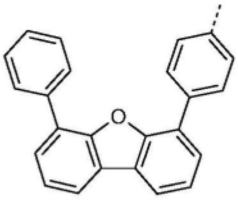	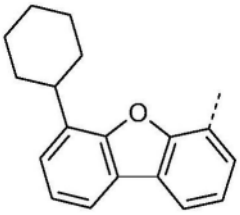	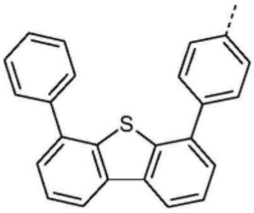
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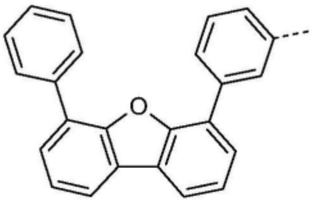	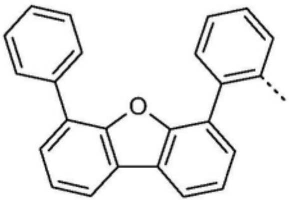	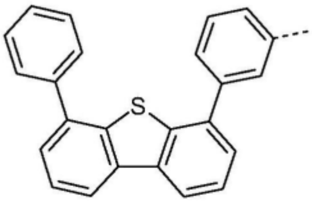
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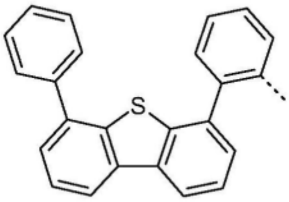
[0063]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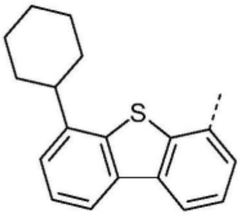	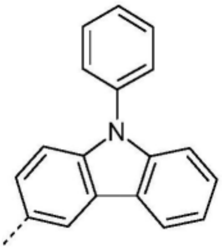	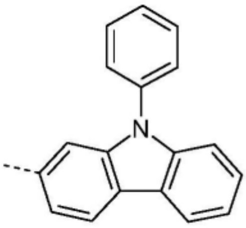
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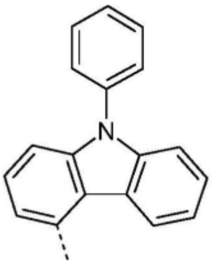	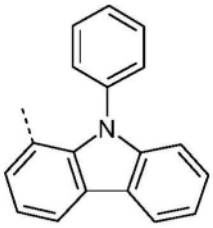	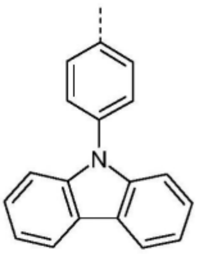
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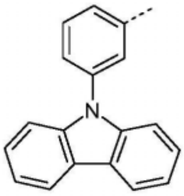
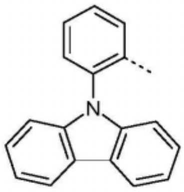
[0064]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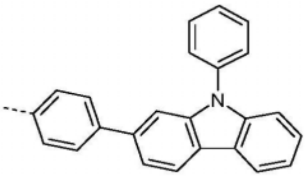	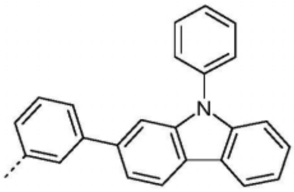	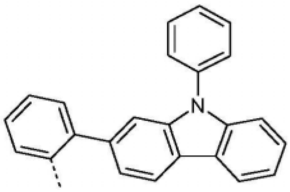
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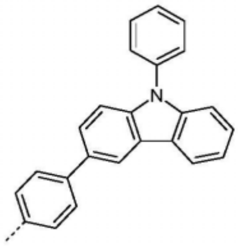	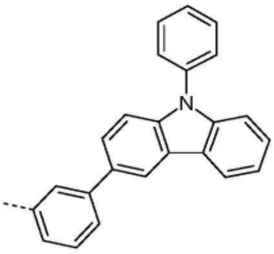	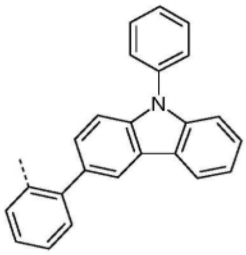
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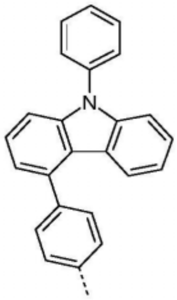	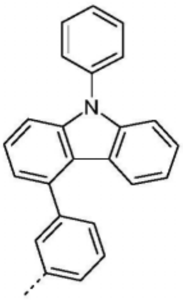	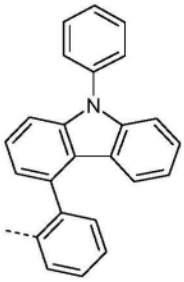
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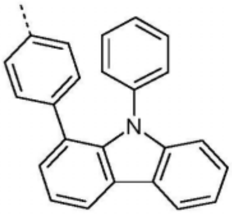	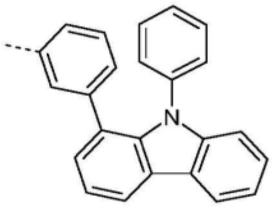	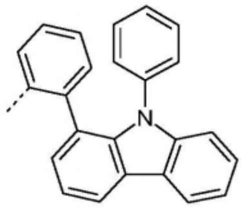
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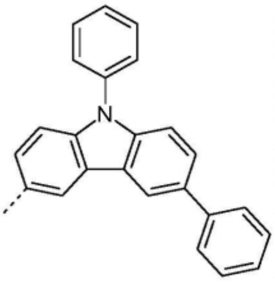	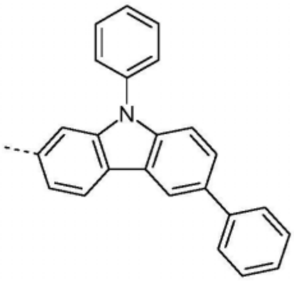	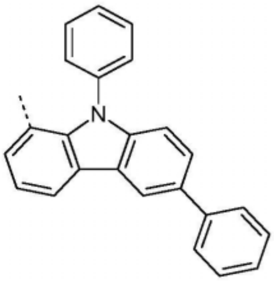
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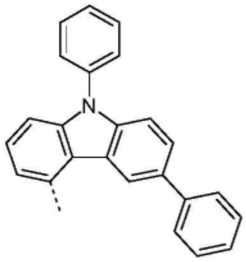
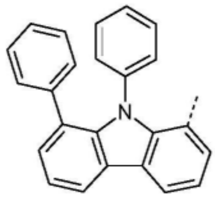
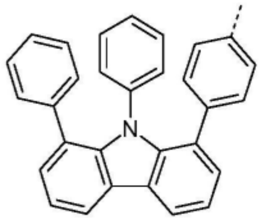
[0065]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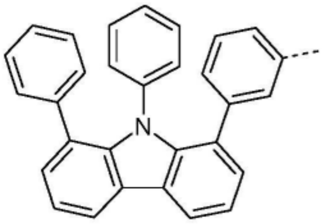	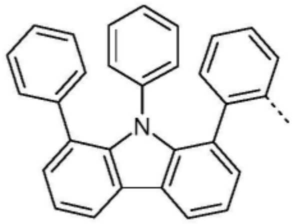	
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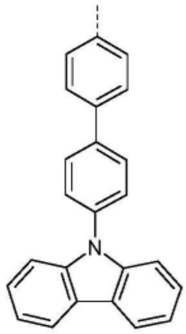	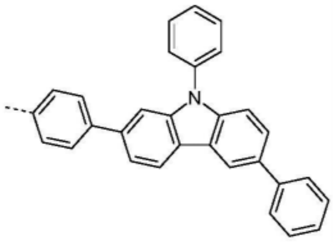	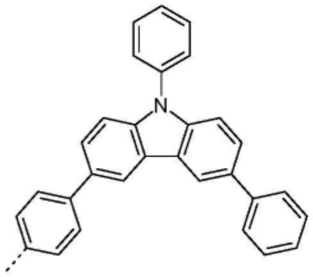
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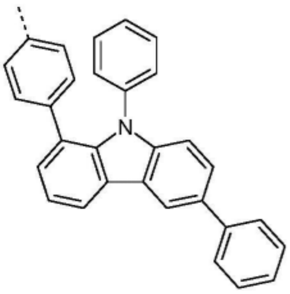	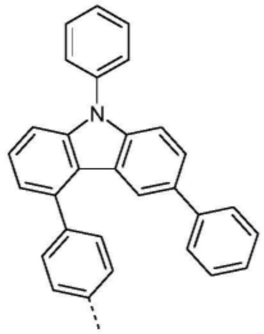	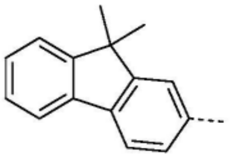
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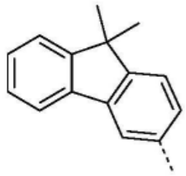
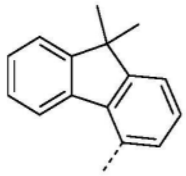
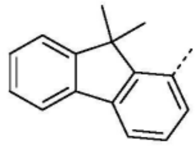
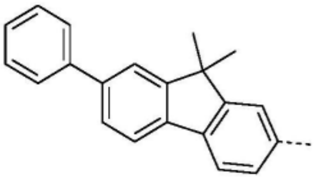
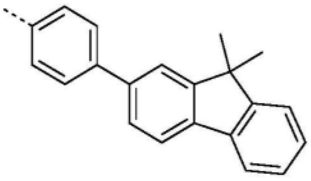
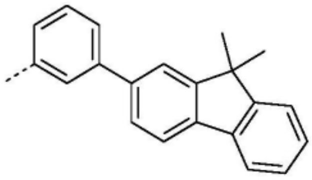
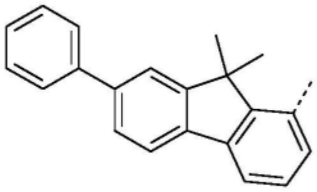
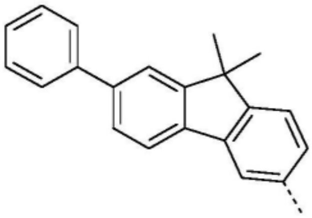
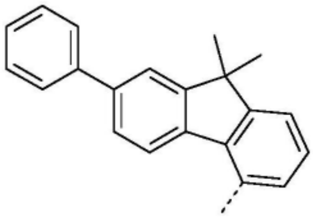
		
Ar-140	Ar-141	Ar-142

[0066]

		
Ar-143	Ar-144	Ar-145
		
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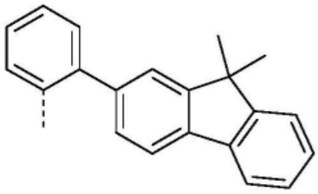	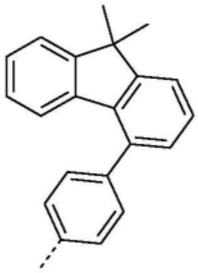	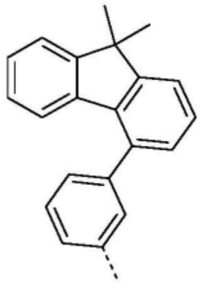
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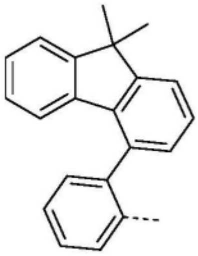
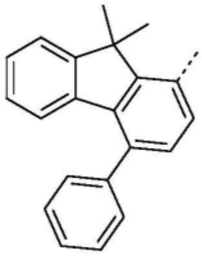
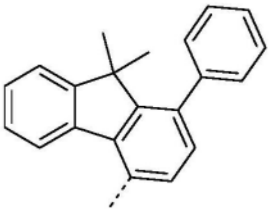
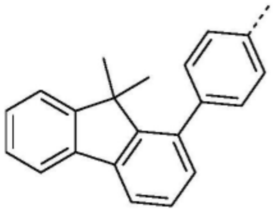
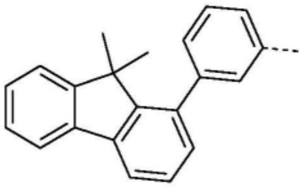
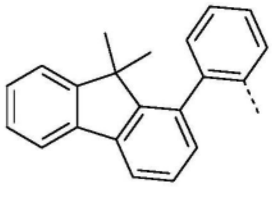
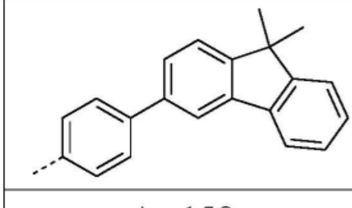
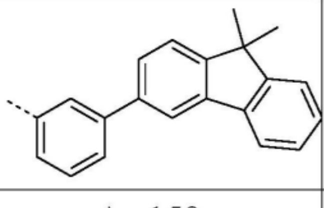
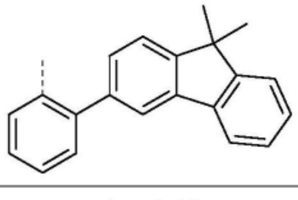
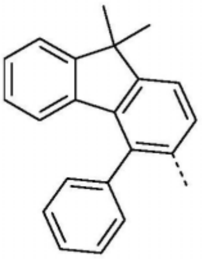
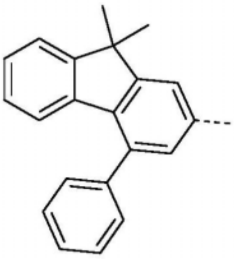
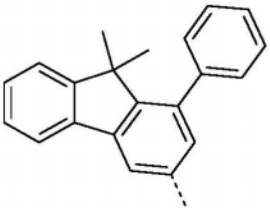
		
Ar-152	Ar-153	Ar-154
		
Ar-155	Ar-156	Ar-157
		
Ar-158	Ar-159	Ar-160

[0067]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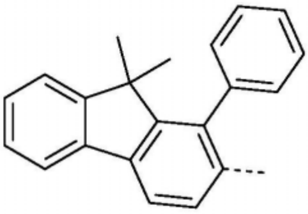	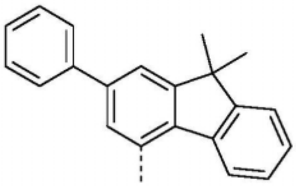	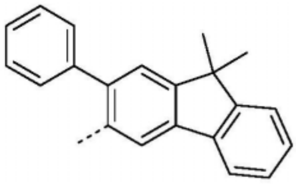
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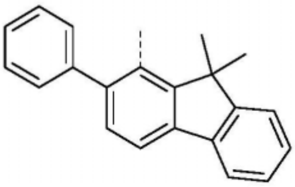	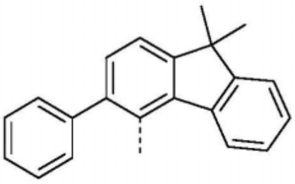	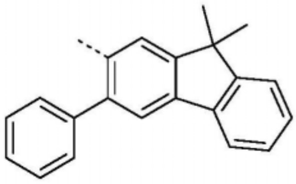
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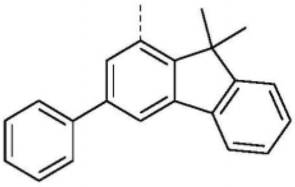	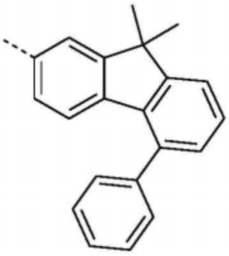	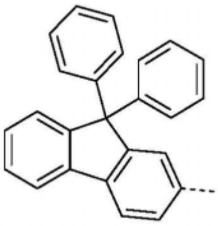
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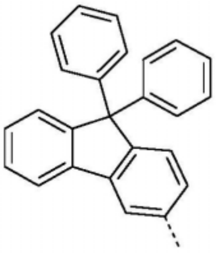	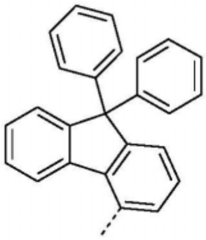	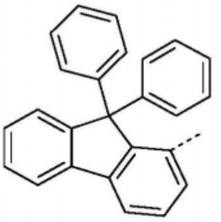
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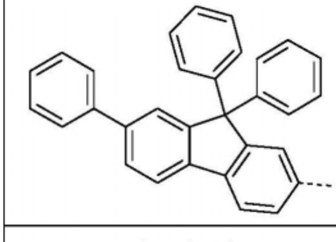	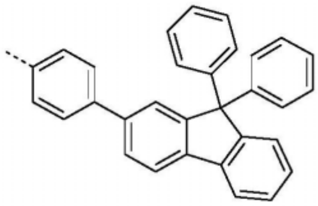	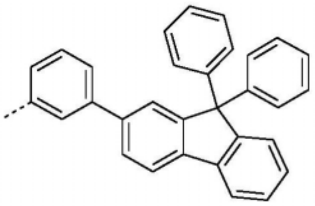
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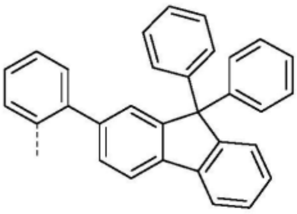
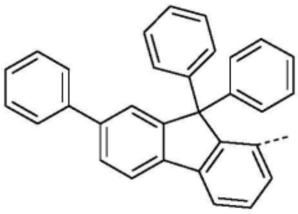
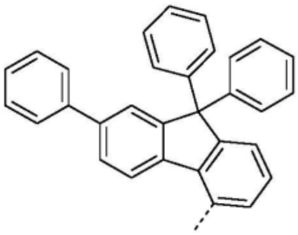
[0068]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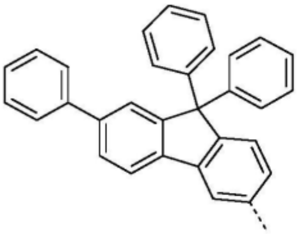	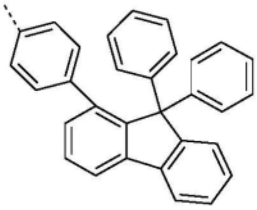	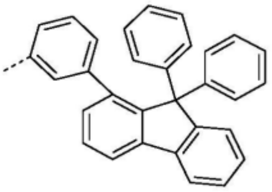
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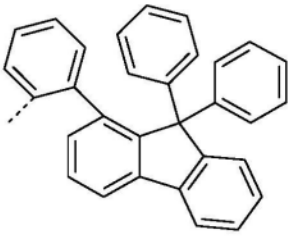	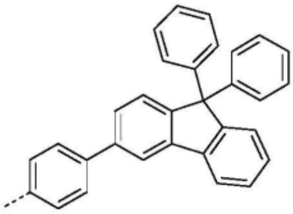	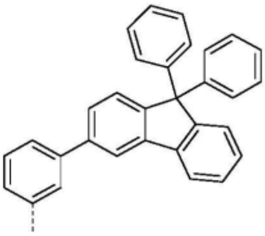
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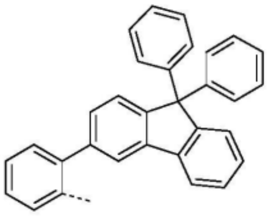	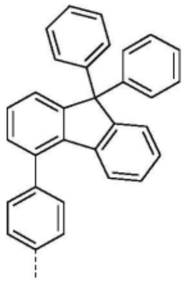	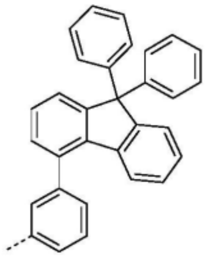
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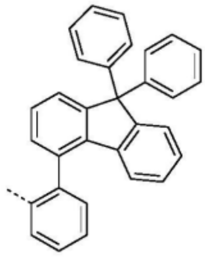		
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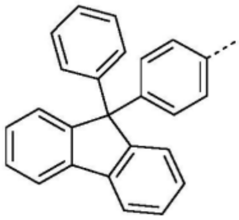	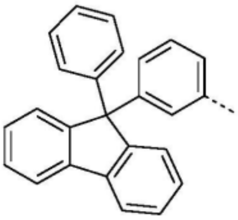	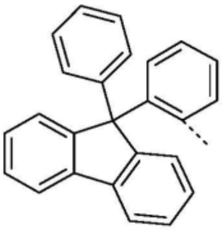

[0069]

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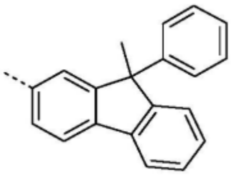	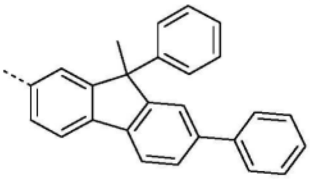	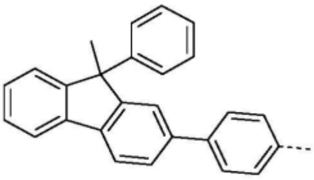
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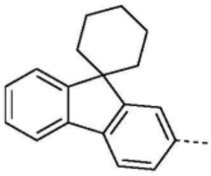	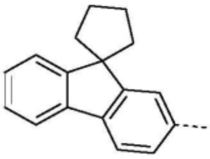	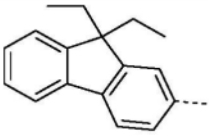
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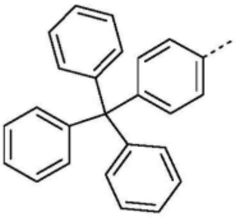	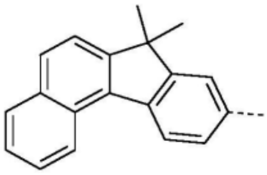	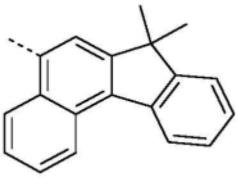
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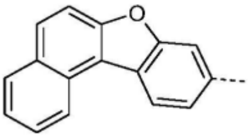	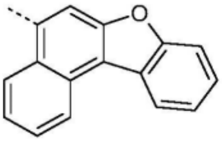	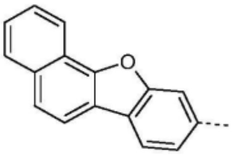
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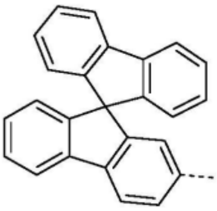	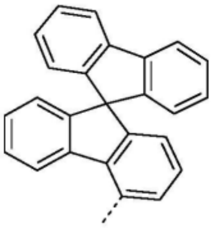	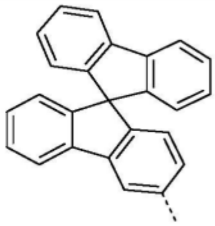
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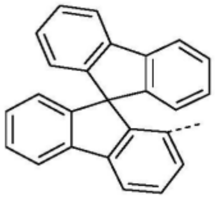	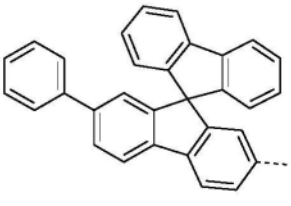	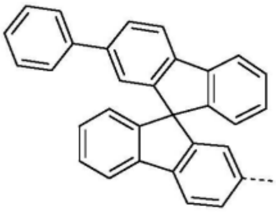
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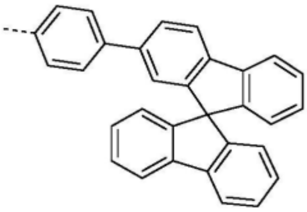	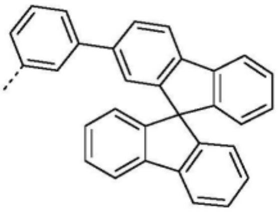	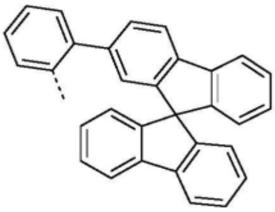

[0070]

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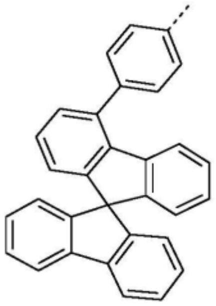	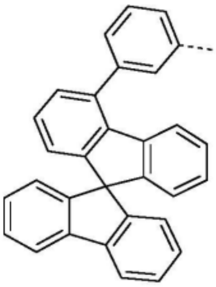	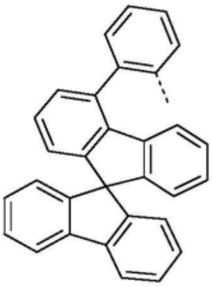
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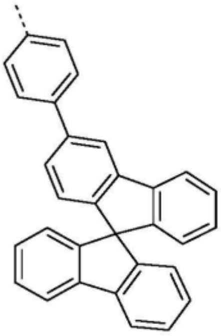	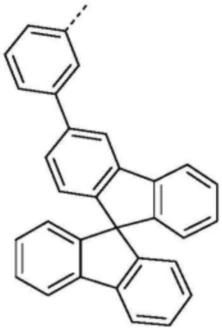	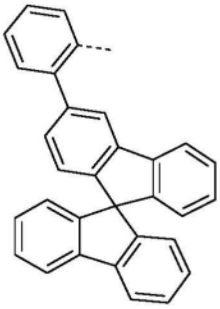
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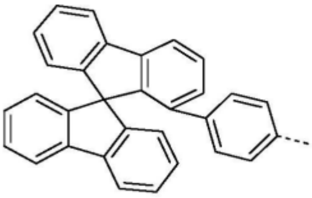	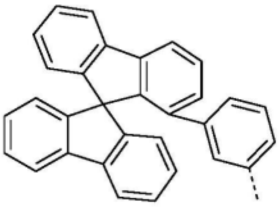	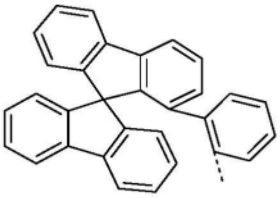
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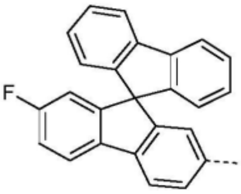	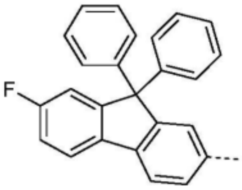	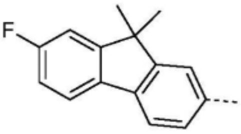
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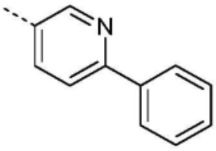	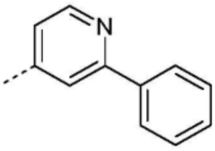	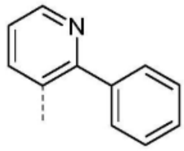
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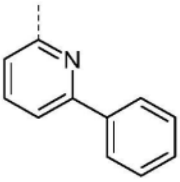
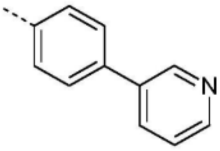
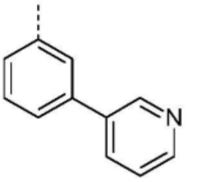
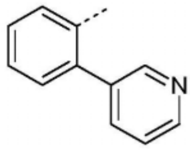
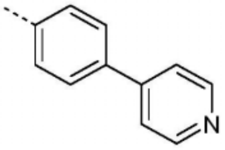
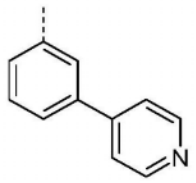
		
Ar-231	Ar-232	Ar-233

[0071]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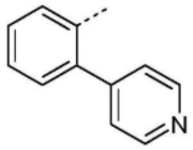	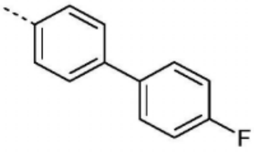	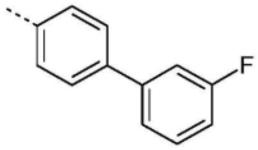
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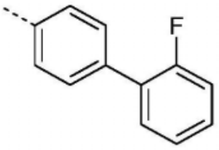	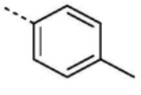	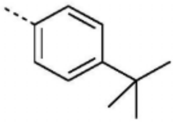
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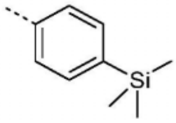	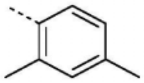	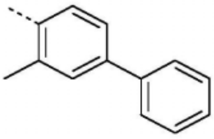
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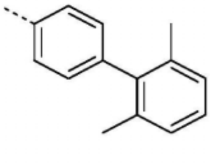	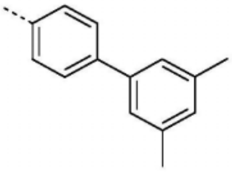	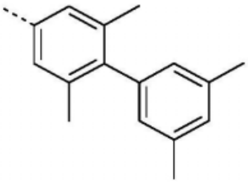
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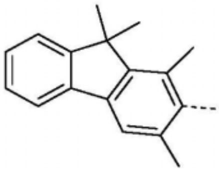	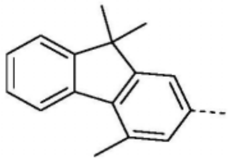	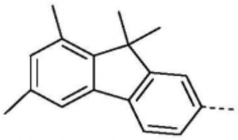
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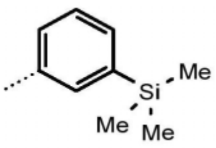	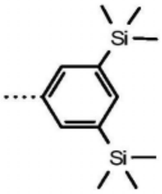	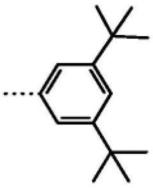
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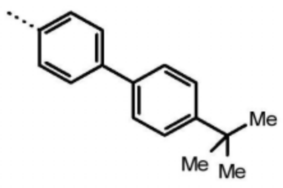
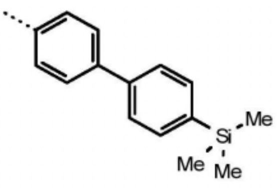
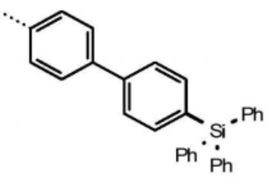
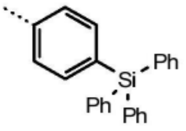
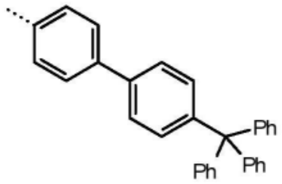
		

[0072]

Ar-256	Ar-257	Ar-258
		
Ar-259	Ar-260	

[0073] 其中所述基团可以各自在所有未被占用的位置处被R^{5}基团取代,其中虚线键表示与式(N)中氮原子连接的键。

[0074] 优选的是,两个不同Ar^{2}基团键合到式(N)的每个氮原子。

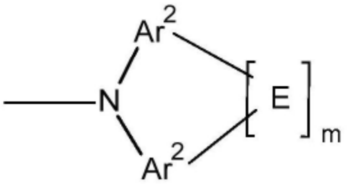
[0075] E基团优选是单键。

[0076] 优选地,m＝0,使得不存在E基团。

[0077] 在一个同样优选的替代实施方式中,m＝1,使得Ar^{2}基团经由E基团彼此键合。在这种情况下,优选Ar^{2}基团选自苯基和芴基,它们各自可以被一个或多个R^{5}基团取代。另外,在这种情况下,优选的是,使两个Ar^{2}基团彼此连接的E基团在式(N)中Ar^{2}基团与氨基的键的邻位与所讨论的Ar^{2}基团键合。另外,优选的是,如果E选自C(R^5)$_2$、Si(R^5)$_2$、NR^5、O和S,那么E基团与Ar^{2}基团一起形成六元环,并且如果E是单键,那么形成五元环。

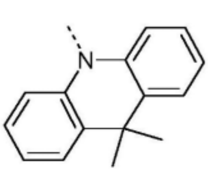
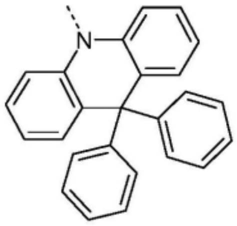
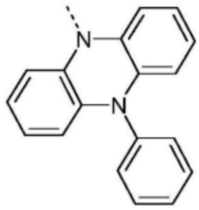
[0078] 当m＝1时,式(N)的基团的单元

[0079]



[0080] 的优选实施方式是以下描绘的基团:

[0081]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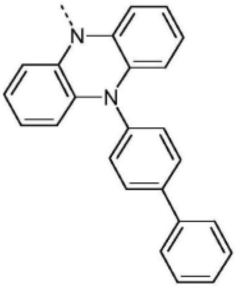	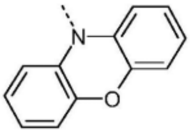	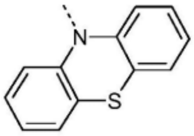
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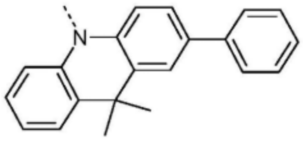
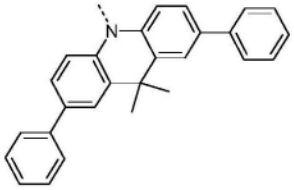
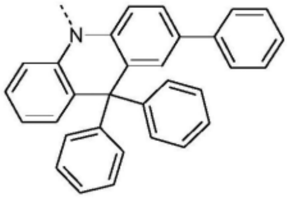
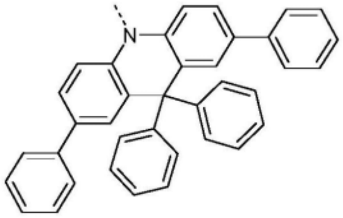
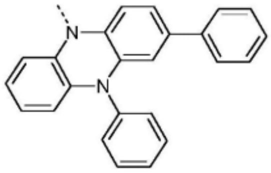
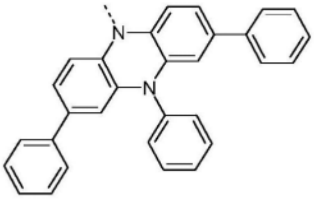
		
N-7	N-8	N-9
		
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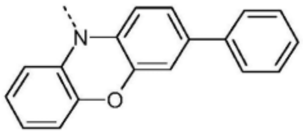	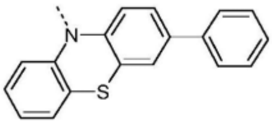	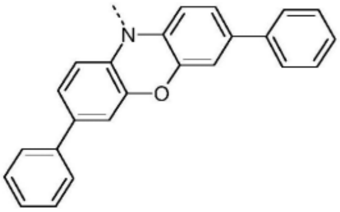
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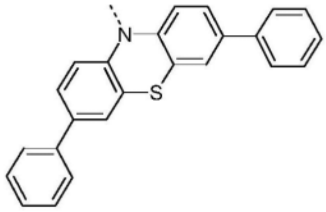	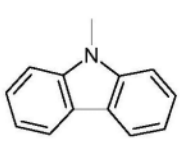	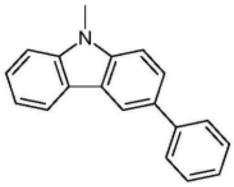
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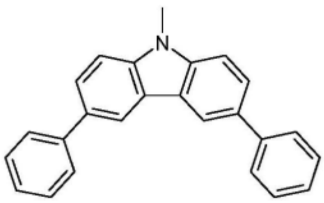
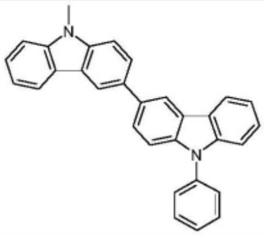
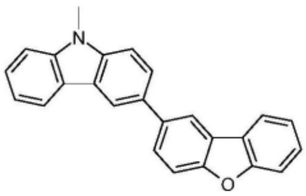
[0082]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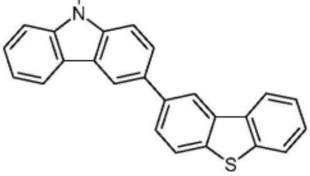	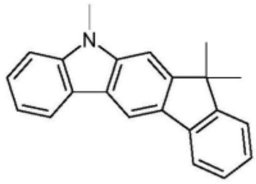	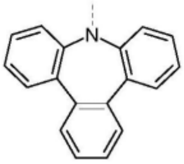
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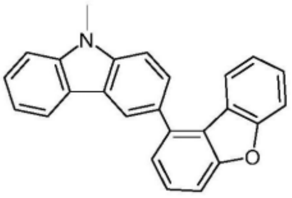	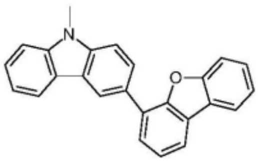	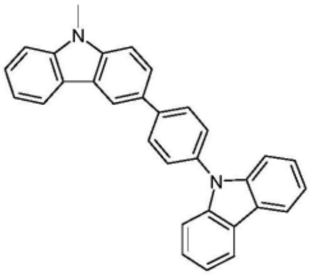
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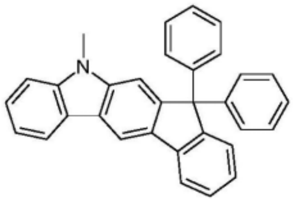	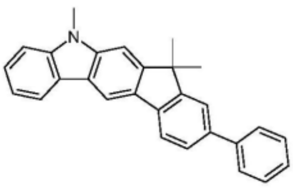	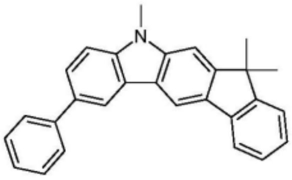
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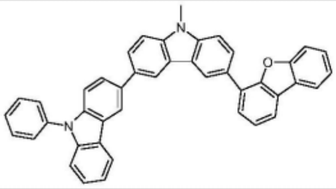
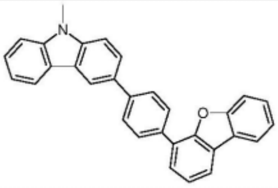
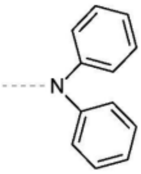
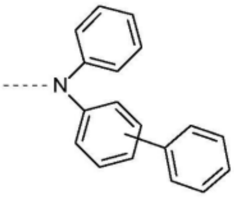
		
N-31	N-32	

[0083] 其中所述基团各自在它们的未被占用的位置处可以被R^5基团取代，并且优选在未被占用的位置处未被取代，并且其中虚线键表示与所述式的其余部分连接的键。

[0084] 当m＝0时，式(N)的基团的优选实施方式是以下描绘的基团：

[0085]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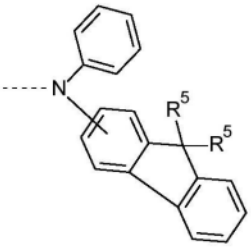	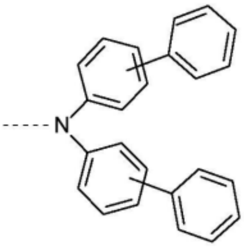
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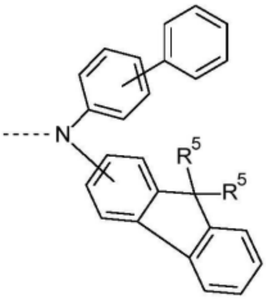
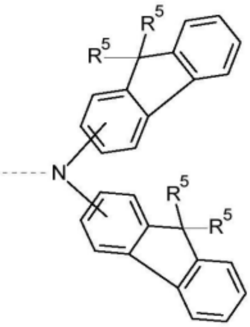
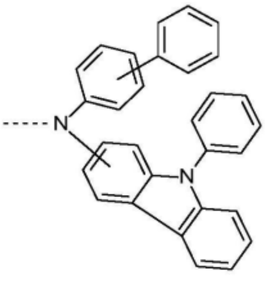
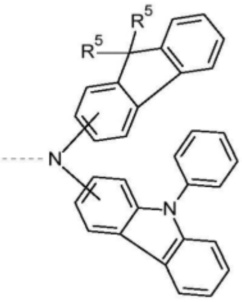
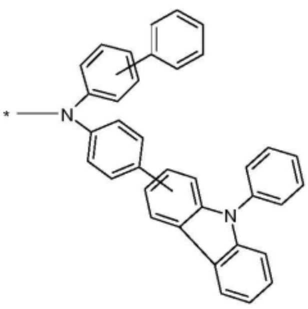
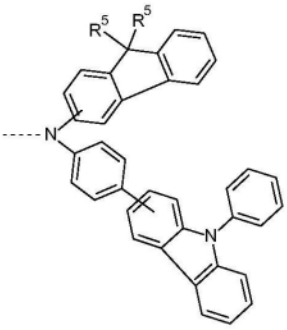
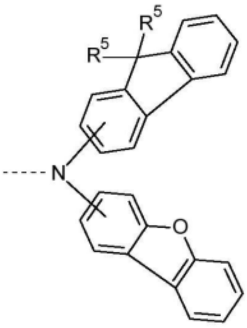
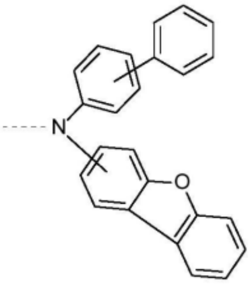
	
A-5	A-6
	
A-7	A-8
	
A-9	A-10

[0086]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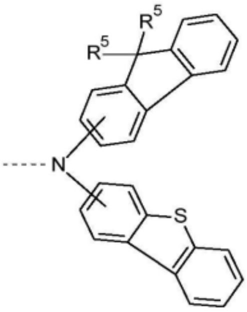	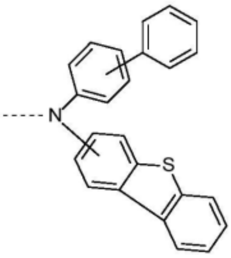
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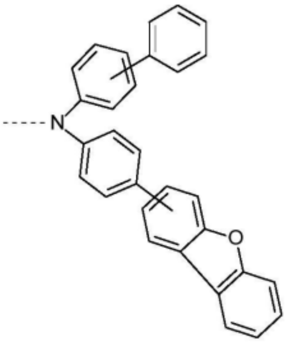	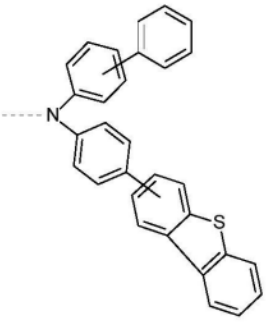
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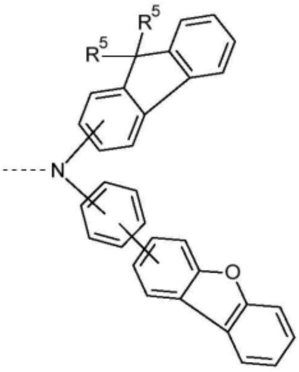	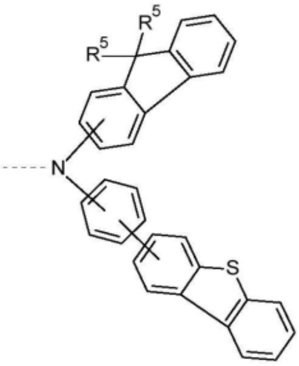
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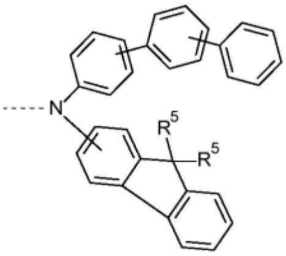
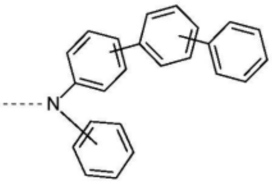
[0087]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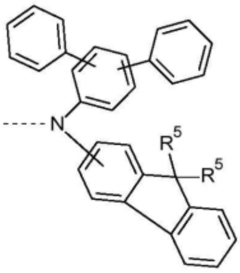 	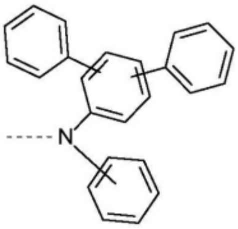
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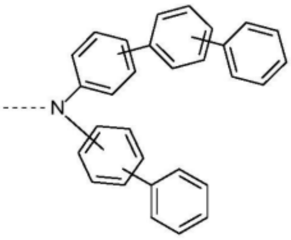 	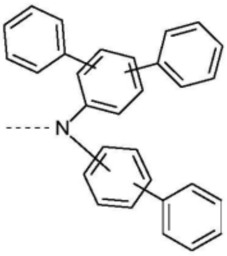
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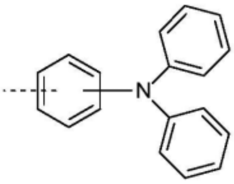 	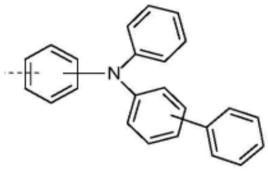
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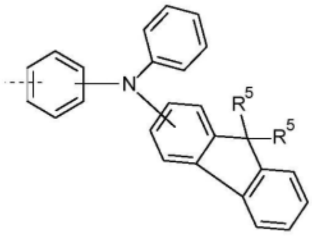
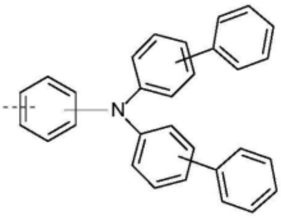
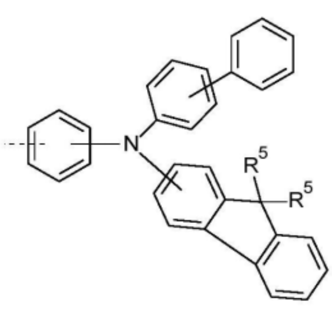
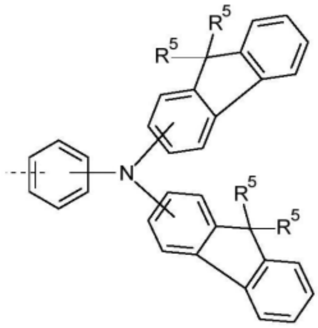
 	
A-27	A-28

[0088]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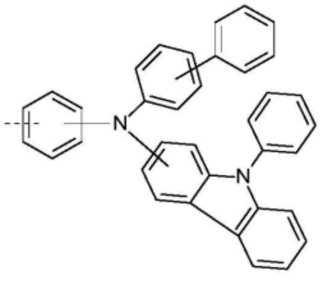	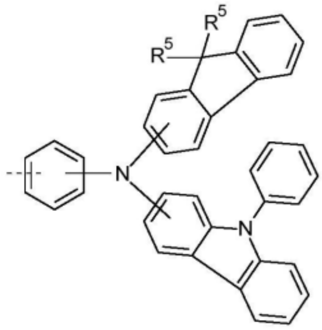
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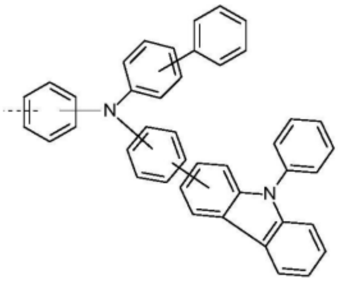	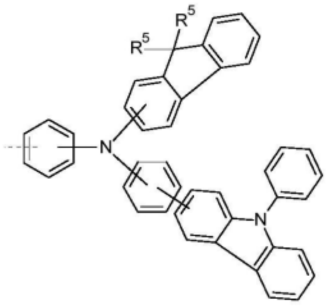
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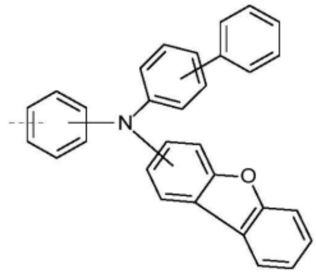
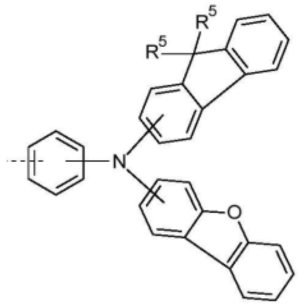
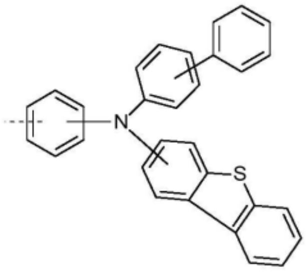
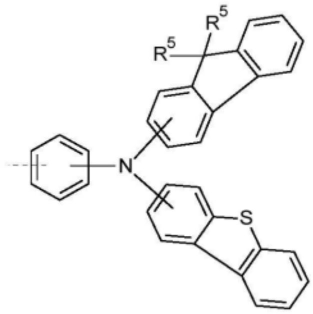
	
A-35	A-36

[0089]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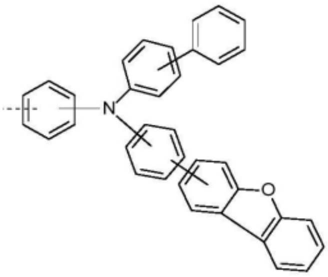	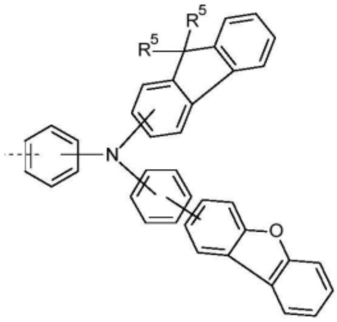
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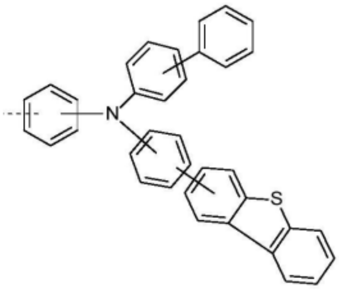	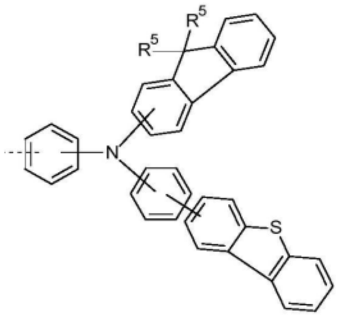
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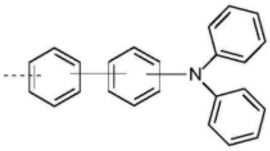	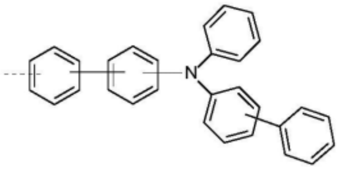
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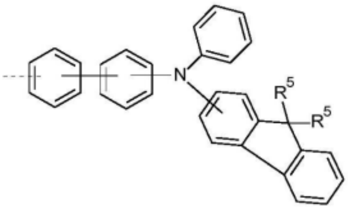
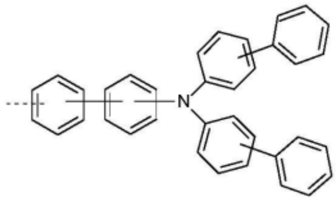
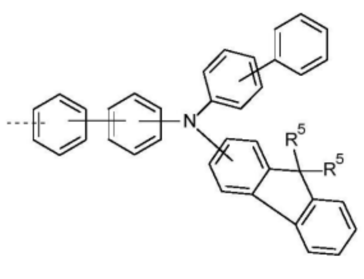
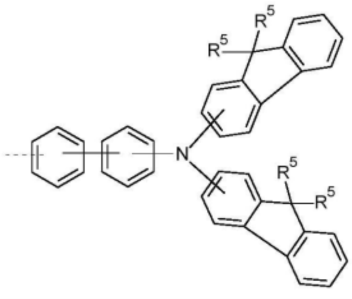
	
A-45	A-46

[0090]

	
A-47	A-48

[0091] 其中所述基团各自在它们的未被占用的位置处可以被R^5基团取代，并且优选在未被占用的位置处未被取代，并且其中虚线键表示与所述式的其余部分连接的键。

[0092] R^2优选选自H、D、F、CN、具有1至10个碳原子的直链的烷基或烷氧基、具有3至10个碳原子的支链或环状的烷基或烷氧基、具有2至10个碳原子的烯基或炔基、具有6至40个芳族环原子的芳族环系和具有5至40个芳族环原子的杂芳族环系，其中所述烷基、烷氧基、烯基和炔基以及所述芳族环系和杂芳族环系可以各自被一个或多个R^7基团取代。更优选地，R^2选自H、F、CN、具有1至10个碳原子的直链烷基、具有3至10个碳原子的支链或环状的烷基、具有6至40个芳族环原子的芳族环系和具有5至40个芳族环原子的杂芳族环系；其中所述烷基和所述芳族环系和杂芳族环系可以各自被一个或多个R^7基团取代。最优选地，R^2是H。

[0093] R^3优选在每种情况下相同或不同，并且选自H、D、F、CN、$Si(R^7)_3$、$N(R^7)_2$、具有1至20个碳原子的直链烷基、具有3至20个碳原子的支链或环状的烷基、具有6至40个芳族环原子的芳族环系和具有5至40个芳族环原子的杂芳族环系，其中所述烷基、所述芳族环系和所述杂芳族环系可以各自被一个或多个R^7基团取代。

[0094] R^4优选在每种情况下相同或不同，并且选自H、D、F、CN、具有1至20个碳原子的直链烷基、具有3至20个碳原子的支链或环状的烷基、具有6至40个芳族环原子的芳族环系和具有5至40个芳族环原子的杂芳族环系；其中所述烷基、所述芳族环系和所述杂芳族环系可以各自被一个或多个R^7基团取代。更优选地，R^4在每种情况下相同或不同，并且选自具有1至20个碳原子的直链烷基、具有3至20个碳原子的支链或环状的烷基和具有6至40个芳族环原子的芳族环系，其中所提及的烷基和所提及的芳族环系可以各自被一个或多个R^7基团取代。

[0095] R^5优选在每种情况下相同或不同，并且选自H、D、F、CN、$Si(R^7)_3$、$N(R^7)_2$、具有1至20个碳原子的直链烷基、具有3至20个碳原子的支链或环状的烷基、具有6至40个芳族环原子的芳族环系和具有5至40个芳族环原子的杂芳族环系，其中所述烷基、所述芳族环系和所述杂芳族环系可以各自被一个或多个R^7基团取代。

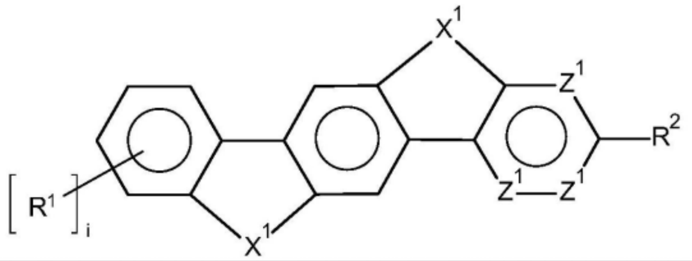
[0096] R^6优选在每种情况下相同或不同，并且选自H、D、F、CN、$Si(R^7)_3$、具有1至20个碳原子的直链烷基、具有3至20个碳原子的支链或环状的烷基、具有6至40个芳族环原子的芳族环系和具有5至40个芳族环原子的杂芳族环系；其中所述烷基、所述芳族环系和所述杂芳族环系可以各自被一个或多个R^7基团取代。更优选地，R^6是H。

[0097] R^7优选在每种情况下相同或不同，并且选自H、D、F、CN、$Si(R^8)_3$、$N(R^8)_2$、具有1至20个碳原子的直链烷基、具有3至20个碳原子的支链或环状的烷基、具有6至40个芳族环原子的芳族环系和具有5至40个芳族环原子的杂芳族环系，其中所述烷基、所述芳族环系和所述杂芳族环系可以各自被一个或多个R^8基团取代。

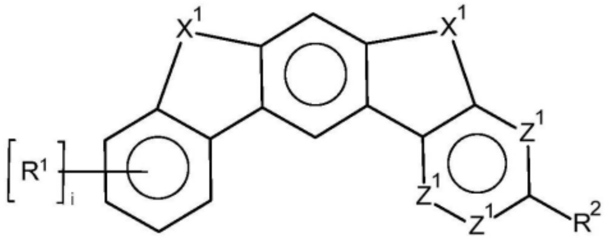
[0098] 标记i优选是0。

[0099] 式(I)的优选实施方式对应于以下式(I-1)至(I-9)之一：

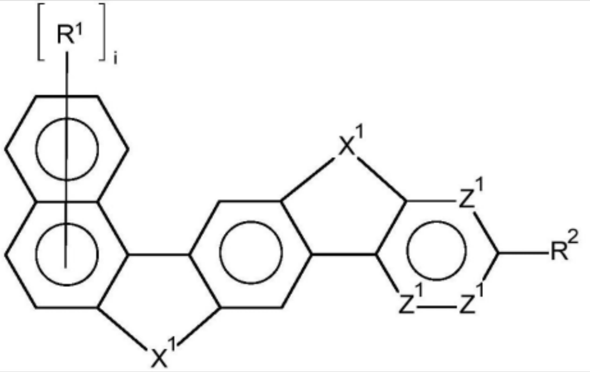
[0100]



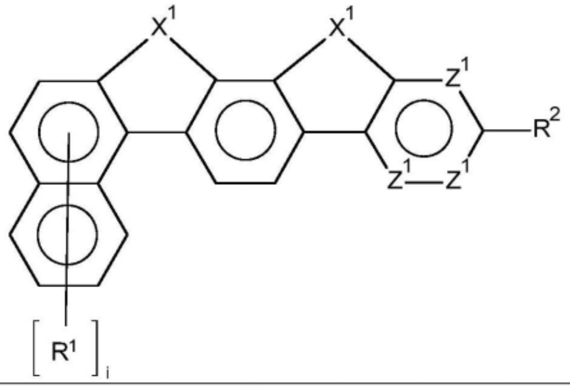
式(I-1)



式(I-2)

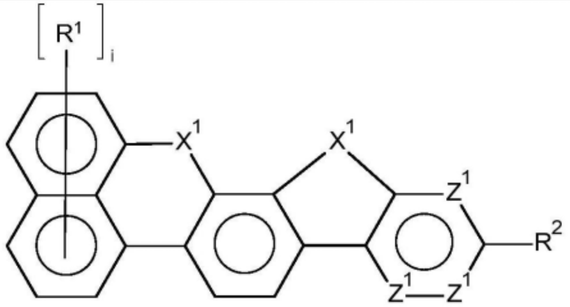


式(I-3)

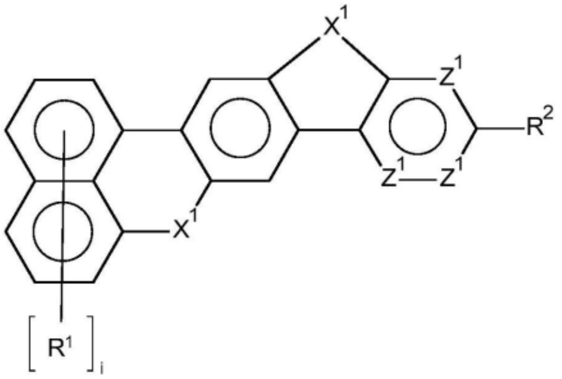


式(I-4)

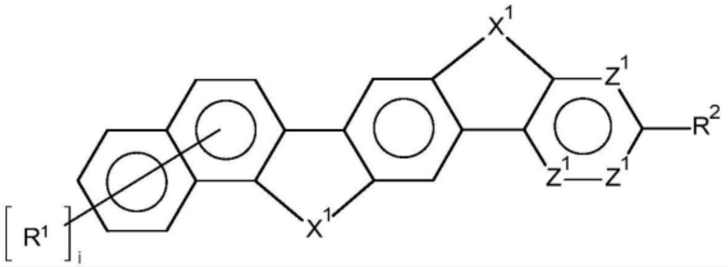
[0101]



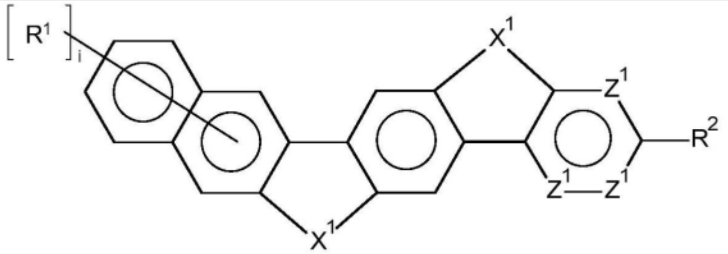
式(I-5)



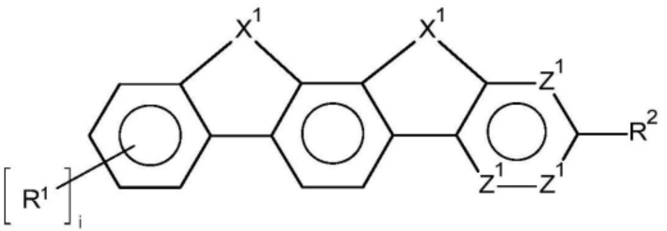
式(I-6)



式(I-7)



式(I-8)

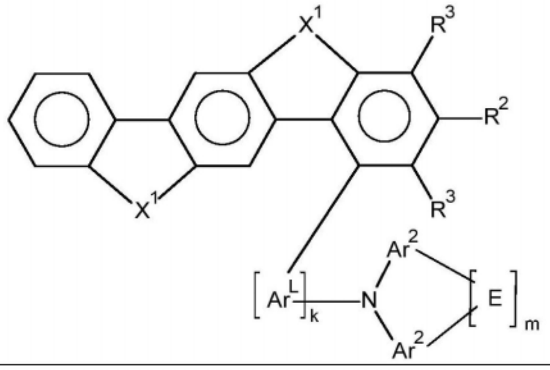


式(I-9)

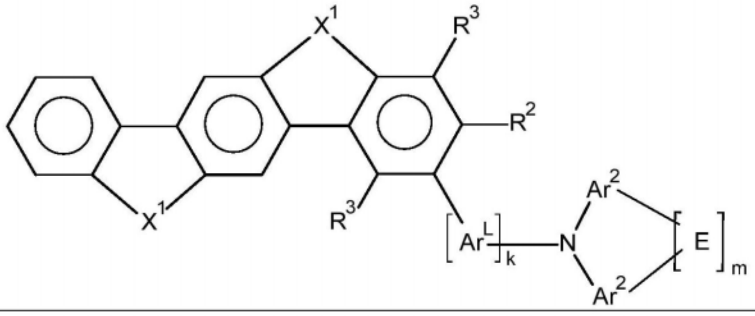
[0102] 其中出现的变量和上文定义的相同，并且X^1优选是$C(R^4)_2$，并且其中化合物可以各自在芳族环上的未被占用的位置处被R^3或R^6基团取代，并且优选在这些位置处未被取代。

[0103]　式(I-1)至(I-9)的优选实施方式符合以下所示的式：

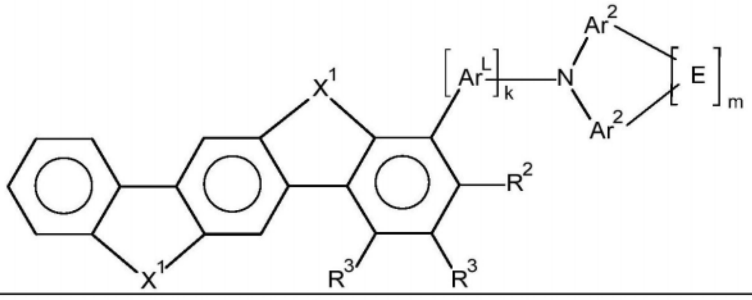
[0104]



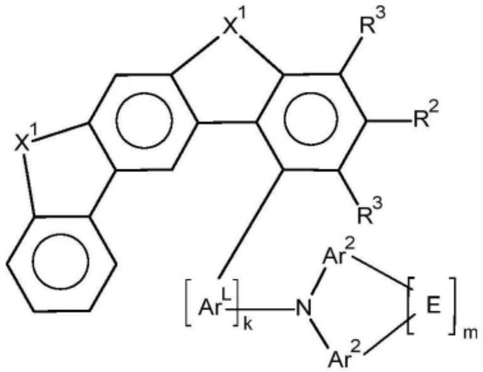
式(I-1-A)



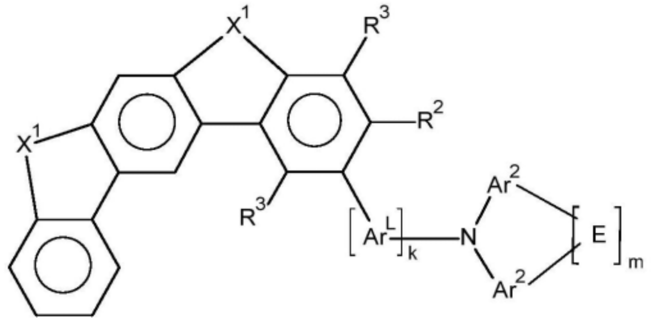
式(I-1-B)



式(I-1-C)

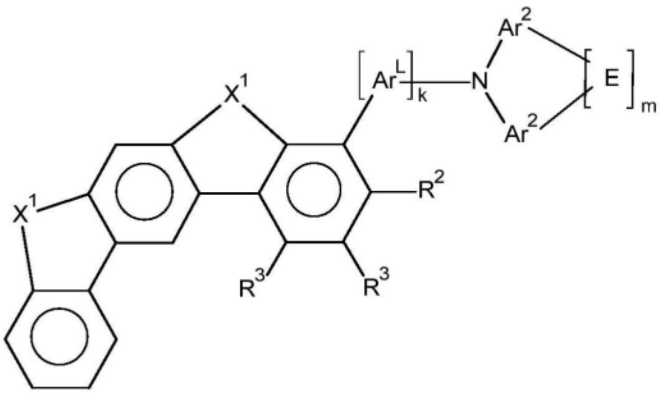


式(I-2-A)

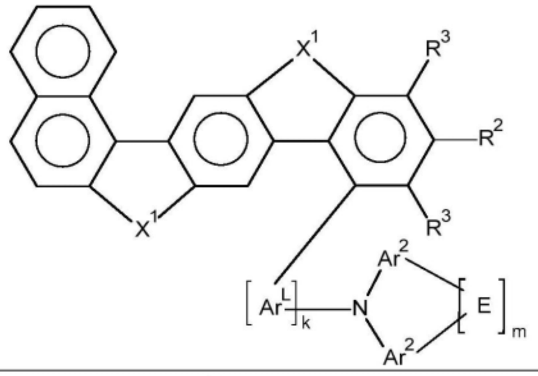


式(I-2-B)

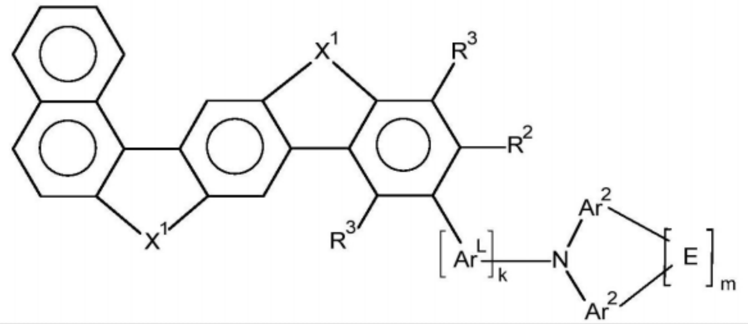
[0105]



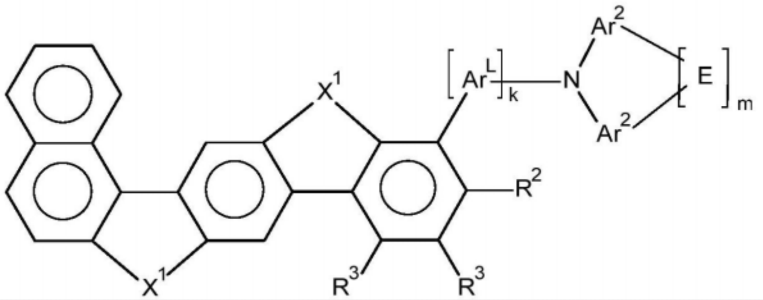
式(I-2-C)



式(I-3-A)

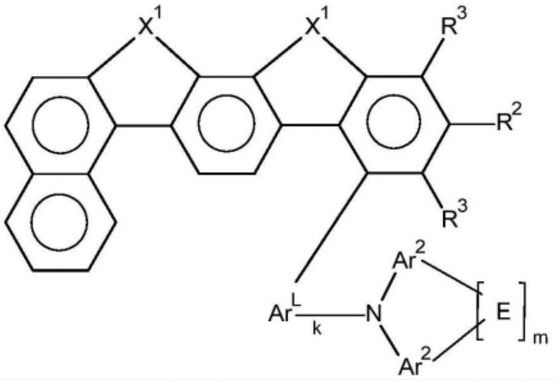


式(I-3-B)

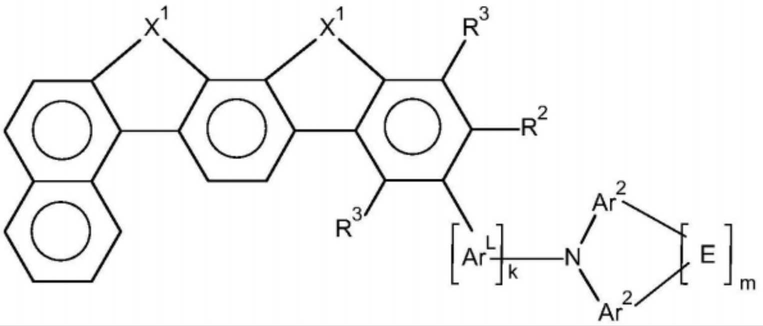


式(I-3-C)

[0106]

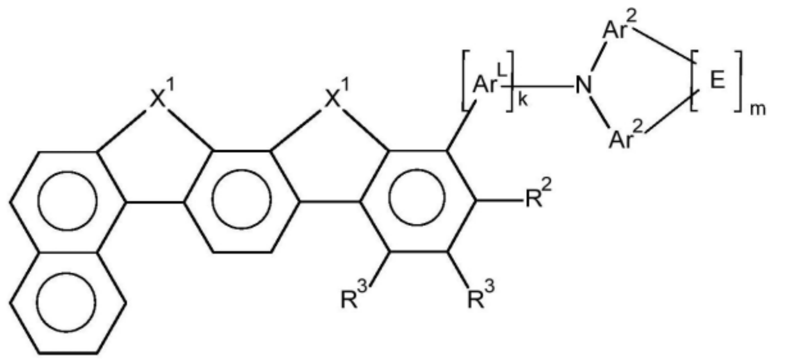


式(I-4-A)

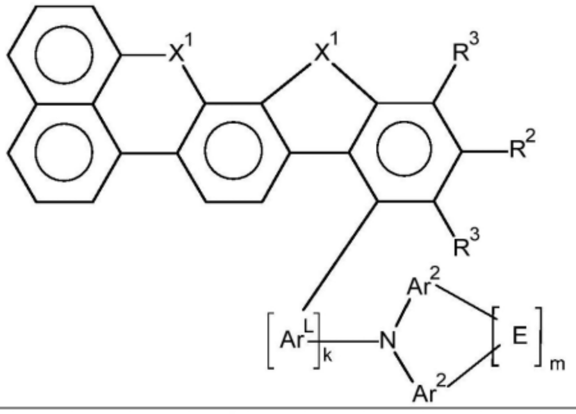


式(I-4-B)

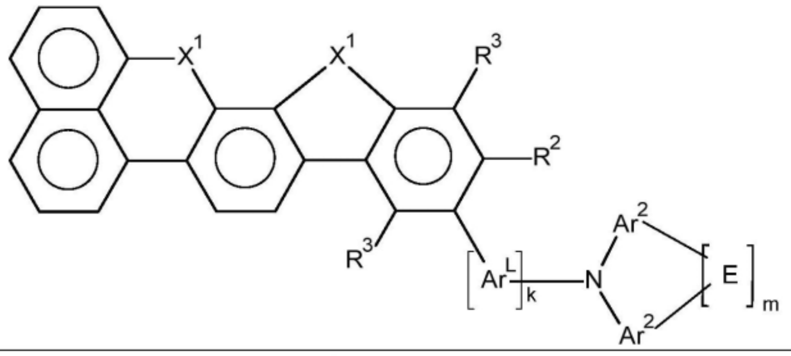
[0107]



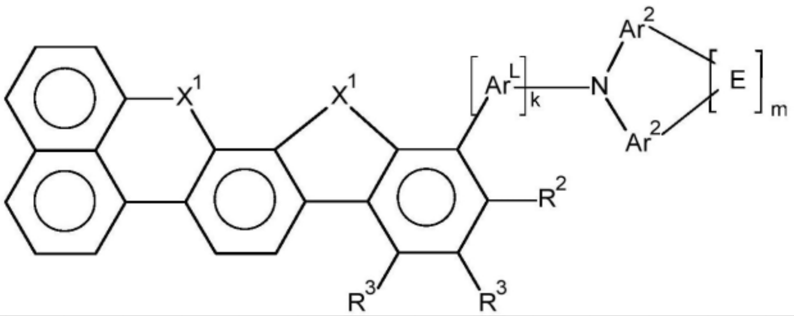
式(I-4-C)



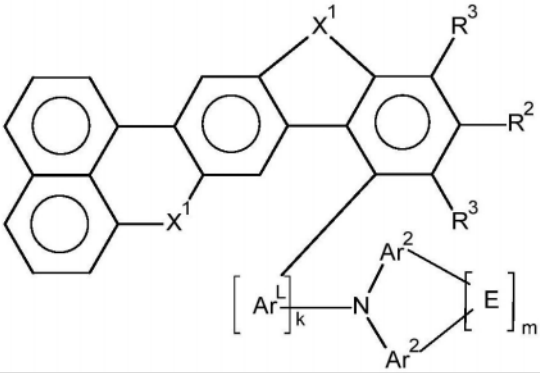
式(I-5-A)



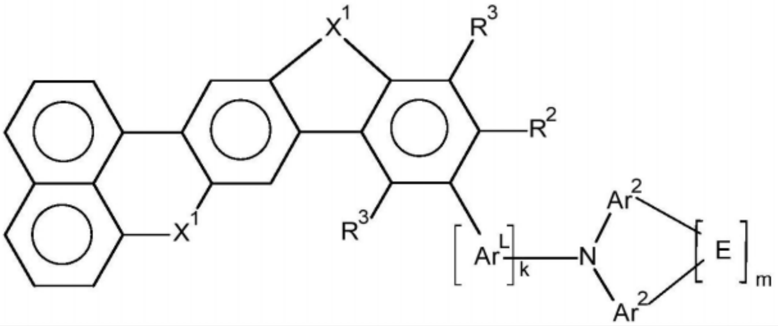
式(I-5-B)



式(I-5-C)

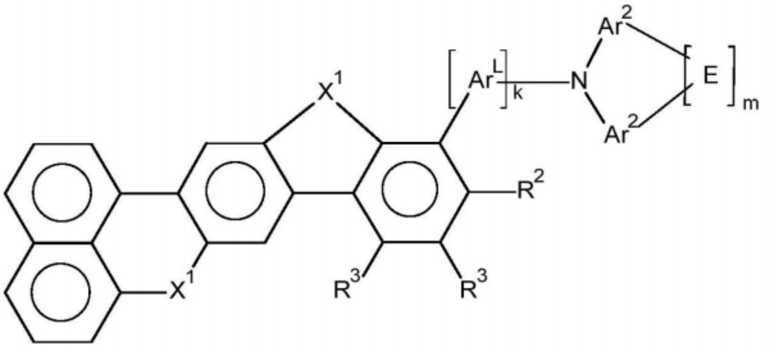


式(I-6-A)

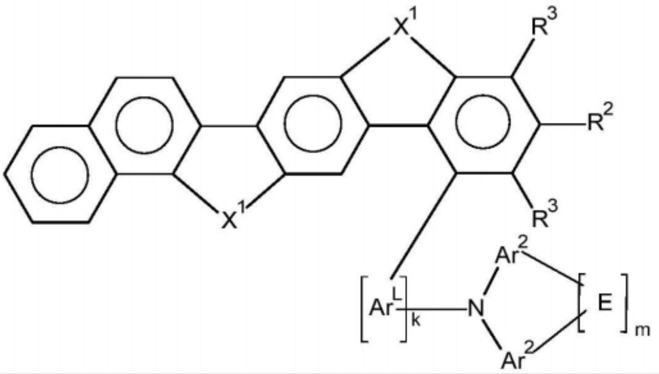


式(I-6-B)

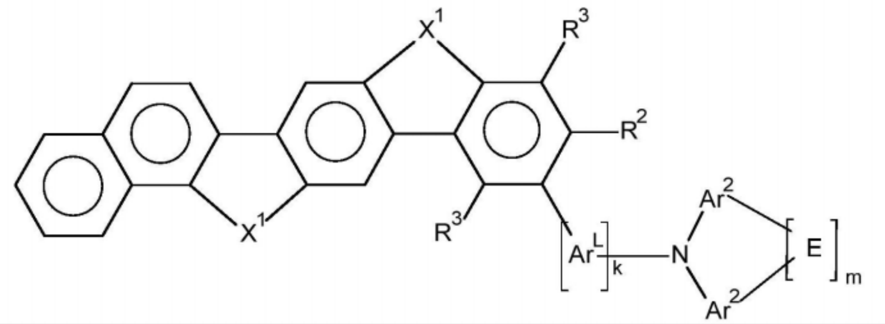
[0108]



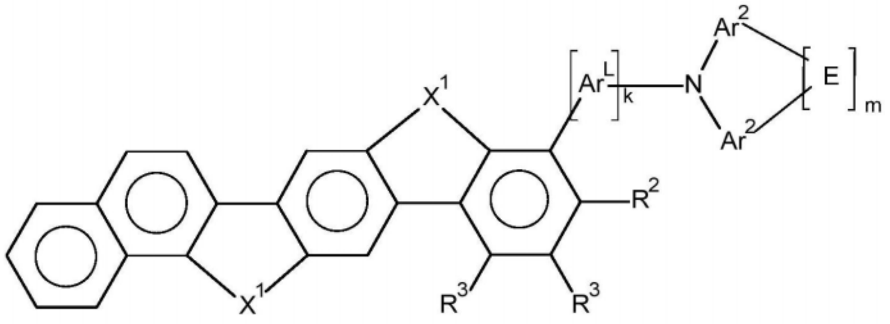
式(I-6-C)



式(I-7-A)

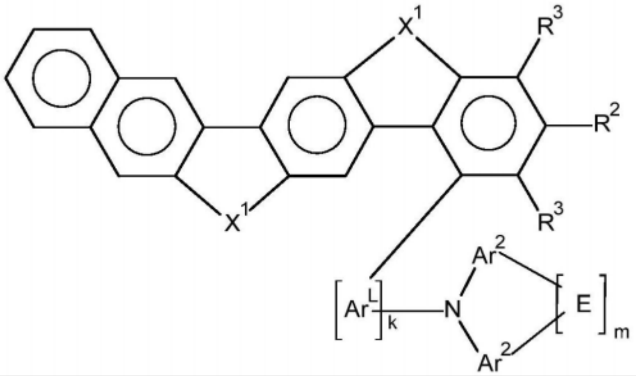


式(I-7-B)

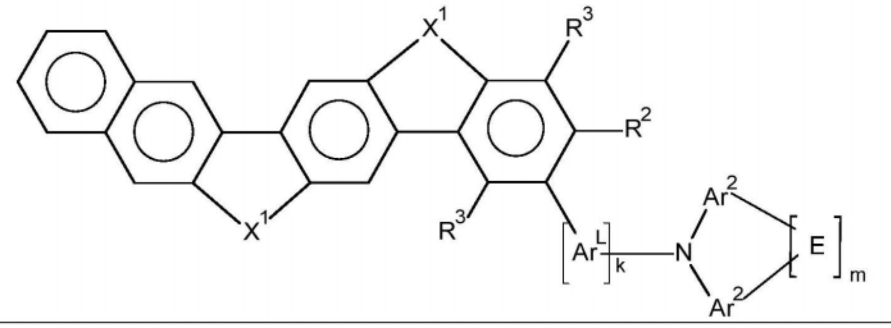


式(I-7-C)

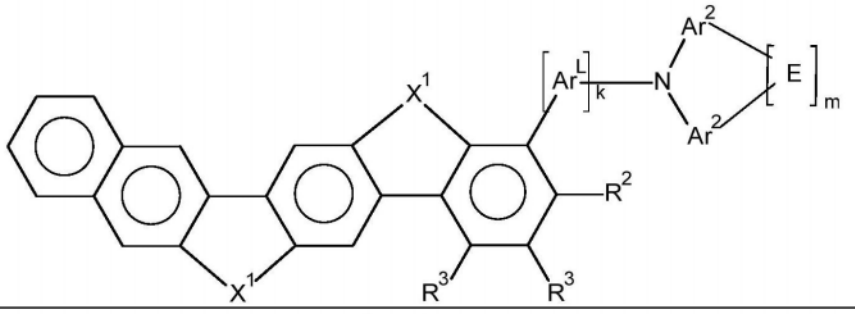
[0109]



式(I-8-A)

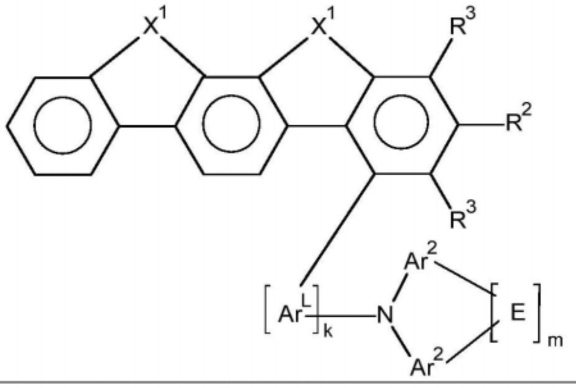


式(I-8-B)

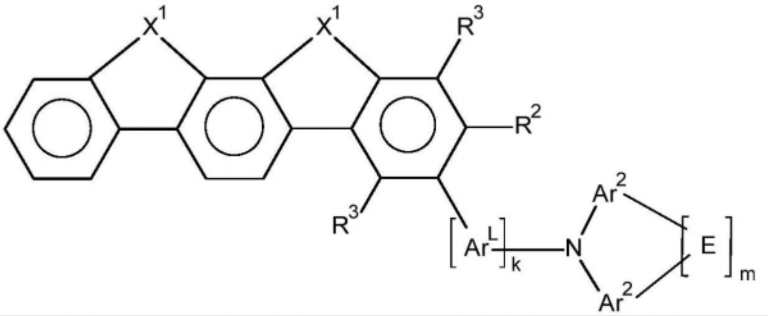


式(I-8-C)

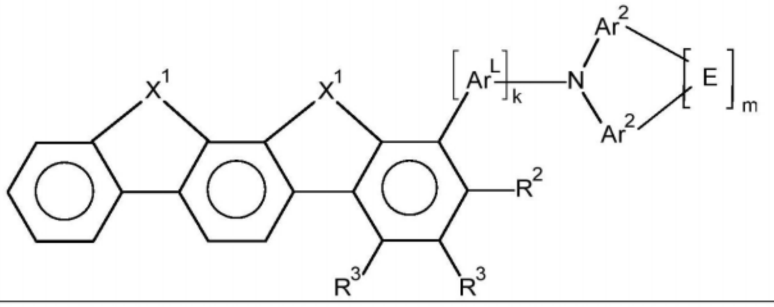
[0110]



式(I-9-A)



式(I-9-B)



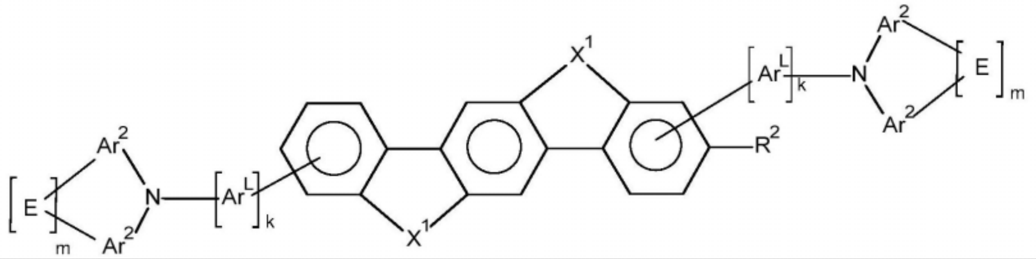
式(I-9-C)

[0111] 其中出现的变量如上所定义,并且X^1优选是$C(R^4)_2$,并且其中化合物可以各自在芳族环上的未被占用的位置处被R^3或R^6基团取代,并且优选在这些位置处未被取代。

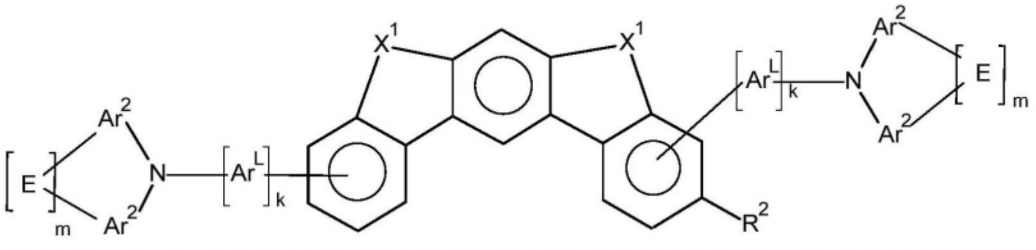
[0112] 在上述式中,优选式(I-1-A)、(I-2-A)、(I-3-A)、(I-4-A)、(I-5-A)、(I-6-A)、(I-7-A)、(I-8-A)和(I-9-A)。特别优选式(I-1-A)。

[0113] 式(I)化合物的其它优选实施方式对应于以下式:

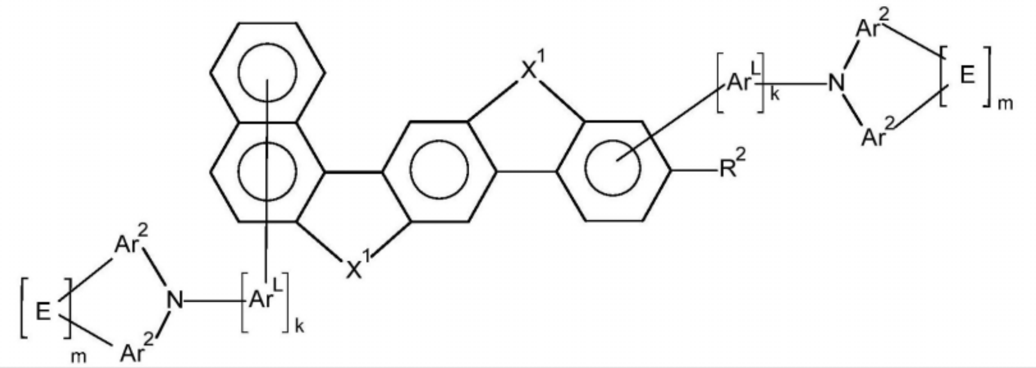
[0114]



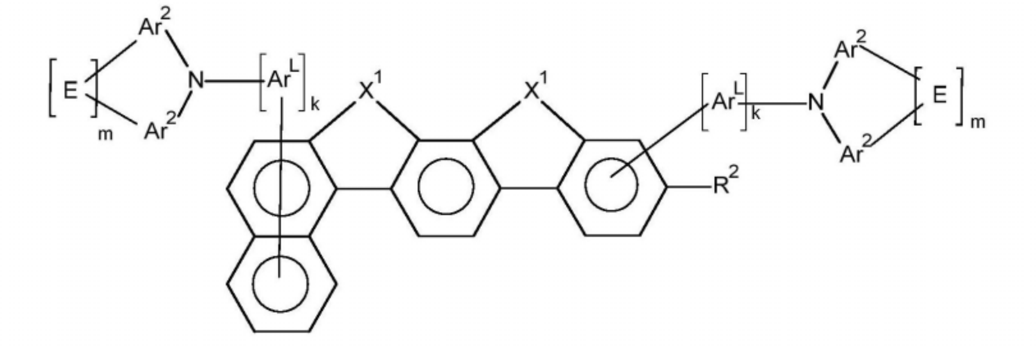
式(I-1-D)



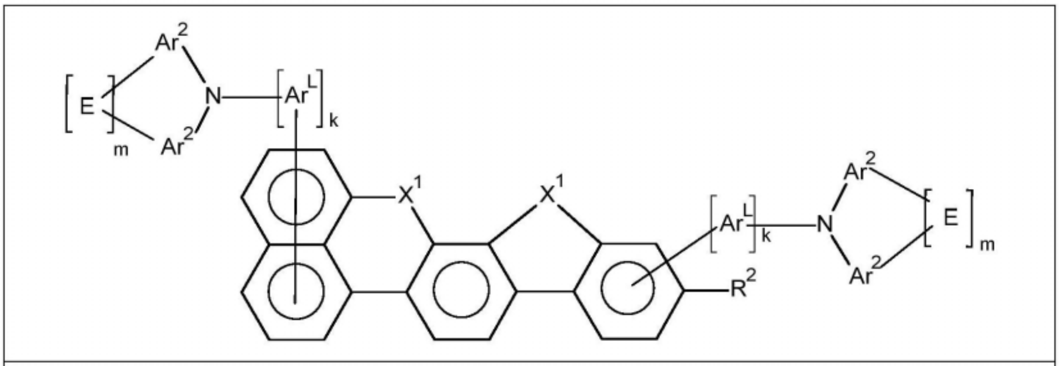
式(I-2-D)



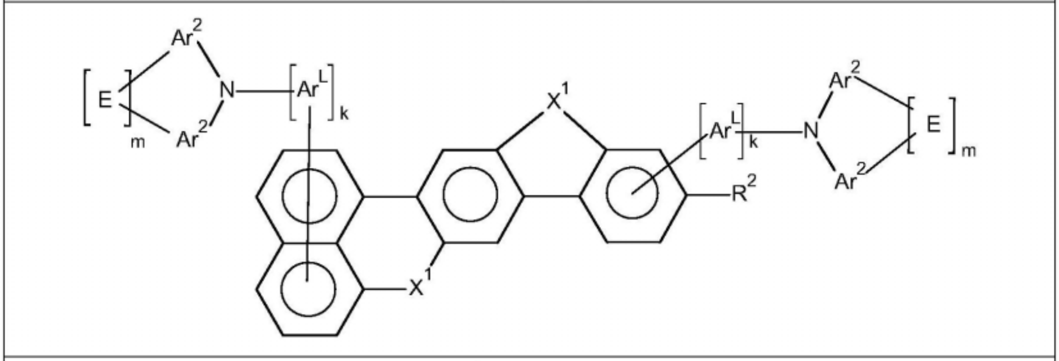
式(I-3-D)



式(I-4-D)

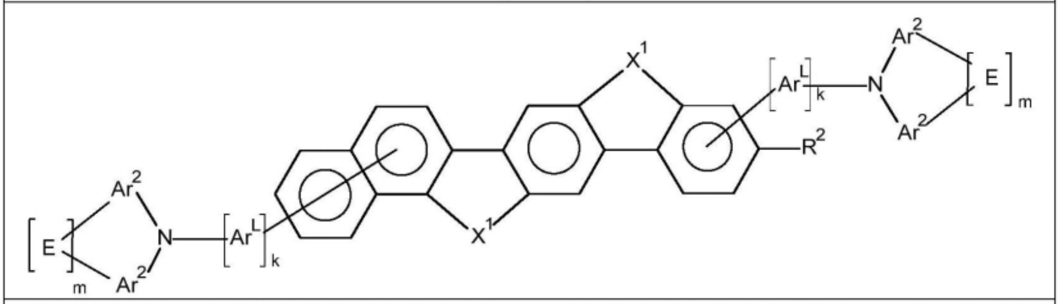


式(I-5-D)

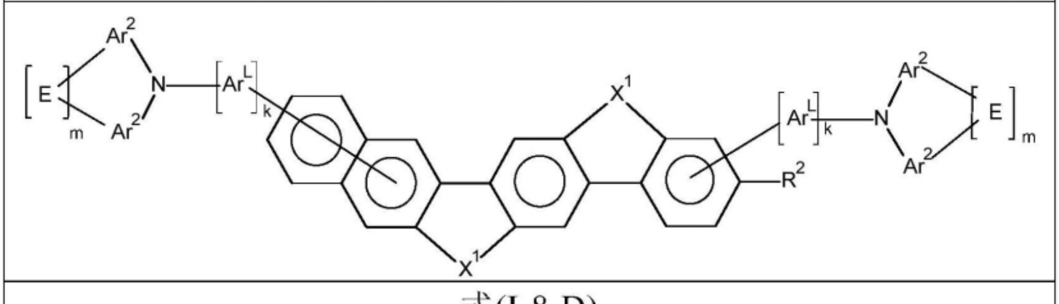


式(I-6-D)

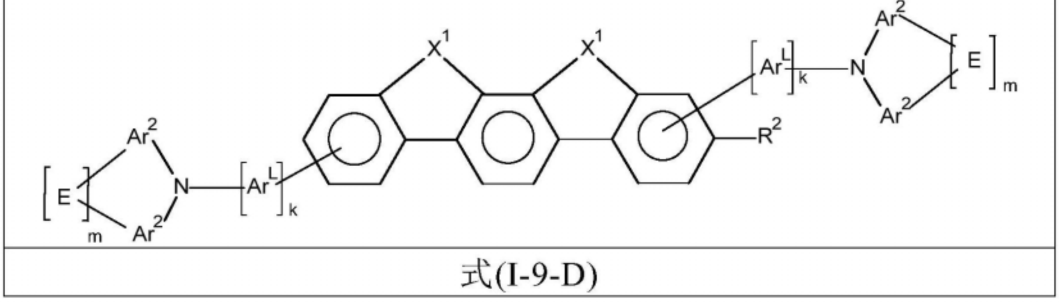
[0115]



式(I-7-D)



式(I-8-D)

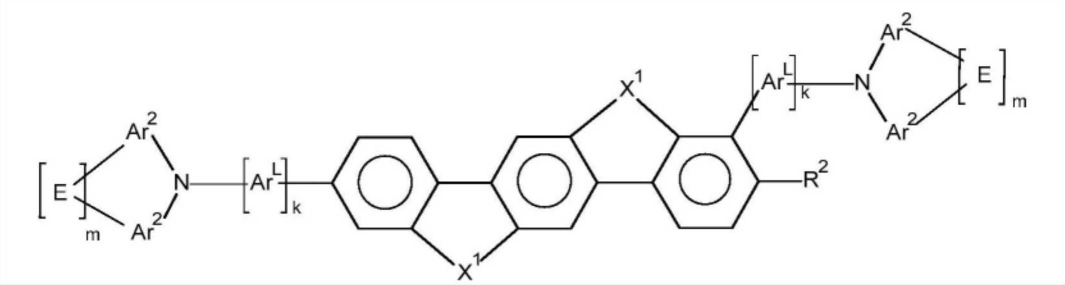


式(I-9-D)

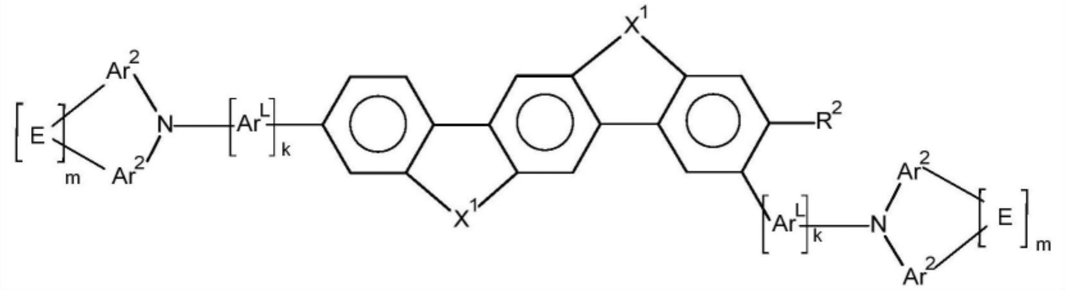
[0116] 其中出现的变量如上所定义，并且X^1优选是$C(R^4)_2$，并且其中化合物可以各自在芳

族环上的未被占用的位置处被R^3或R^6基团取代，并且优选在这些位置处未被取代。

[0117] 式(I-1-D)的优选实施方式对应于以下式：

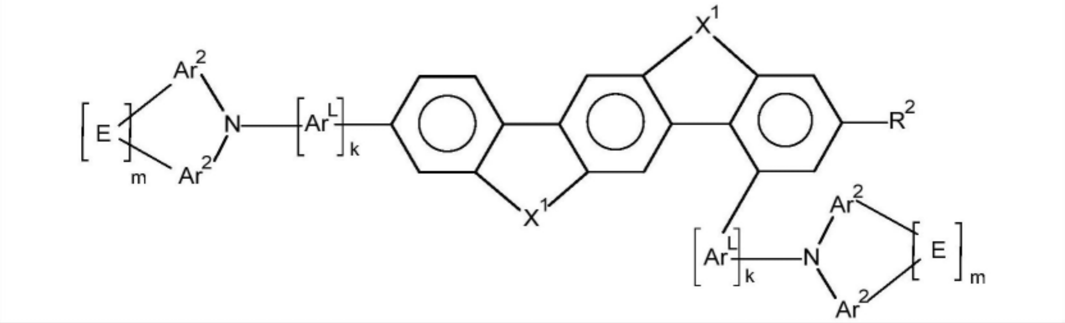


式(I-1-D-1)

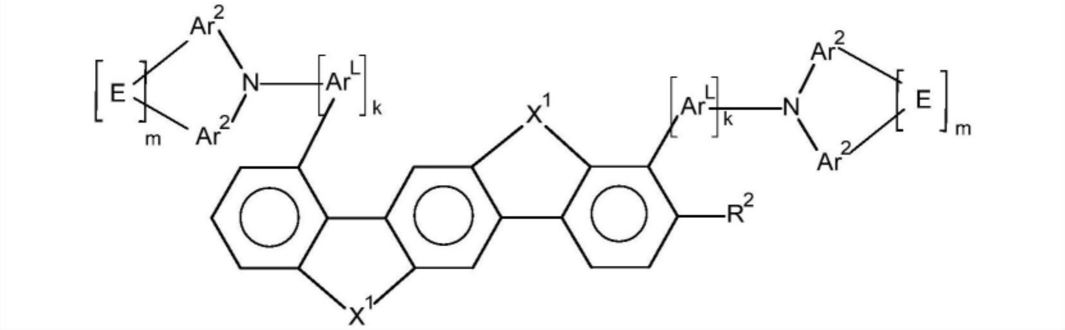


式(I-1-D-2)

[0118]

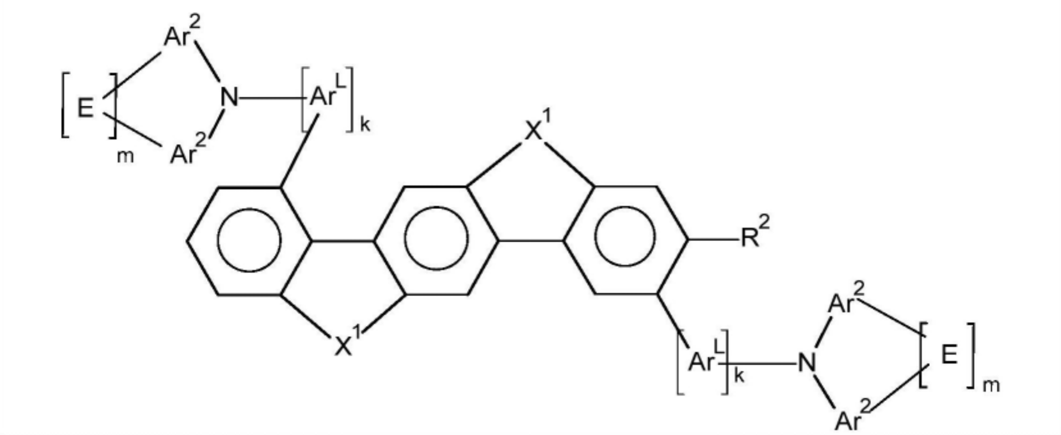


式(I-1-D-3)

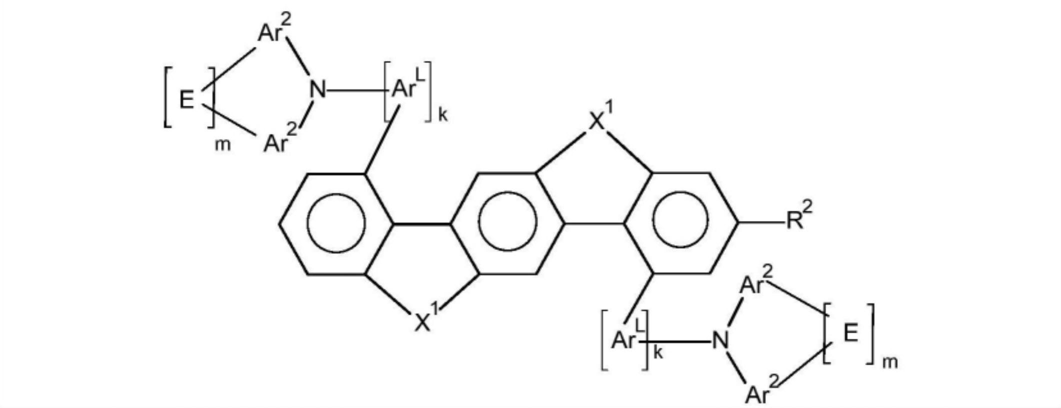


式(I-1-D-4)

[0119]



式(I-1-D-5)

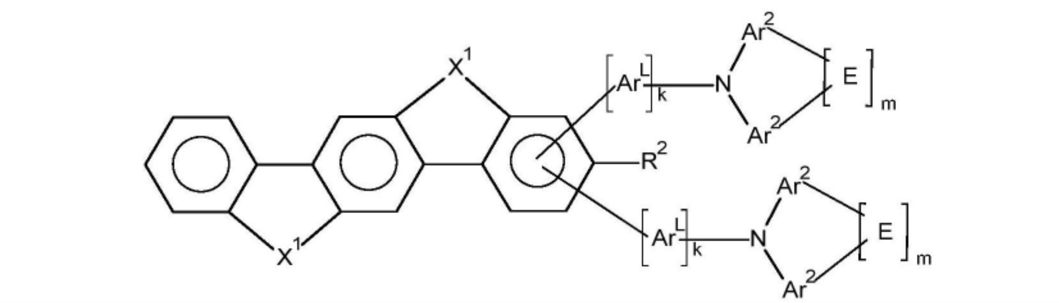


式(I-1-D-6)

[0120] 其中出现的变量如上所定义，并且X^1优选是$C(R^4)_2$，并且其中化合物可以各自在芳族环上的未被占用的位置处被R^3或R^6基团取代，并且优选在这些位置处未被取代。

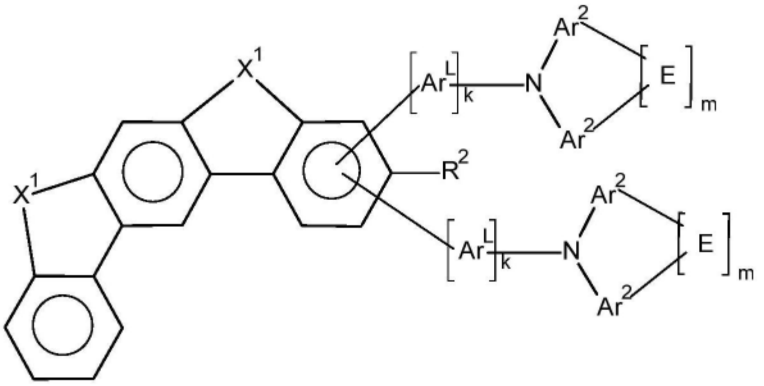
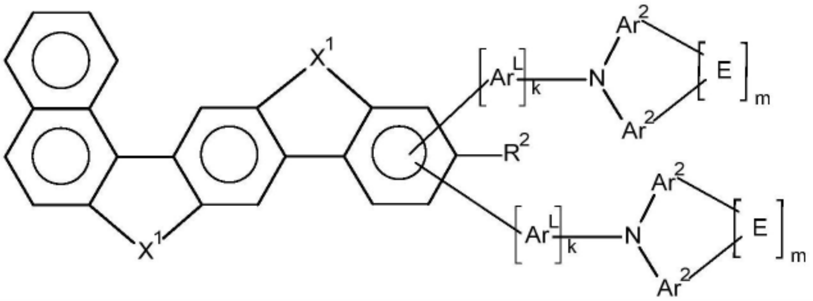
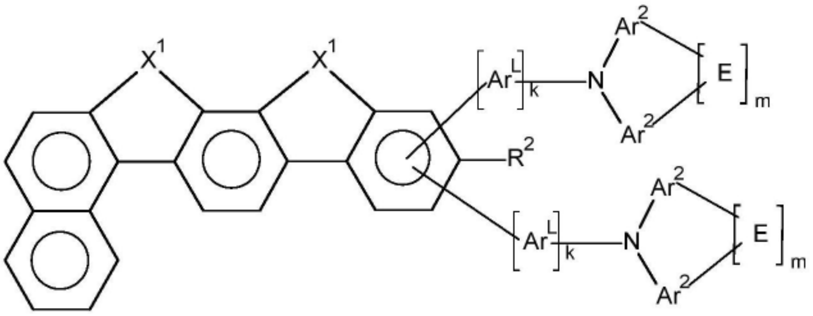
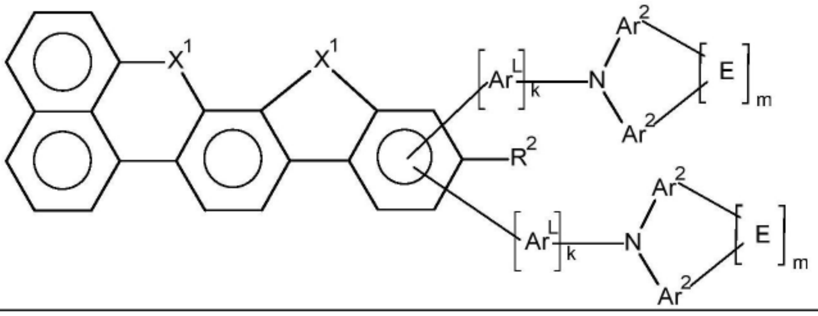
[0121] 式(I-1)至(I-8)的化合物的其它优选实施方式对应于以下式：

[0122]

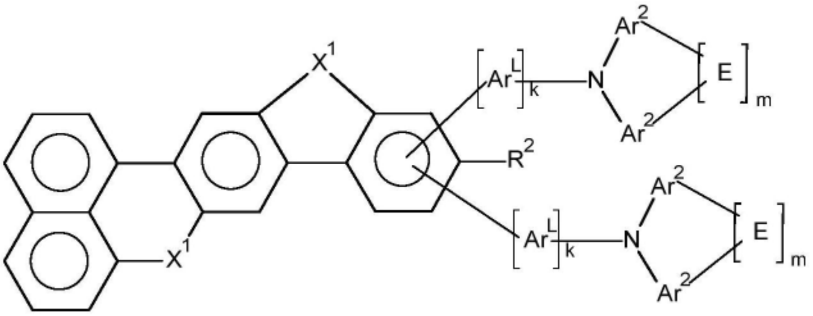


式(I-1-E)

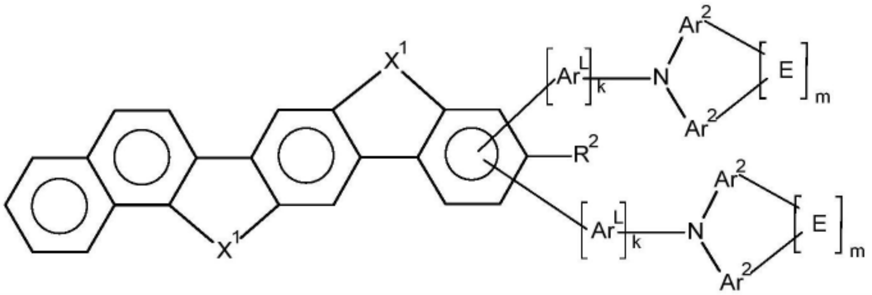
[0123]


式(I-2-E)

式(I-3-E)

式(I-4-E)

式(I-5-E)

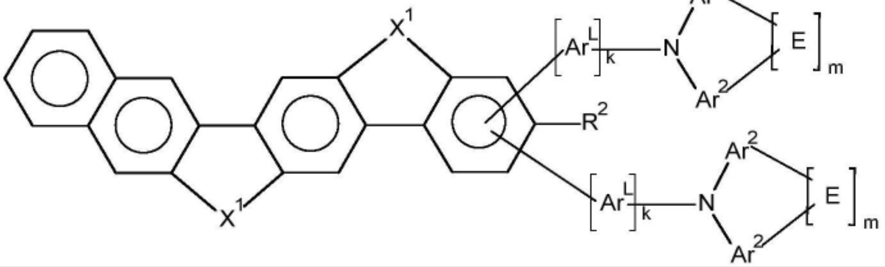
[0124]



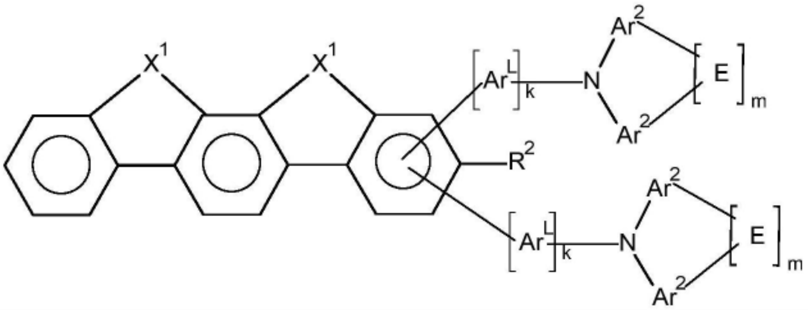
式(I-6-E)



式(I-7-E)



式(I-8-E)

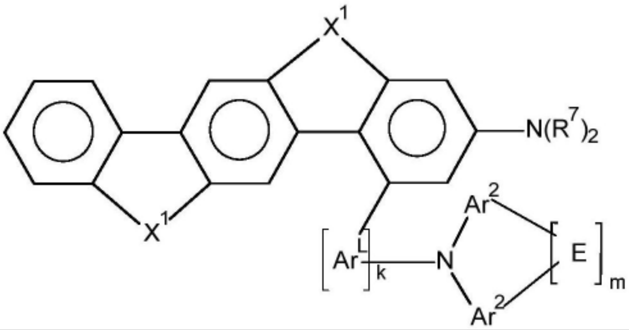


式(I-9-E)

[0125] 其中出现的变量如上所定义，并且X^1优选是$C(R^4)_2$，并且其中化合物可以各自在芳族环上的未被占用的位置处被R^3或R^6基团取代，并且优选在这些位置处未被取代。

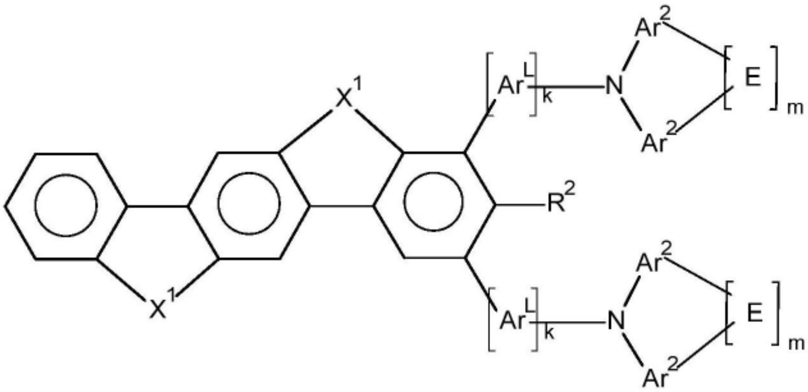
[0126] 在这些式中，特别优选式(I-1-E)。

[0127] 式(I-1-E)至(I-9-E)的优选实施方式符合以下所示的式：

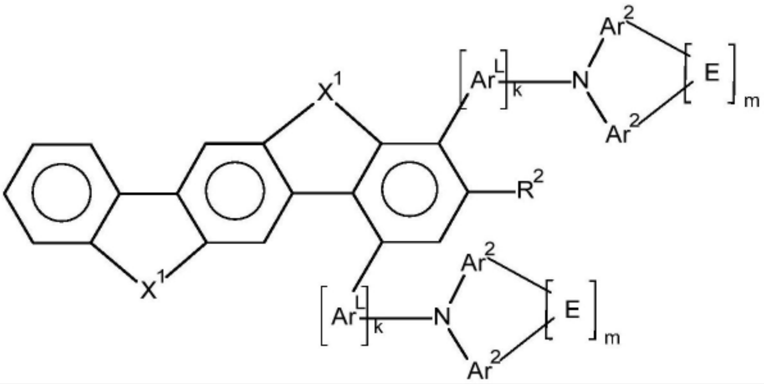


式(I-1-E-1)

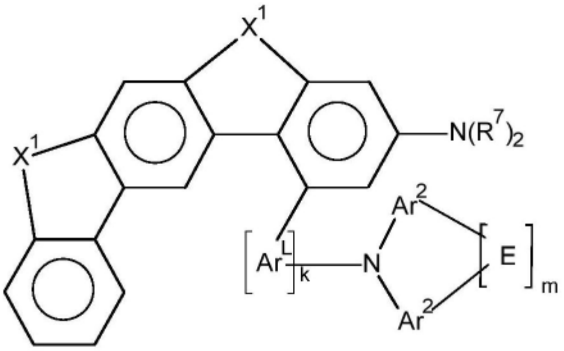
[0128]



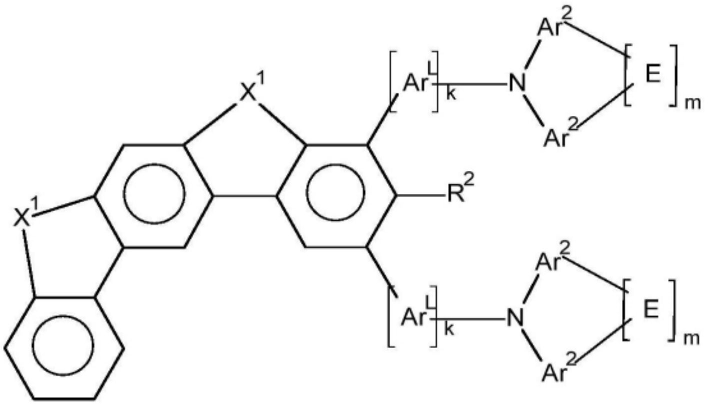
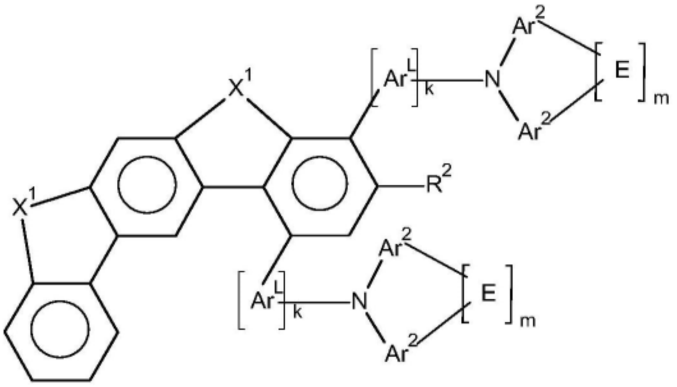
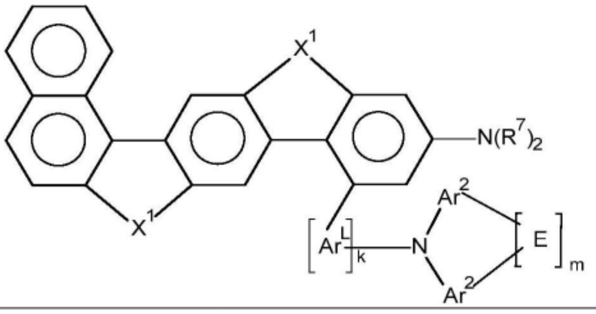
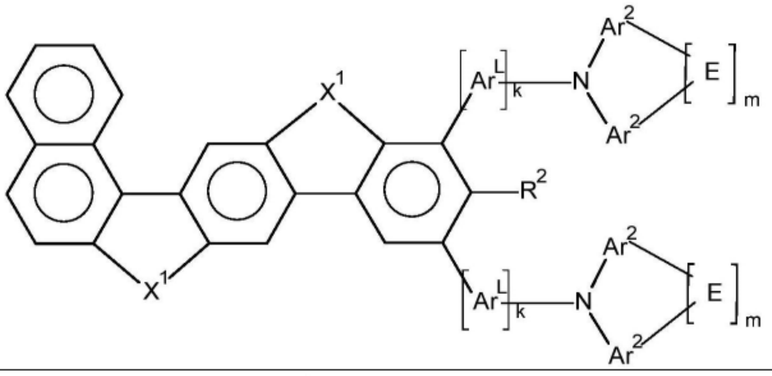
式(I-1-E-2)

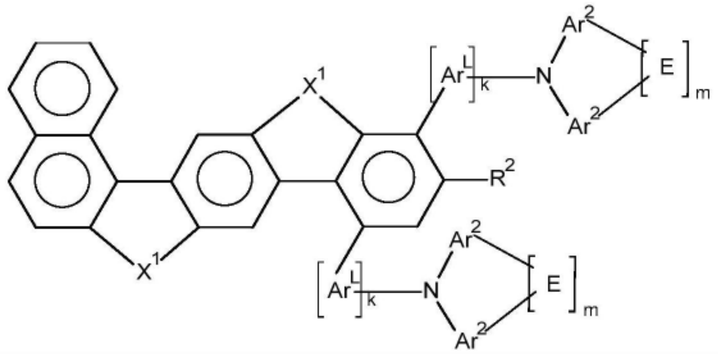


式(I-1-E-3)

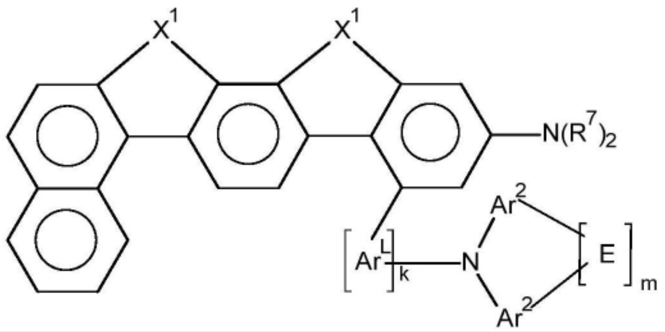


[0129]

式(I-2-E-1)

式(I-2-E-2)

式(I-2-E-3)

式(I-3-E-1)

式(I-3-E-2)

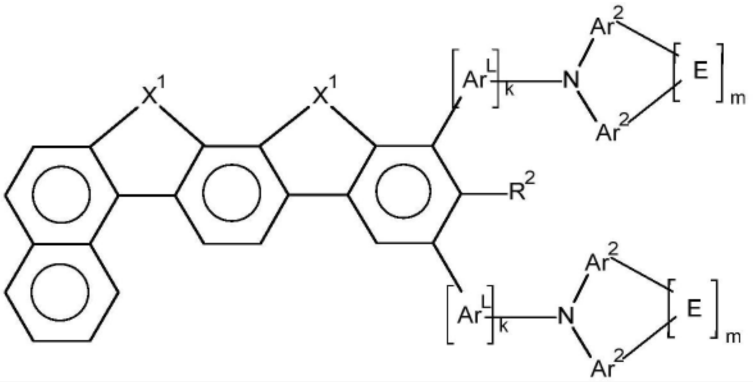


式(I-3-E-3)

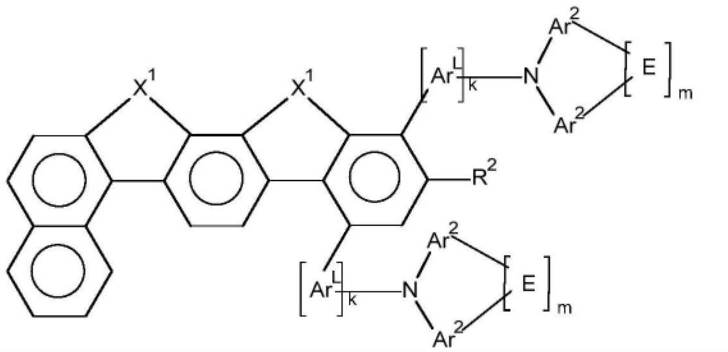


式(I-4-E-1)

[0130]

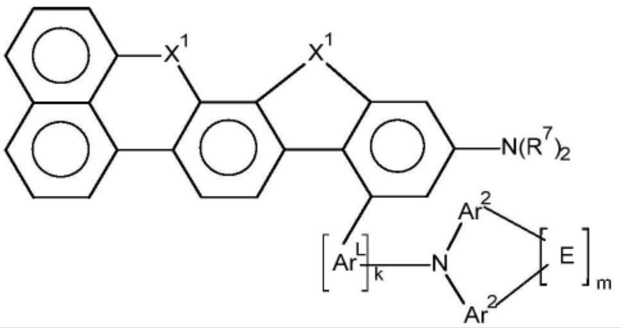


式(I-4-E-2)

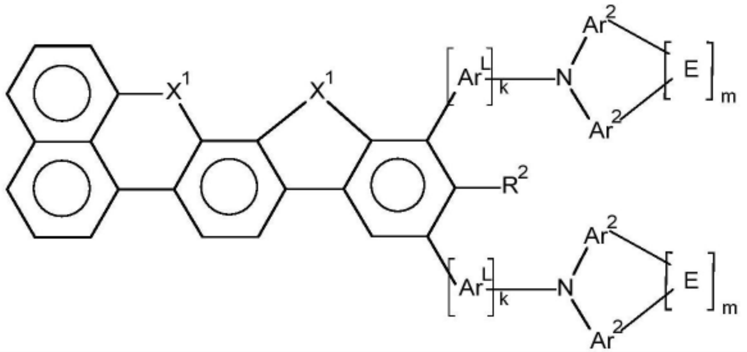


式(I-4-E-3)

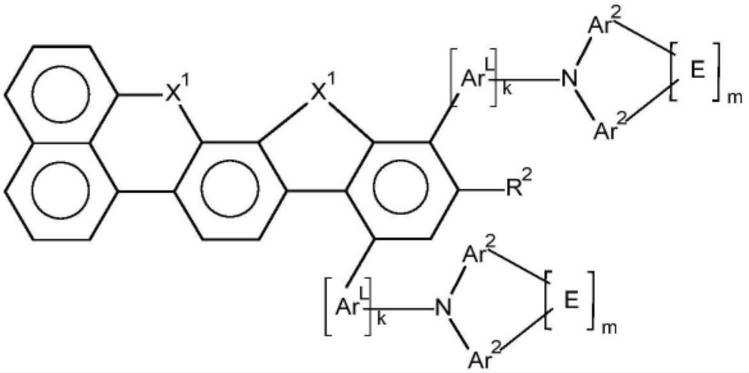
[0131]



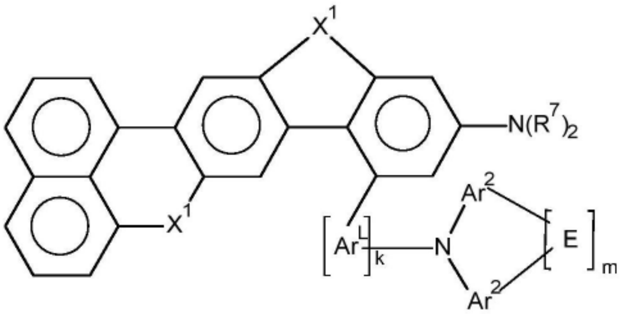
式(I-5-E-1)



式(I-5-E-2)

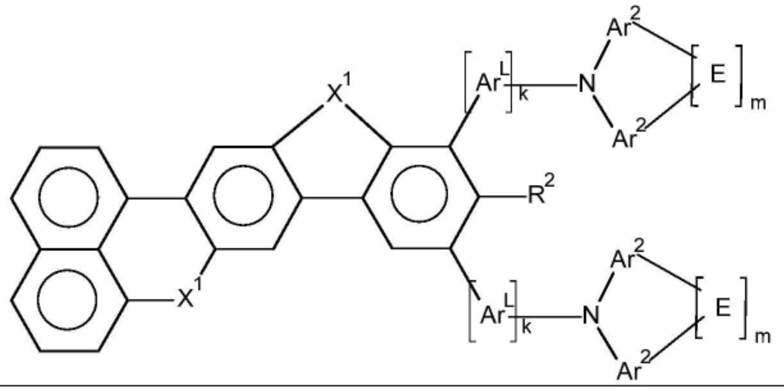


式(I-5-E-3)

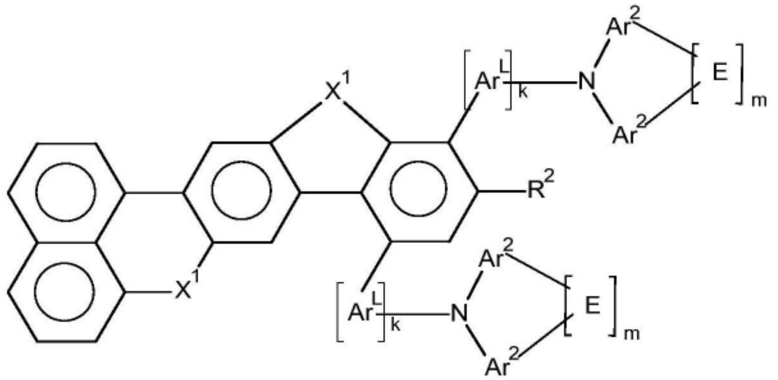


式(I-6-E-1)

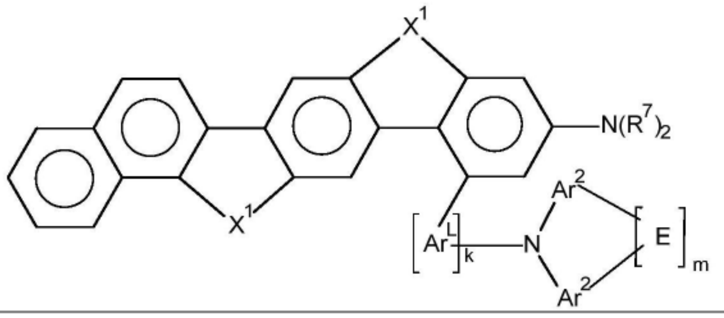
[0132]



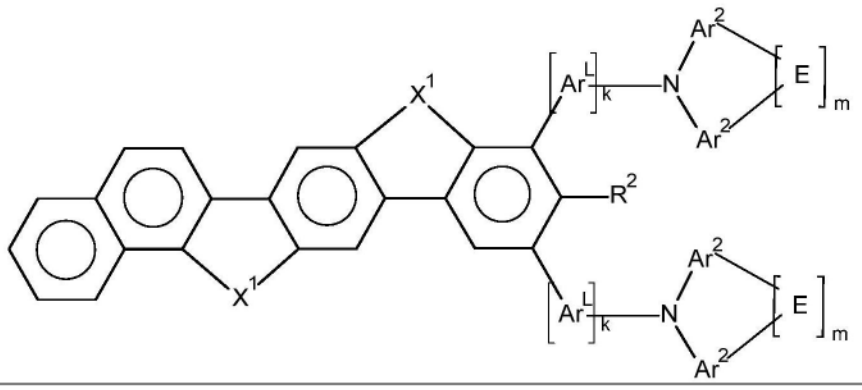
式(I-6-E-2)



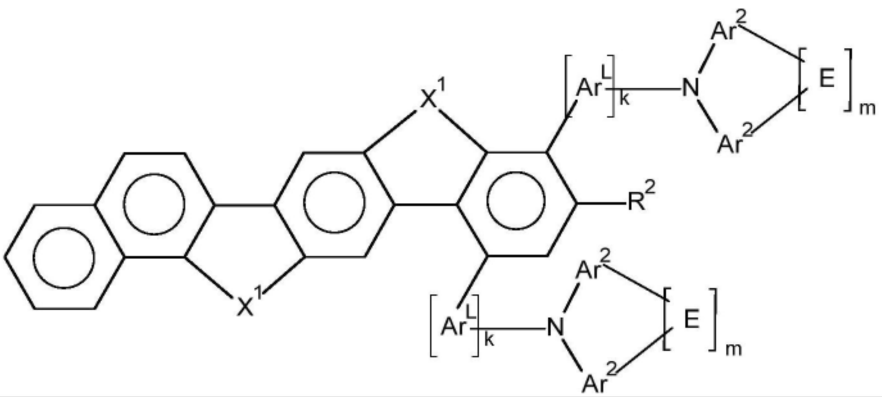
式(I-6-E-3)



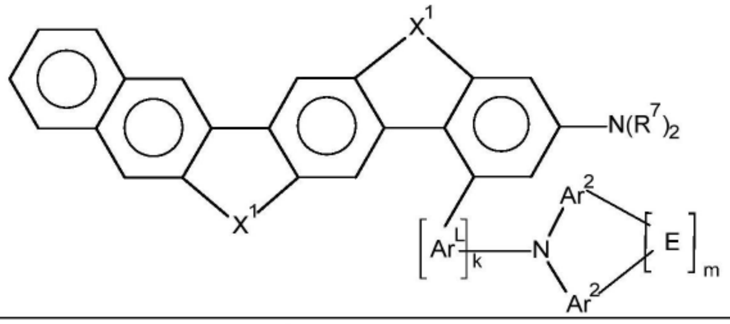
式(I-7-E-1)



式(I-7-E-2)

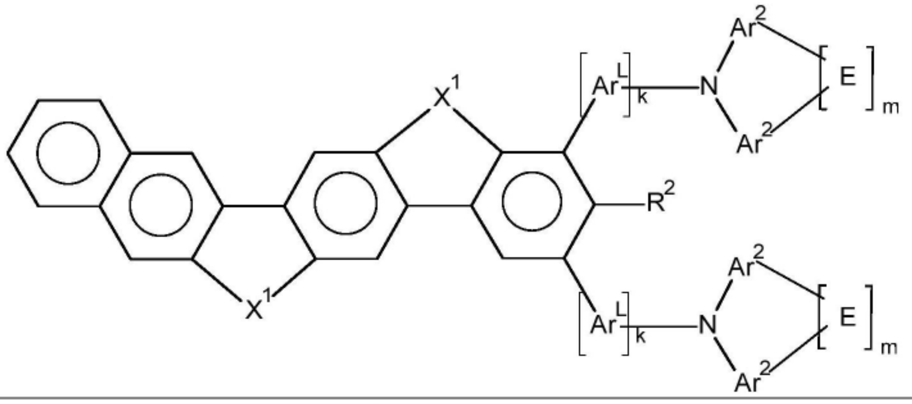


式(I-7-E-3)

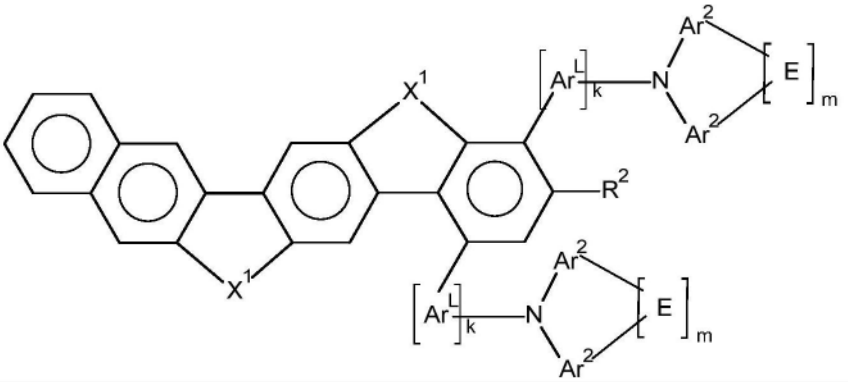


式(I-8-E-1)

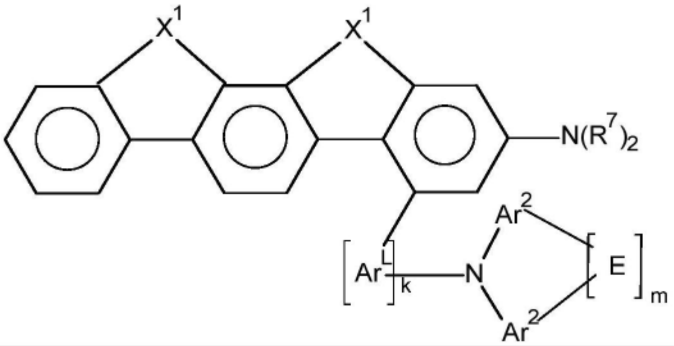
[0133]



式(I-8-E-2)

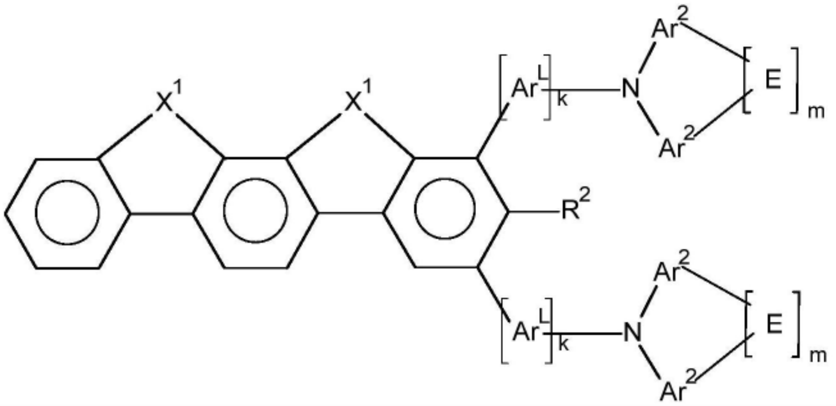


式(I-8-E-3)

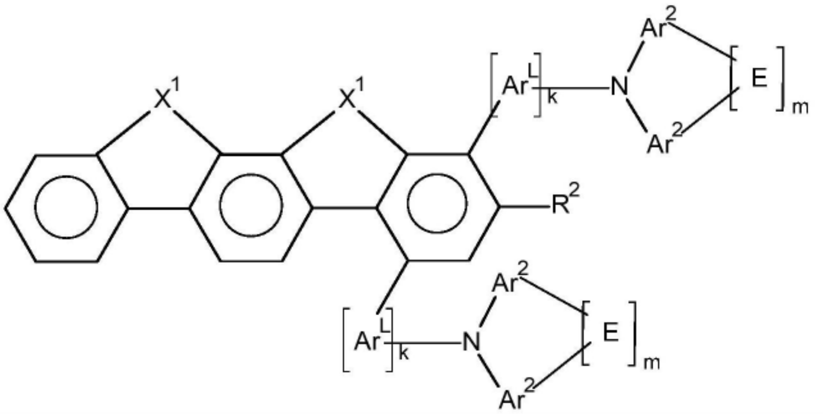


式(I-9-E-1)

[0134]



式(I-9-E-2)



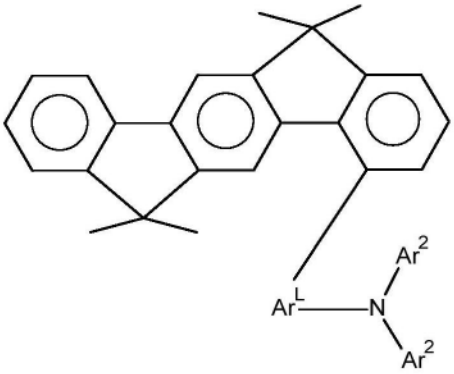
式(I-9-E-3)

[0135] 其中出现的变量如上所定义，并且X^1优选是$C(R^4)_2$，并且其中化合物可以各自在芳族环上的未被占用的位置处被R^3或R^6基团取代，并且优选在这些位置处未被取代。

[0136] 在这些式中，特别优选式(I-1-E-1)、(I-1-E-2)和(I-1-E-3)。

[0137] 对于上述优选的基础结构，变量的上述优选实施方式是优选适用的。

[0138] 特别优选的特定化合物符合下式：

[0139] 

式(I-1-A-1)，

[0140] 其中出现的变量Ar^{L}和Ar^{2}如下选择：

[0141]

化合物	Ar^L 基团	一个 Ar^2 基团	另一个 Ar^2 基团
V-1	Ar^L-1	Ar-1	Ar-1
V-2	"	"	Ar-2
V-3	"	"	Ar-4
V-4	"	"	Ar-5
V-5	"	"	Ar-74
V-6	"	"	Ar-78
V-7	"	"	Ar-82
V-8	"	"	Ar-108
V-9	"	"	Ar-117
V-10	"	"	Ar-139
V-11	"	"	Ar-150
V-12	"	"	Ar-172
V-13	"	"	Ar-207
V-14	"	Ar-2	Ar-2
V-15	"	"	Ar-4
V-16	"	"	Ar-5
V-17	"	"	Ar-74
V-18	"	"	Ar-78
V-19	"	"	Ar-82
V-20	"	"	Ar-108
V-21	"	"	Ar-117
V-22	"	"	Ar-139
V-23	"	"	Ar-150
V-24	"	"	Ar-172
V-25	"	"	Ar-207
V-26	"	Ar-4	Ar-4

[0142]

V-27	"	"	Ar-5
V-28	"	"	Ar-74
V-29	"	"	Ar-78
V-30	"	"	Ar-82
V-31	"	"	Ar-108
V-32	"	"	Ar-117
V-33	"	"	Ar-139
V-34	"	"	Ar-150
V-35	"	"	Ar-172
V-36	"	"	Ar-207
V-37	"	Ar-5	Ar-5
V-38	"	"	Ar-74
V-39	"	"	Ar-78
V-40	"	"	Ar-82
V-41	"	"	Ar-108
V-42	"	"	Ar-117
V-43	"	"	Ar-139
V-44	"	"	Ar-150
V-45	"	"	Ar-172
V-46	"	"	Ar-207
V-47	"	Ar-74	Ar-74
V-48	"	"	Ar-78
V-49	"	"	Ar-82
V-50	"	"	Ar-108
V-51	"	"	Ar-117
V-52	"	"	Ar-139
V-53	"	"	Ar-150
V-54	"	"	Ar-172
V-55	"	"	Ar-207
V-56	"	Ar-78	Ar-78
V-57	"	"	Ar-82
V-58	"	"	Ar-108
V-59	"	"	Ar-117
V-60	"	"	Ar-139
V-61	"	"	Ar-150
V-62	"	"	Ar-172
V-63	"	"	Ar-207
V-64	"	Ar-82	Ar-82
V-65	"	"	Ar-108
V-66	"	"	Ar-117
V-67	"	"	Ar-139
V-68	"	"	Ar-150
V-69	"	"	Ar-172
V-70	"	"	Ar-207
V-71	"	Ar-108	Ar-108

[0143]

V-72	"	"	Ar-117
V-73	"	"	Ar-139
V-74	"	"	Ar-150
V-75	"	"	Ar-172
V-76	"	"	Ar-207
V-77	"	Ar-117	Ar-117
V-78	"	"	Ar-139
V-79	"	"	Ar-150
V-80	"	"	Ar-172
V-81	"	"	Ar-207
V-82	"	Ar-139	Ar-139
V-83	"	"	Ar-150
V-84	"	"	Ar-172
V-85	"	"	Ar-207
V-86	"	Ar-150	Ar-150
V-87	"	"	Ar-172
V-88	"	"	Ar-207
V-89	"	Ar-172	Ar-172
V-90	"	"	Ar-207
V-91	"	Ar-207	Ar-207
V-92	Ar^{L}-2	Ar-1	Ar-1
V-93	"	"	Ar-2
V-94	"	"	Ar-4
V-95	"	"	Ar-5
V-96	"	"	Ar-74
V-97	"	"	Ar-78
V-98	"	"	Ar-82
V-99	"	"	Ar-108
V-100	"	"	Ar-117
V-101	"	"	Ar-139
V-102	"	"	Ar-150
V-103	"	"	Ar-172
V-104	"	"	Ar-207
V-105	"	Ar-2	Ar-2
V-106	"	"	Ar-4
V-107	"	"	Ar-5
V-108	"	"	Ar-74
V-109	"	"	Ar-78
V-110	"	"	Ar-82
V-111	"	"	Ar-108
V-112	"	"	Ar-117
V-113	"	"	Ar-139
V-114	"	"	Ar-150
V-115	"	"	Ar-172
V-116	"	"	Ar-207

[0144]

V-117	"	Ar-4	Ar-4
V-118	"	"	Ar-5
V-119	"	"	Ar-74
V-120	"	"	Ar-78
V-121	"	"	Ar-82
V-122	"	"	Ar-108
V-123	"	"	Ar-117
V-124	"	"	Ar-139
V-125	"	"	Ar-150
V-126	"	"	Ar-172
V-127	"	"	Ar-207
V-128	"	Ar-5	Ar-5
V-129	"	"	Ar-74
V-130	"	"	Ar-78
V-131	"	"	Ar-82
V-132	"	"	Ar-108
V-133	"	"	Ar-117
V-134	"	"	Ar-139
V-135	"	"	Ar-150
V-136	"	"	Ar-172
V-137	"	"	Ar-207
V-138	"	Ar-74	Ar-74
V-139	"	"	Ar-78
V-140	"	"	Ar-82
V-141	"	"	Ar-108
V-142	"	"	Ar-117
V-143	"	"	Ar-139
V-144	"	"	Ar-150
V-145	"	"	Ar-172
V-146	"	"	Ar-207
V-147	"	Ar-78	Ar-78
V-148	"	"	Ar-82
V-149	"	"	Ar-108
V-150	"	"	Ar-117
V-151	"	"	Ar-139
V-152	"	"	Ar-150
V-153	"	"	Ar-172
V-154	"	"	Ar-207
V-155	"	Ar-82	Ar-82
V-156	"	"	Ar-108
V-157	"	"	Ar-117
V-158	"	"	Ar-139
V-159	"	"	Ar-150
V-160	"	"	Ar-172
V-161	"	"	Ar-207

[0145]

V-162	"	Ar-108	Ar-108
V-163	"	"	Ar-117
V-164	"	"	Ar-139
V-165	"	"	Ar-150
V-166	"	"	Ar-172
V-167	"	"	Ar-207
V-168	"	Ar-117	Ar-117
V-169	"	"	Ar-139
V-170	"	"	Ar-150
V-171	"	"	Ar-172
V-172	"	"	Ar-207
V-173	"	Ar-139	Ar-139
V-174	"	"	Ar-150
V-175	"	"	Ar-172
V-176	"	"	Ar-207
V-177	"	Ar-150	Ar-150
V-178	"	"	Ar-172
V-179	"	"	Ar-207
V-180	"	Ar-172	Ar-172
V-181	"	"	Ar-207
V-182	"	Ar-207	Ar-207
V-183	Ar^L-3	Ar-1	Ar-1
V-184	"	"	Ar-2
V-185	"	"	Ar-4
V-186	"	"	Ar-5
V-187	"	"	Ar-74
V-188	"	"	Ar-78
V-189	"	"	Ar-82
V-190	"	"	Ar-108
V-191	"	"	Ar-117
V-192	"	"	Ar-139
V-193	"	"	Ar-150
V-194	"	"	Ar-172
V-195	"	"	Ar-207
V-196	"	Ar-2	Ar-2
V-197	"	"	Ar-4
V-198	"	"	Ar-5
V-199	"	"	Ar-74
V-200	"	"	Ar-78
V-201	"	"	Ar-82
V-202	"	"	Ar-108
V-203	"	"	Ar-117
V-204	"	"	Ar-139
V-205	"	"	Ar-150
V-206	"	"	Ar-172

[0146]

V-207	"	"	Ar-207
V-208	"	Ar-4	Ar-4
V-209	"	"	Ar-5
V-210	"	"	Ar-74
V-211	"	"	Ar-78
V-212	"	"	Ar-82
V-213	"	"	Ar-108
V-214	"	"	Ar-117
V-215	"	"	Ar-139
V-216	"	"	Ar-150
V-217	"	"	Ar-172
V-218	"	"	Ar-207
V-219	"	Ar-5	Ar-5
V-220	"	"	Ar-74
V-221	"	"	Ar-78
V-222	"	"	Ar-82
V-223	"	"	Ar-108
V-224	"	"	Ar-117
V-225	"	"	Ar-139
V-226	"	"	Ar-150
V-227	"	"	Ar-172
V-228	"	"	Ar-207
V-229	"	Ar-74	Ar-74
V-230	"	"	Ar-78
V-231	"	"	Ar-82
V-232	"	"	Ar-108
V-233	"	"	Ar-117
V-234	"	"	Ar-139
V-235	"	"	Ar-150
V-236	"	"	Ar-172
V-237	"	"	Ar-207
V-238	"	Ar-78	Ar-78
V-239	"	"	Ar-82
V-240	"	"	Ar-108
V-241	"	"	Ar-117
V-242	"	"	Ar-139
V-243	"	"	Ar-150
V-244	"	"	Ar-172
V-245	"	"	Ar-207
V-246	"	Ar-82	Ar-82
V-247	"	"	Ar-108
V-248	"	"	Ar-117
V-249	"	"	Ar-139
V-250	"	"	Ar-150
V-251	"	"	Ar-172

V-252	"	"	Ar-207
V-253	"	Ar-108	Ar-108
V-254	"	"	Ar-117
V-255	"	"	Ar-139
V-256	"	"	Ar-150
V-257	"	"	Ar-172
V-258	"	"	Ar-207
V-259	"	Ar-117	Ar-117
V-260	"	"	Ar-139
V-261	"	"	Ar-150
V-262	"	"	Ar-172
V-263	"	"	Ar-207
V-264	"	Ar-139	Ar-139
V-265	"	"	Ar-150
V-266	"	"	Ar-172
V-267	"	"	Ar-207
V-268	"	Ar-150	Ar-150
V-269	"	"	Ar-172
V-270	"	"	Ar-207
V-271	"	Ar-172	Ar-172
V-272	"	"	Ar-207
V-273	"	Ar-207	Ar-207

[0147]

V-274	Ar^{L}-4	Ar-1	Ar-1
V-275	"	"	Ar-2
V-276	"	"	Ar-4
V-277	"	"	Ar-5
V-278	"	"	Ar-74
V-279	"	"	Ar-78
V-280	"	"	Ar-82
V-281	"	"	Ar-108
V-282	"	"	Ar-117
V-283	"	"	Ar-139
V-284	"	"	Ar-150
V-285	"	"	Ar-172
V-286	"	"	Ar-207
V-287	"	Ar-2	Ar-2
V-288	"	"	Ar-4
V-289	"	"	Ar-5
V-290	"	"	Ar-74
V-291	"	"	Ar-78
V-292	"	"	Ar-82
V-293	"	"	Ar-108
V-294	"	"	Ar-117
V-295	"	"	Ar-139
V-296	"	"	Ar-150

[0148]

V-297	"	"	Ar-172
V-298	"	"	Ar-207
V-299	"	Ar-4	Ar-4
V-300	"	"	Ar-5
V-301	"	"	Ar-74
V-302	"	"	Ar-78
V-303	"	"	Ar-82
V-304	"	"	Ar-108
V-305	"	"	Ar-117
V-306	"	"	Ar-139
V-307	"	"	Ar-150
V-308	"	"	Ar-172
V-309	"	"	Ar-207
V-310	"	Ar-5	Ar-5
V-311	"	"	Ar-74
V-312	"	"	Ar-78
V-313	"	"	Ar-82
V-314	"	"	Ar-108
V-315	"	"	Ar-117
V-316	"	"	Ar-139
V-317	"	"	Ar-150
V-318	"	"	Ar-172
V-319	"	"	Ar-207
V-320	"	Ar-74	Ar-74
V-321	"	"	Ar-78
V-322	"	"	Ar-82
V-323	"	"	Ar-108
V-324	"	"	Ar-117
V-325	"	"	Ar-139
V-326	"	"	Ar-150
V-327	"	"	Ar-172
V-328	"	"	Ar-207
V-329	"	Ar-78	Ar-78
V-330	"	"	Ar-82
V-331	"	"	Ar-108
V-332	"	"	Ar-117
V-333	"	"	Ar-139
V-334	"	"	Ar-150
V-335	"	"	Ar-172
V-336	"	"	Ar-207
V-337	"	Ar-82	Ar-82
V-338	"	"	Ar-108
V-339	"	"	Ar-117
V-340	"	"	Ar-139
V-341	"	"	Ar-150

[0149]

V-342	"	"	Ar-172
V-343	"	"	Ar-207
V-344	"	Ar-108	Ar-108
V-345	"	"	Ar-117
V-346	"	"	Ar-139
V-347	"	"	Ar-150
V-348	"	"	Ar-172
V-349	"	"	Ar-207
V-350	"	Ar-117	Ar-117
V-351	"	"	Ar-139
V-352	"	"	Ar-150
V-353	"	"	Ar-172
V-354	"	"	Ar-207
V-355	"	Ar-139	Ar-139
V-356	"	"	Ar-150
V-357	"	"	Ar-172
V-358	"	"	Ar-207
V-359	"	Ar-150	Ar-150
V-360	"	"	Ar-172
V-361	"	"	Ar-207
V-362	"	Ar-172	Ar-172
V-363	"	"	Ar-207
V-364	"	Ar-207	Ar-207
V-365	Ar^{L}-7	Ar-1	Ar-1
V-366	"	"	Ar-2
V-367	"	"	Ar-4
V-368	"	"	Ar-5
V-369	"	"	Ar-74
V-370	"	"	Ar-78
V-371	"	"	Ar-82
V-372	"	"	Ar-108
V-373	"	"	Ar-117
V-374	"	"	Ar-139
V-375	"	"	Ar-150
V-376	"	"	Ar-172
V-377	"	"	Ar-207
V-378	"	Ar-2	Ar-2
V-379	"	"	Ar-4
V-380	"	"	Ar-5
V-381	"	"	Ar-74
V-382	"	"	Ar-78
V-383	"	"	Ar-82
V-384	"	"	Ar-108
V-385	"	"	Ar-117
V-386	"	"	Ar-139

[0150]

V-387	"	"	Ar-150
V-388	"	"	Ar-172
V-389	"	"	Ar-207
V-390	"	Ar-4	Ar-4
V-391	"	"	Ar-5
V-392	"	"	Ar-74
V-393	"	"	Ar-78
V-394	"	"	Ar-82
V-395	"	"	Ar-108
V-396	"	"	Ar-117
V-397	"	"	Ar-139
V-398	"	"	Ar-150
V-399	"	"	Ar-172
V-400	"	"	Ar-207
V-401	"	Ar-5	Ar-5
V-402	"	"	Ar-74
V-403	"	"	Ar-78
V-404	"	"	Ar-82
V-405	"	"	Ar-108
V-406	"	"	Ar-117
V-407	"	"	Ar-139
V-408	"	"	Ar-150
V-409	"	"	Ar-172
V-410	"	"	Ar-207
V-411	"	Ar-74	Ar-74
V-412	"	"	Ar-78
V-413	"	"	Ar-82
V-414	"	"	Ar-108
V-415	"	"	Ar-117
V-416	"	"	Ar-139
V-417	"	"	Ar-150
V-418	"	"	Ar-172
V-419	"	"	Ar-207
V-420	"	Ar-78	Ar-78
V-421	"	"	Ar-82
V-422	"	"	Ar-108
V-423	"	"	Ar-117
V-424	"	"	Ar-139
V-425	"	"	Ar-150
V-426	"	"	Ar-172
V-427	"	"	Ar-207
V-428	"	Ar-82	Ar-82
V-429	"	"	Ar-108
V-430	"	"	Ar-117
V-431	"	"	Ar-139

[0151]

V-432	"	"	Ar-150
V-433	"	"	Ar-172
V-434	"	"	Ar-207
V-435	"	Ar-108	Ar-108
V-436	"	"	Ar-117
V-437	"	"	Ar-139
V-438	"	"	Ar-150
V-439	"	"	Ar-172
V-440	"	"	Ar-207
V-441	"	Ar-117	Ar-117
V-442	"	"	Ar-139
V-443	"	"	Ar-150
V-444	"	"	Ar-172
V-445	"	"	Ar-207
V-446	"	Ar-139	Ar-139
V-447	"	"	Ar-150
V-448	"	"	Ar-172
V-449	"	"	Ar-207
V-450	"	Ar-150	Ar-150
V-451	"	"	Ar-172
V-452	"	"	Ar-207
V-453	"	Ar-172	Ar-172
V-454	"	"	Ar-207
V-455	"	Ar-207	Ar-207
V-456	Ar^L-19	Ar-1	Ar-1
V-457	"	"	Ar-2
V-458	"	"	Ar-4
V-459	"	"	Ar-5
V-460	"	"	Ar-74
V-461	"	"	Ar-78
V-462	"	"	Ar-82
V-463	"	"	Ar-108
V-464	"	"	Ar-117
V-465	"	"	Ar-139
V-466	"	"	Ar-150
V-467	"	"	Ar-172
V-468	"	"	Ar-207
V-469	"	Ar-2	Ar-2
V-470	"	"	Ar-4
V-471	"	"	Ar-5
V-472	"	"	Ar-74
V-473	"	"	Ar-78
V-474	"	"	Ar-82
V-475	"	"	Ar-108
V-476	"	"	Ar-117

[0152]

V-477	"	"	Ar-139
V-478	"	"	Ar-150
V-479	"	"	Ar-172
V-480	"	"	Ar-207
V-481	"	Ar-4	Ar-4
V-482	"	"	Ar-5
V-483	"	"	Ar-74
V-484	"	"	Ar-78
V-485	"	"	Ar-82
V-486	"	"	Ar-108
V-487	"	"	Ar-117
V-488	"	"	Ar-139
V-489	"	"	Ar-150
V-490	"	"	Ar-172
V-491	"	"	Ar-207
V-492	"	Ar-5	Ar-5
V-493	"	"	Ar-74
V-494	"	"	Ar-78
V-495	"	"	Ar-82
V-496	"	"	Ar-108
V-497	"	"	Ar-117
V-498	"	"	Ar-139
V-499	"	"	Ar-150
V-500	"	"	Ar-172
V-501	"	"	Ar-207
V-502	"	Ar-74	Ar-74
V-503	"	"	Ar-78
V-504	"	"	Ar-82
V-505	"	"	Ar-108
V-506	"	"	Ar-117
V-507	"	"	Ar-139
V-508	"	"	Ar-150
V-509	"	"	Ar-172
V-510	"	"	Ar-207
V-511	"	Ar-78	Ar-78
V-512	"	"	Ar-82
V-513	"	"	Ar-108
V-514	"	"	Ar-117
V-515	"	"	Ar-139
V-516	"	"	Ar-150
V-517	"	"	Ar-172
V-518	"	"	Ar-207
V-519	"	Ar-82	Ar-82
V-520	"	"	Ar-108
V-521	"	"	Ar-117

[0153]

V-522	"	"	Ar-139
V-523	"	"	Ar-150
V-524	"	"	Ar-172
V-525	"	"	Ar-207
V-526	"	Ar-108	Ar-108
V-527	"	"	Ar-117
V-528	"	"	Ar-139
V-529	"	"	Ar-150
V-530	"	"	Ar-172
V-531	"	"	Ar-207
V-532	"	Ar-117	Ar-117
V-533	"	"	Ar-139
V-534	"	"	Ar-150
V-535	"	"	Ar-172
V-536	"	"	Ar-207
V-537	"	Ar-139	Ar-139
V-538	"	"	Ar-150
V-539	"	"	Ar-172
V-540	"	"	Ar-207
V-541	"	Ar-150	Ar-150
V-542	"	"	Ar-172
V-543	"	"	Ar-207
V-544	"	Ar-172	Ar-172
V-545	"	"	Ar-207
V-546	"	Ar-207	Ar-207
V-547	Ar^{L}-36	Ar-1	Ar-1
V-548	"	"	Ar-2
V-549	"	"	Ar-4
V-550	"	"	Ar-5
V-551	"	"	Ar-74
V-552	"	"	Ar-78
V-553	"	"	Ar-82
V-554	"	"	Ar-108
V-555	"	"	Ar-117
V-556	"	"	Ar-139
V-557	"	"	Ar-150
V-558	"	"	Ar-172
V-559	"	"	Ar-207
V-560	"	Ar-2	Ar-2
V-561	"	"	Ar-4
V-562	"	"	Ar-5
V-563	"	"	Ar-74
V-564	"	"	Ar-78
V-565	"	"	Ar-82
V-566	"	"	Ar-108

[0154]

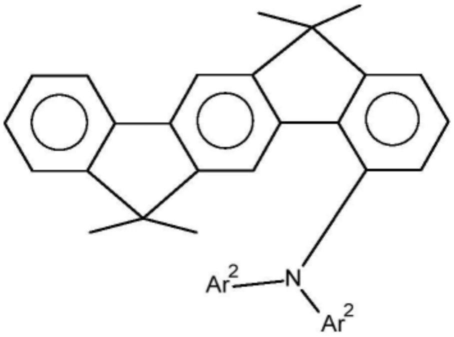
V-567	"	"	Ar-117
V-568	"	"	Ar-139
V-569	"	"	Ar-150
V-570	"	"	Ar-172
V-571	"	"	Ar-207
V-572	"	Ar-4	Ar-4
V-573	"	"	Ar-5
V-574	"	"	Ar-74
V-575	"	"	Ar-78
V-576	"	"	Ar-82
V-577	"	"	Ar-108
V-578	"	"	Ar-117
V-579	"	"	Ar-139
V-580	"	"	Ar-150
V-581	"	"	Ar-172
V-582	"	"	Ar-207
V-583	"	Ar-5	Ar-5
V-584	"	"	Ar-74
V-585	"	"	Ar-78
V-586	"	"	Ar-82
V-587	"	"	Ar-108
V-588	"	"	Ar-117
V-589	"	"	Ar-139
V-590	"	"	Ar-150
V-591	"	"	Ar-172
V-592	"	"	Ar-207
V-593	"	Ar-74	Ar-74
V-594	"	"	Ar-78
V-595	"	"	Ar-82
V-596	"	"	Ar-108
V-597	"	"	Ar-117
V-598	"	"	Ar-139
V-599	"	"	Ar-150
V-600	"	"	Ar-172
V-601	"	"	Ar-207
V-602	"	Ar-78	Ar-78
V-603	"	"	Ar-82
V-604	"	"	Ar-108
V-605	"	"	Ar-117
V-606	"	"	Ar-139
V-607	"	"	Ar-150
V-608	"	"	Ar-172
V-609	"	"	Ar-207
V-610	"	Ar-82	Ar-82
V-611	"	"	Ar-108

[0155]

V-612	"	"	Ar-117
V-613	"	"	Ar-139
V-614	"	"	Ar-150
V-615	"	"	Ar-172
V-616	"	"	Ar-207
V-617	"	Ar-108	Ar-108
V-618	"	"	Ar-117
V-619	"	"	Ar-139
V-620	"	"	Ar-150
V-621	"	"	Ar-172
V-622	"	"	Ar-207
V-623	"	Ar-117	Ar-117
V-624	"	"	Ar-139
V-625	"	"	Ar-150
V-626	"	"	Ar-172
V-627	"	"	Ar-207
V-628	"	Ar-139	Ar-139
V-629	"	"	Ar-150
V-630	"	"	Ar-172
V-631	"	"	Ar-207
V-632	"	Ar-150	Ar-150
V-633	"	"	Ar-172
V-634	"	"	Ar-207
V-635	"	Ar-172	Ar-172
V-636	"	"	Ar-207
V-637	"	Ar-207	Ar-207

[0156] 还特别优选的特定化合物符合下式：

[0157]



式(I-1-A-2)，

[0158] 其中出现的变量Ar^2如下选择：

[0159]

化合物	一个 Ar^2 基团	另一个 Ar^2 基团
V-638	Ar-1	Ar-1
V-639	"	Ar-2
V-640	"	Ar-4

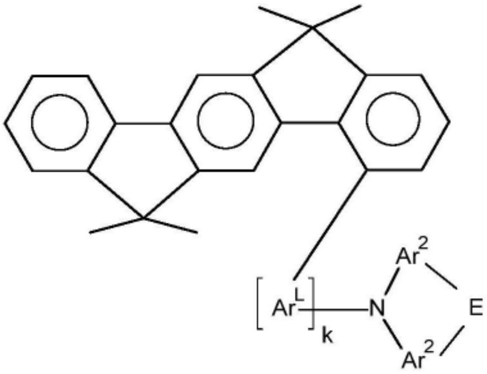
[0160]

V-641	"	Ar-5
V-642	"	Ar-74
V-643	"	Ar-78
V-644	"	Ar-82
V-645	"	Ar-108
V-646	"	Ar-117
V-647	"	Ar-139
V-648	"	Ar-150
V-649	"	Ar-172
V-650	"	Ar-207
V-651	Ar-2	Ar-2
V-652	"	Ar-4
V-653	"	Ar-5
V-654	"	Ar-74
V-655	"	Ar-78
V-656	"	Ar-82
V-657	"	Ar-108
V-658	"	Ar-117
V-659	"	Ar-139
V-660	"	Ar-150
V-661	"	Ar-172
V-662	"	Ar-207
V-663	Ar-4	Ar-4
V-664	"	Ar-5
V-665	"	Ar-74
V-666	"	Ar-78
V-667	"	Ar-82
V-668	"	Ar-108
V-669	"	Ar-117
V-670	"	Ar-139
V-671	"	Ar-150
V-672	"	Ar-172
V-673	"	Ar-207
V-674	Ar-5	Ar-5
V-675	"	Ar-74
V-676	"	Ar-78
V-677	"	Ar-82
V-678	"	Ar-108
V-679	"	Ar-117
V-680	"	Ar-139
V-681	"	Ar-150
V-682	"	Ar-172
V-683	"	Ar-207
V-684	Ar-74	Ar-74
V-685	"	Ar-78

[0161]

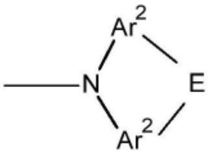
V-686	"	Ar-82
V-687	"	Ar-108
V-688	"	Ar-117
V-689	"	Ar-139
V-690	"	Ar-150
V-691	"	Ar-172
V-692	"	Ar-207
V-693	Ar-78	Ar-78
V-694	"	Ar-82
V-695	"	Ar-108
V-696	"	Ar-117
V-697	"	Ar-139
V-698	"	Ar-150
V-699	"	Ar-172
V-700	"	Ar-207
V-701	Ar-82	Ar-82
V-702	"	Ar-108
V-703	"	Ar-117
V-704	"	Ar-139
V-705	"	Ar-150
V-706	"	Ar-172
V-707	"	Ar-207
V-708	Ar-108	Ar-108
V-709	"	Ar-117
V-710	"	Ar-139
V-711	"	Ar-150
V-712	"	Ar-172
V-713	"	Ar-207
V-714	Ar-117	Ar-117
V-715	"	Ar-139
V-716	"	Ar-150
V-717	"	Ar-172
V-718	"	Ar-207
V-719	Ar-139	Ar-139
V-720	"	Ar-150
V-721	"	Ar-172
V-722	"	Ar-207
V-723	Ar-150	Ar-150
V-724	"	Ar-172
V-725	"	Ar-207
V-726	Ar-172	Ar-172
V-727	"	Ar-207
V-728	Ar-207	Ar-207

[0162] 还特别优选的特定化合物符合下式：

[0163] 

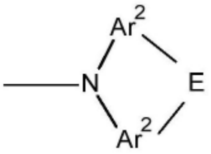
式(I-1-A-3)，

[0164] 其中出现的变量k、Ar^{L}基团和单元

[0165] 

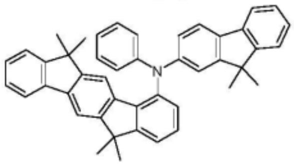
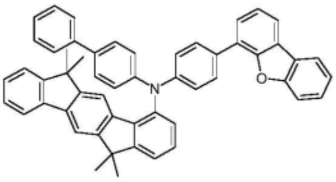
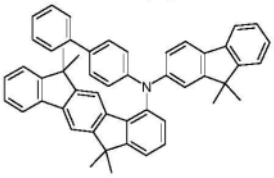
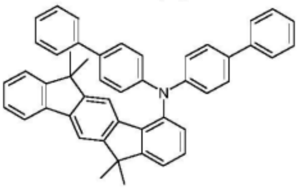
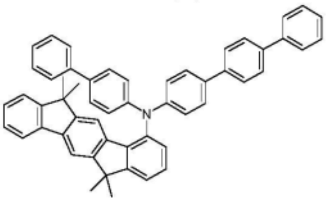
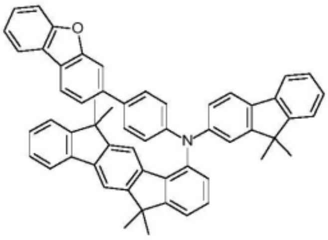
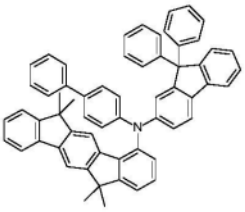
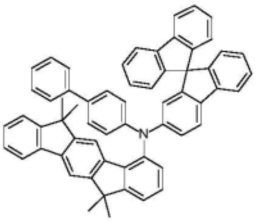
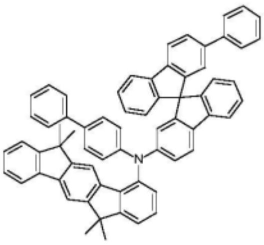
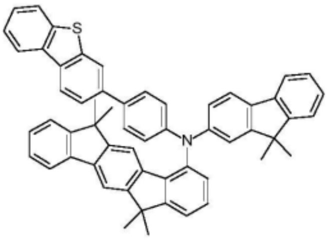
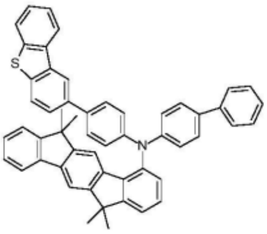
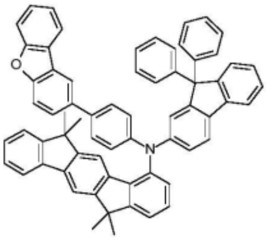
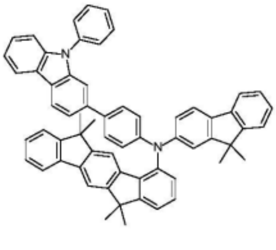
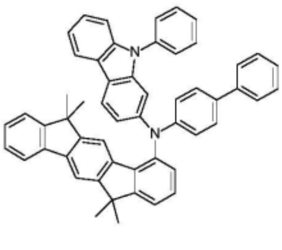
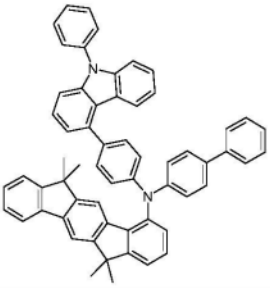
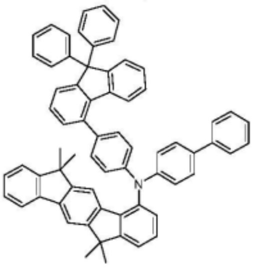
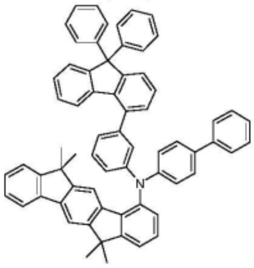
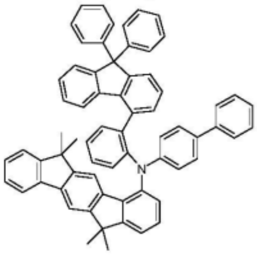
[0166] 如下选择：

[0167]

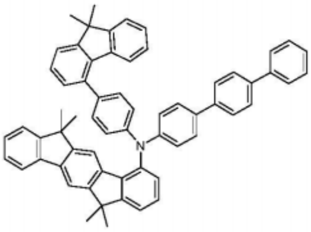
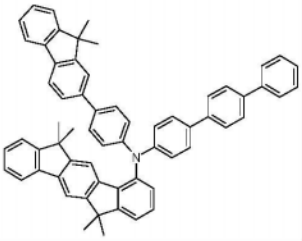
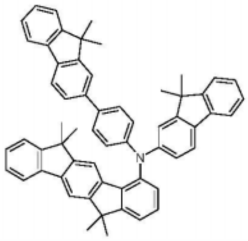
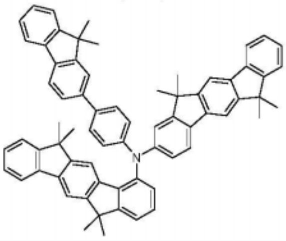
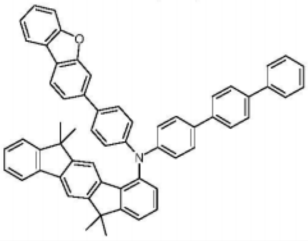
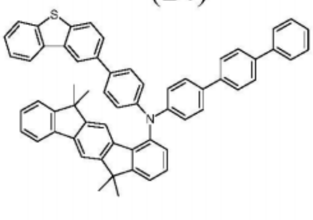
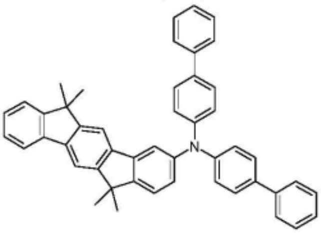
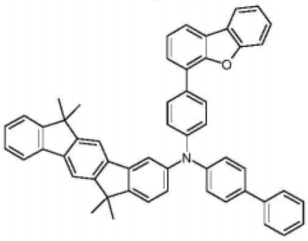
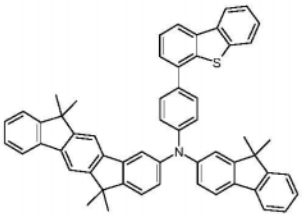
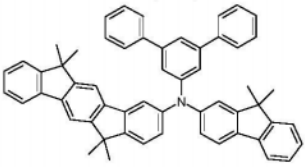
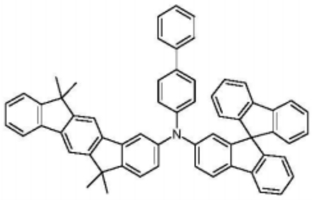
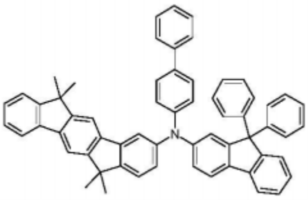
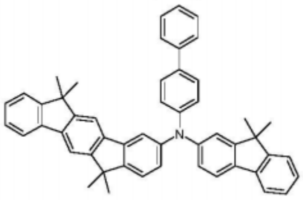
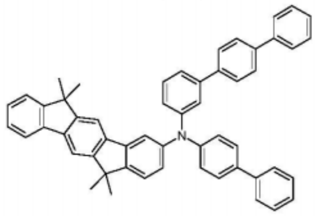
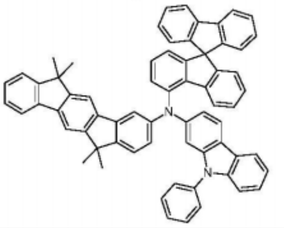
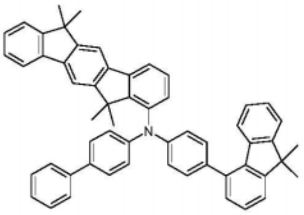
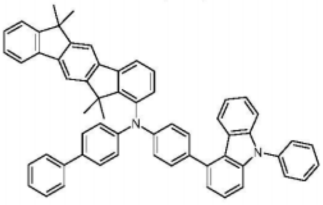
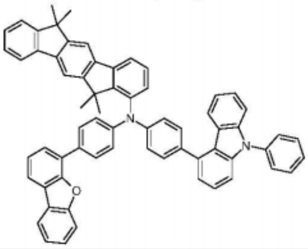
化合物	**k**	**Ar^L**	 **单元**
V-729	0	--	N-17
V-730	0	--	N-20
V-731	1	Ar^L-1	N-17
V-732	1	Ar^L-1	N-20
V-733	1	Ar^L-2	N-17
V-734	1	Ar^L-2	N-20
V-735	1	Ar^L-3	N-17
V-736	1	Ar^L-3	N-20
V-737	1	Ar^L-4	N-17
V-738	1	Ar^L-4	N-20
V-739	1	Ar^L-7	N-17
V-740	1	Ar^L-7	N-20
V-741	1	Ar^L-19	N-17
V-742	1	Ar^L-19	N-20
V-743	1	Ar^L-36	N-17
V-744	1	Ar^L-36	N-20

[0168] 优选的特定式(I)化合物描绘于下表中：

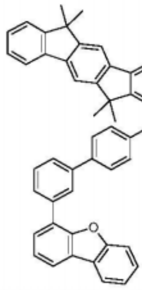
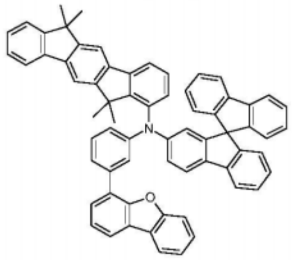
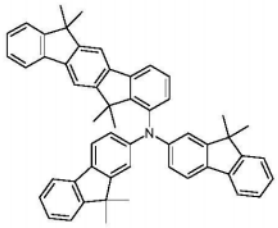
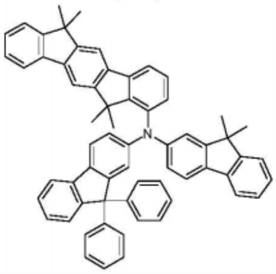
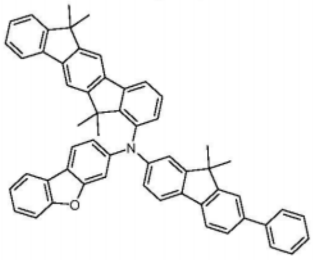
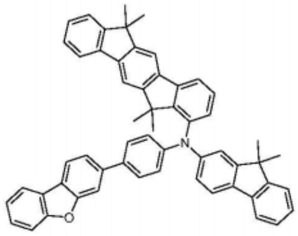
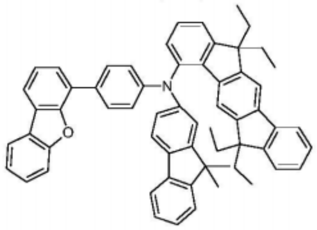
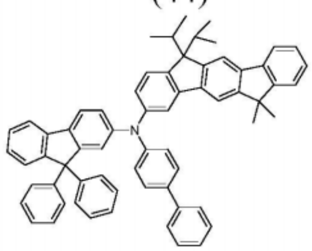
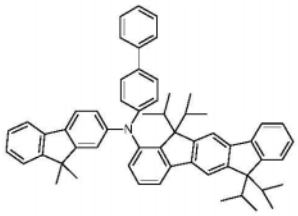
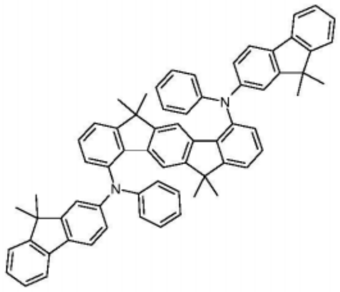
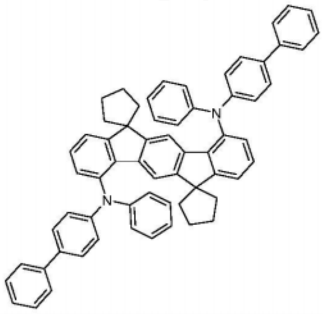
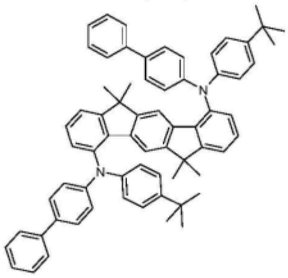
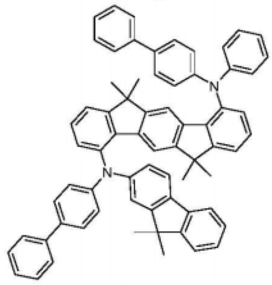
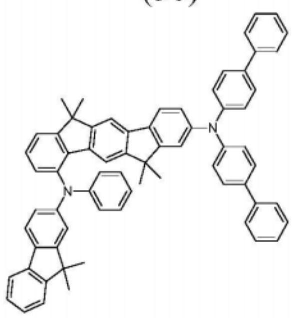
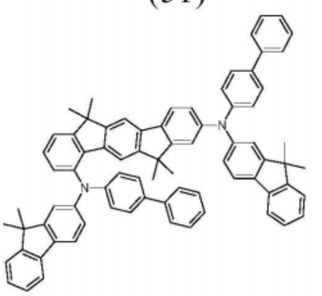
[0169]

(1) 	(2) 	(3) 
(4) 	(5) 	(6) 
(7) 	(8) 	(9) 
(10) 	(11) 	(12) 
(13) 	(14) 	(15) 
(16) 	(17) 	(18) 

[0170]

(19) 	(20) 	(21) 
(22) 	(23) 	(24) 
(25) 	(26) 	(27) 
(28) 	(29) 	(30) 
(31) 	(32) 	(33) 
(34) 	(35) 	(36) 

[0171]

(37) 	(38) 	(39) 
(40) 	(41) 	(42) 
(43) 	(44) 	(45) 
(46) 	(47) 	(48) 
(49) 	(50) 	(51) 

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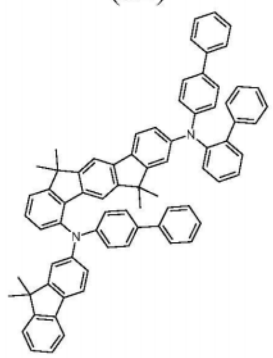
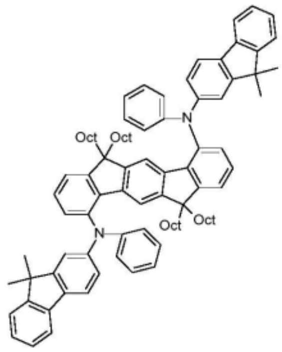
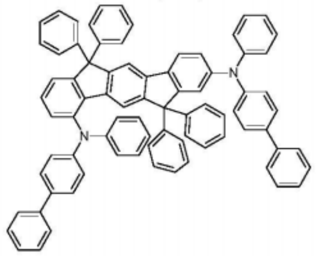
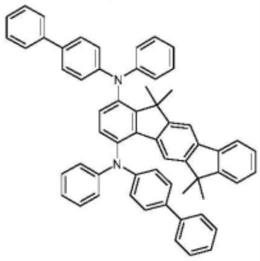
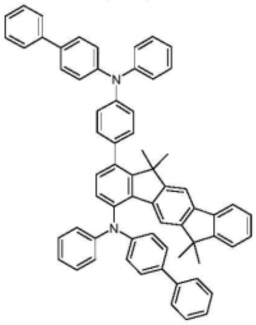
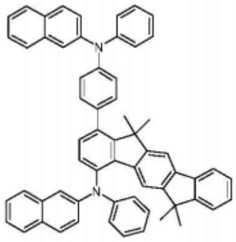
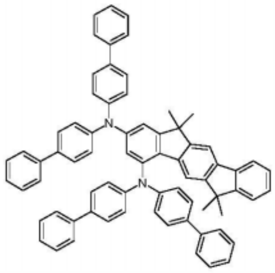
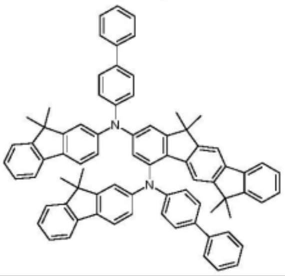
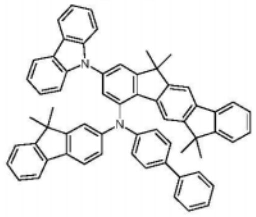
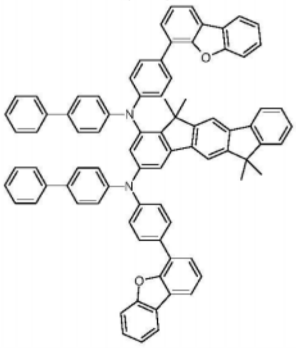
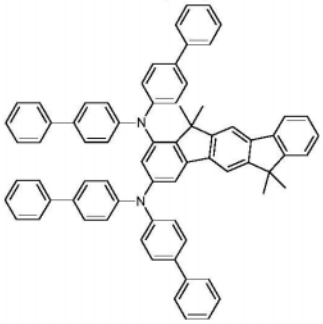
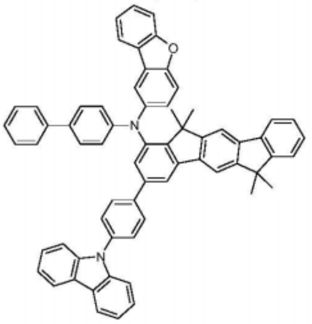
(52) 	(53) 	(54) 
(55) 	(56) 	(57) 
(58) 	(59) 	(60) 
(61) 	(62) 	(63) 

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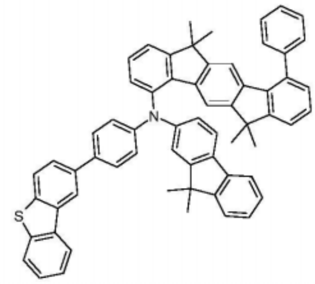
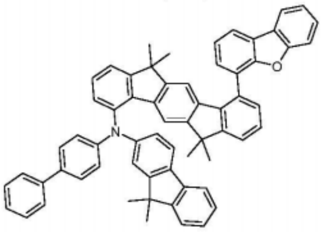
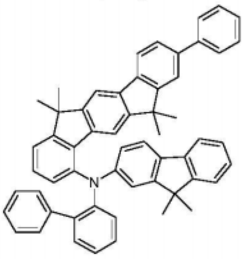
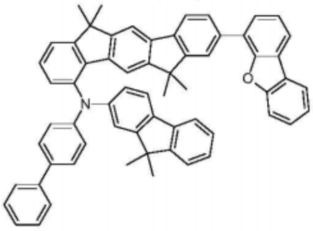
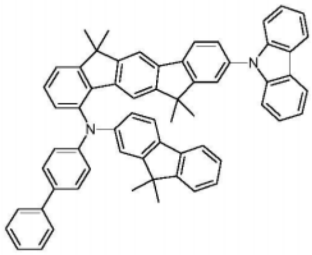
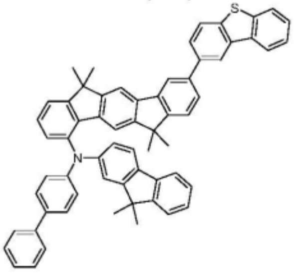
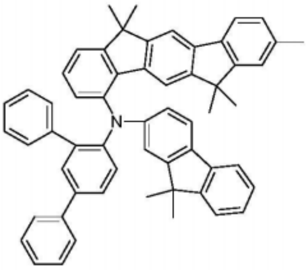
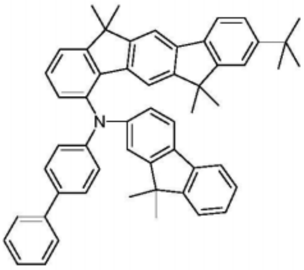
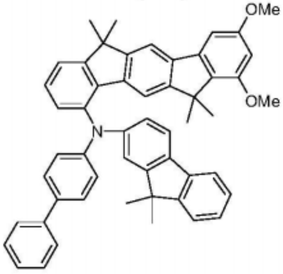
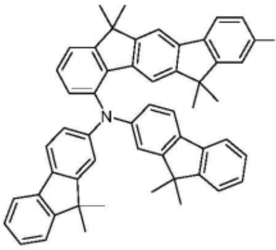
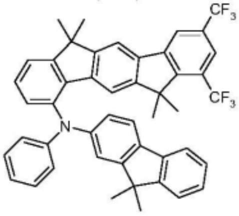
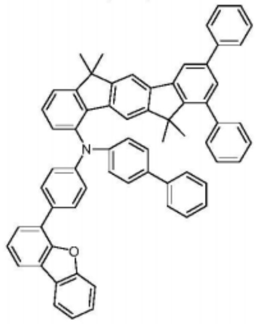
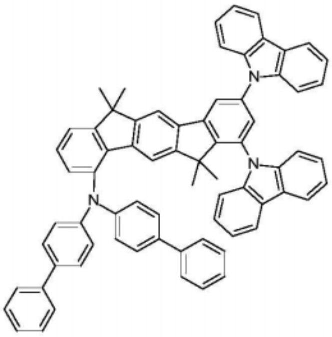
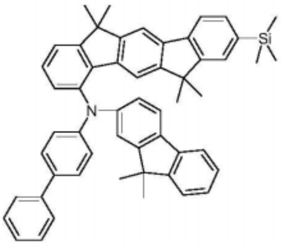
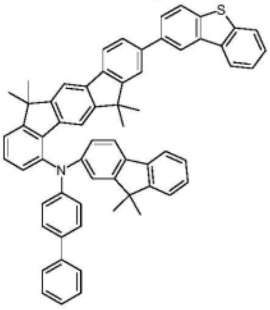
(64)  	(65)  	(66) 
(67)  	(68)  	(69) 
(70)  	(71)  	(72) 
(73)  	(74)  	(75) 
(76)  	(77)  	(78) 

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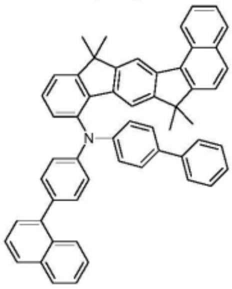
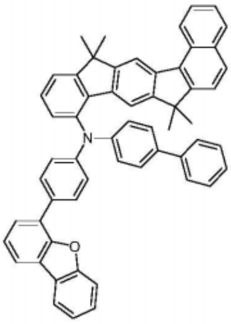
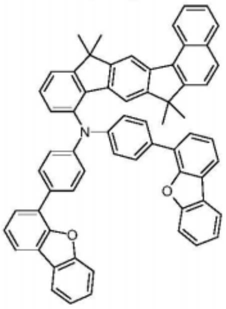
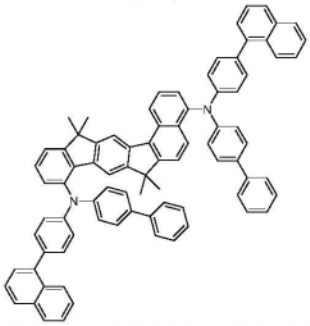
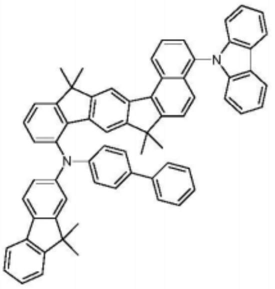
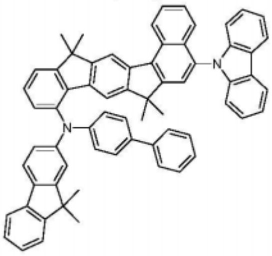
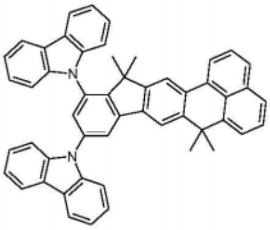
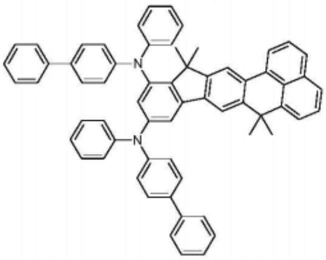
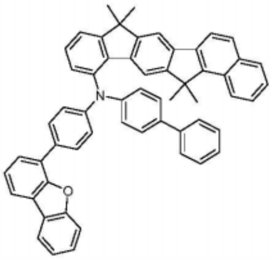
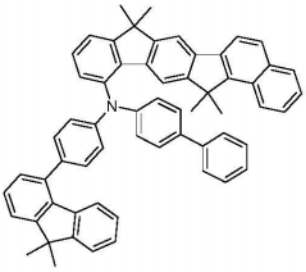
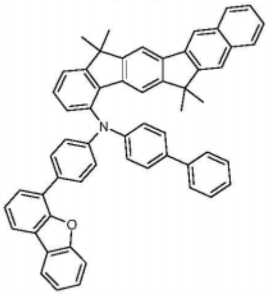
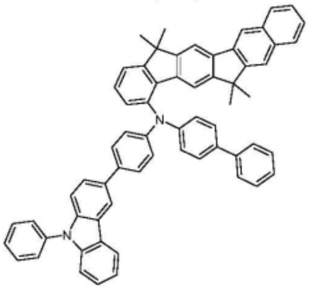
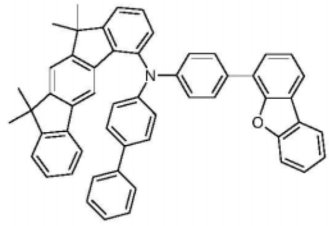
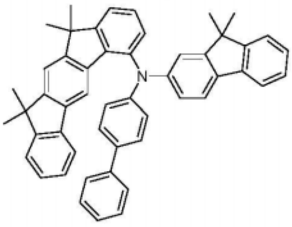
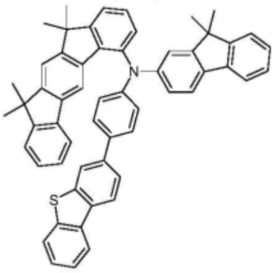
(79) 	(80) 	(81) 
(82) 	(83) 	(84) 
(85) 	(86) 	(87) 
(88) 	(89) 	(90) 
(91) 	(92) 	(93) 

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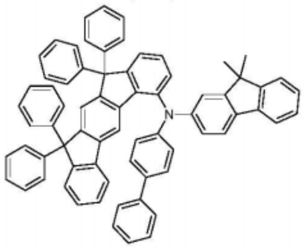
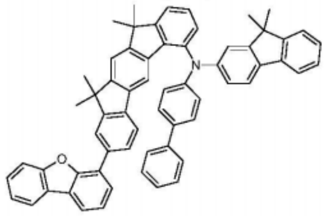
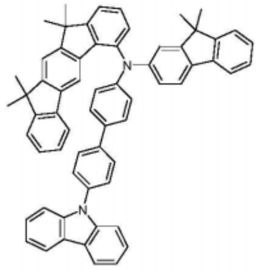
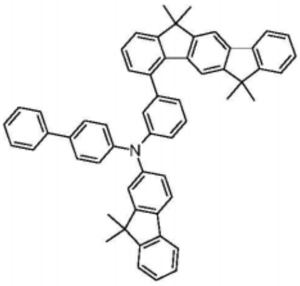
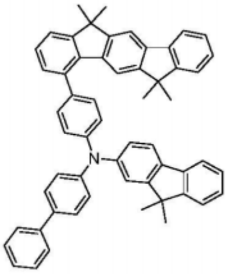
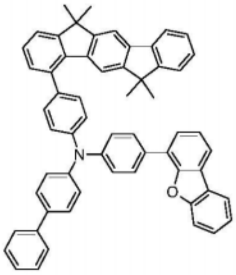
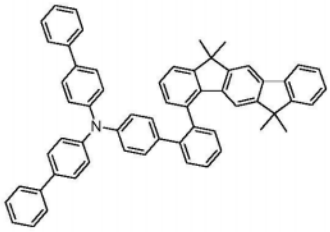
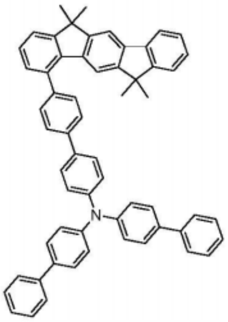
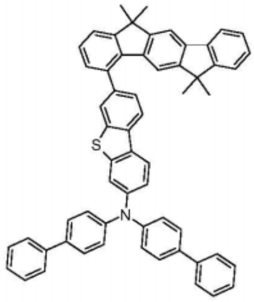
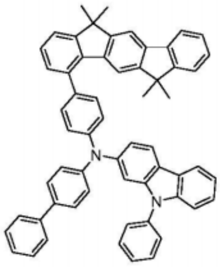
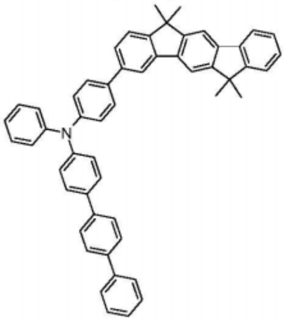
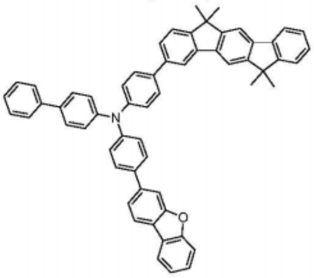
(94) 	(95) 	(96) 
(97) 	(98) 	(99) 
(100) 	(101) 	(102) 
(103) 	(104) 	(105) 

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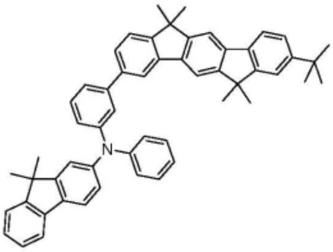
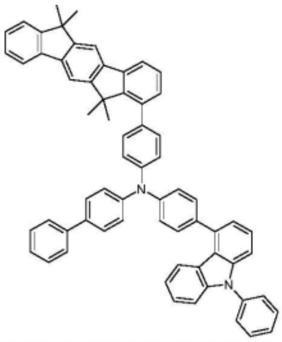
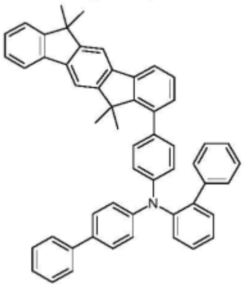
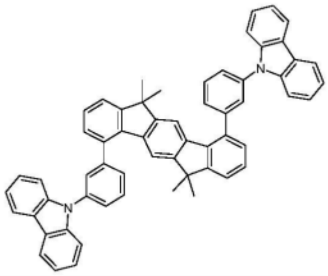
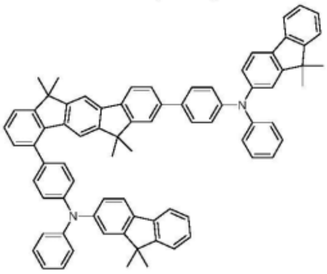
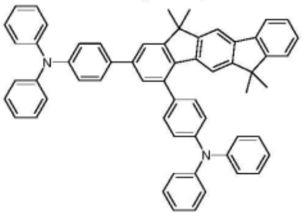
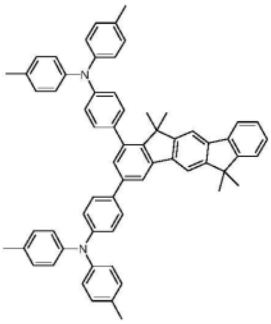
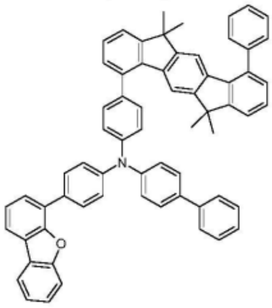
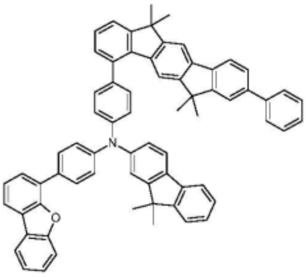
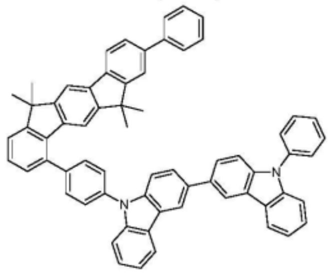
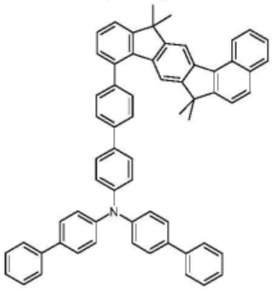
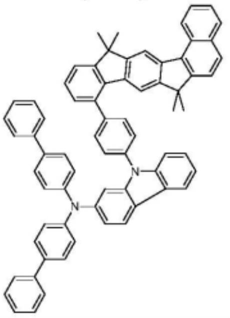
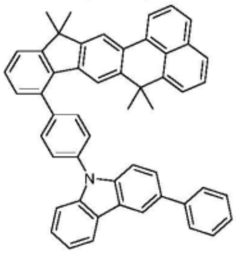
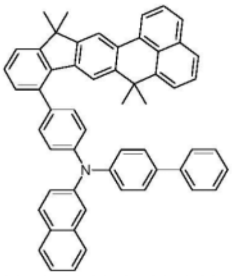
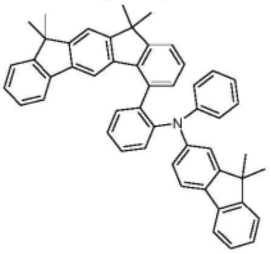
(106) 	(107) 	(108) 
(109) 	(110) 	(111) 
(112) 	(113) 	(114) 
(115) 	(116) 	(117) 
(118) 	(119) 	(120) 

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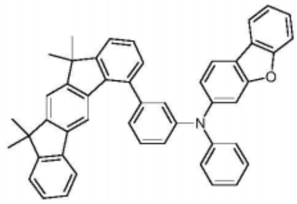
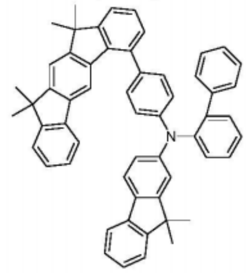
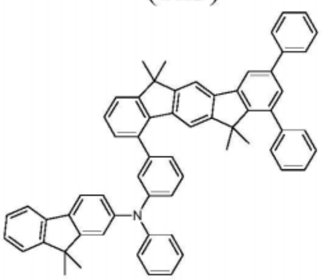
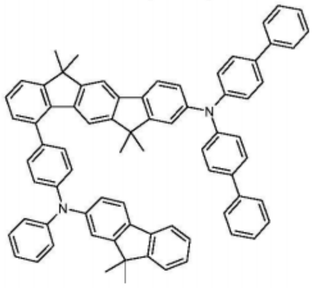
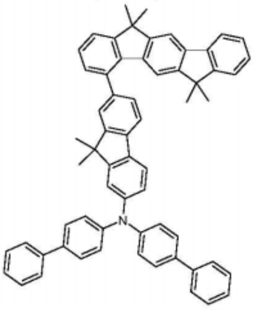
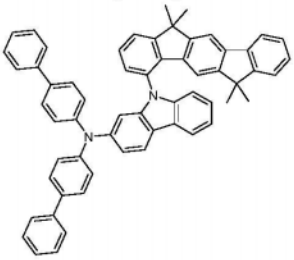
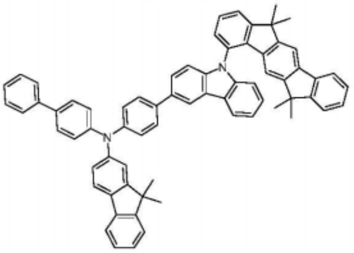
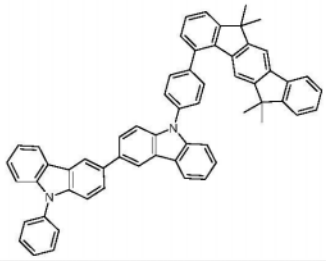
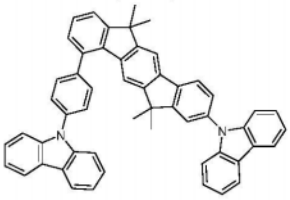
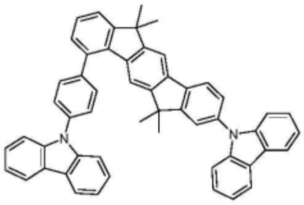
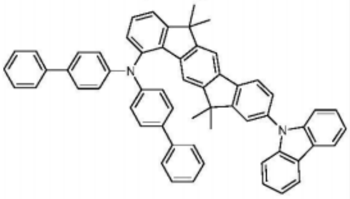
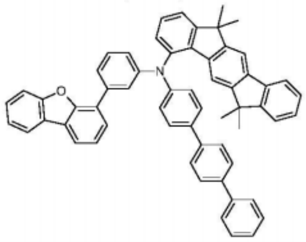
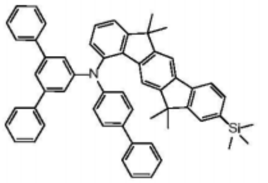
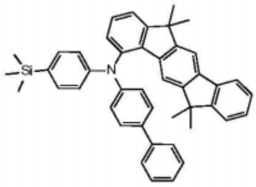
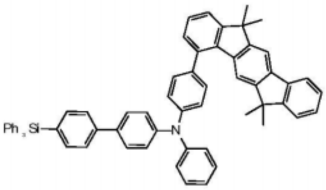
(121) 	(122) 	(123) 
(124) 	(125) 	(126) 
(127) 	(128) 	(129) 
(130) 	(131) 	(132) 
(133) 	(134) 	(135) 

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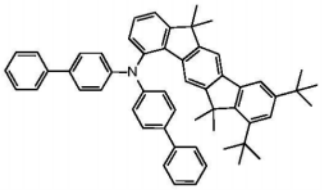
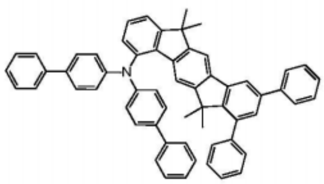
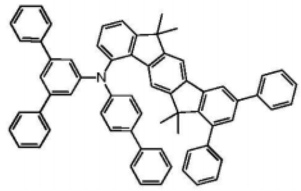
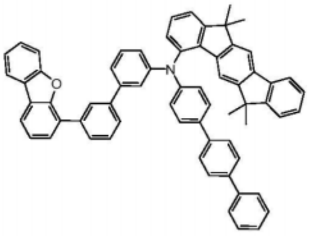
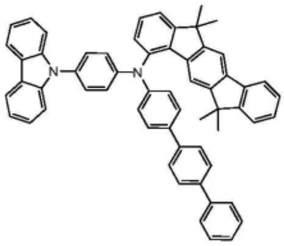
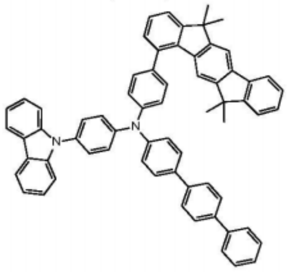
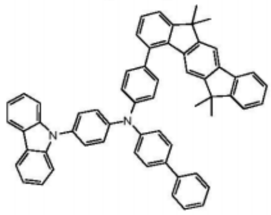
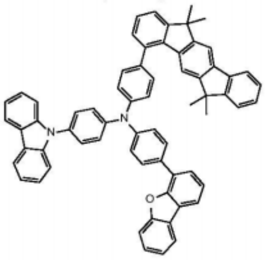
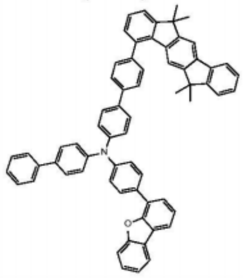
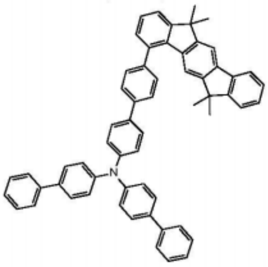
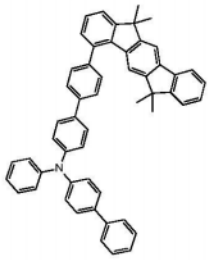
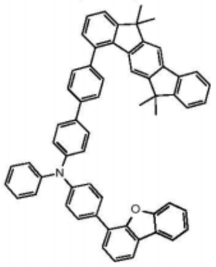
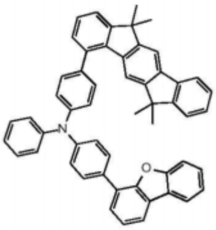
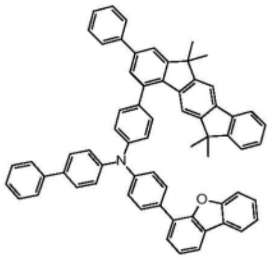
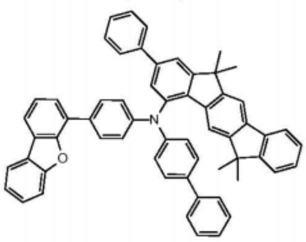
(136) 	(137) 	(138) 
(139) 	(140) 	(141) 
(142) 	(143) 	(144) 
(145) 	(146) 	(147) 
(148) 	(149) 	(150) 

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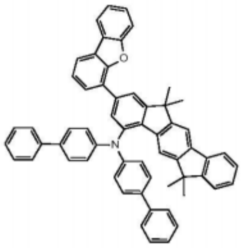
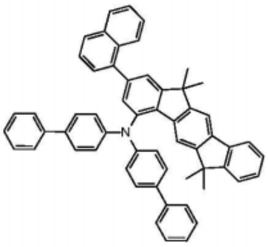
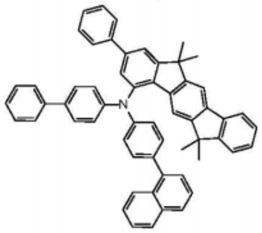
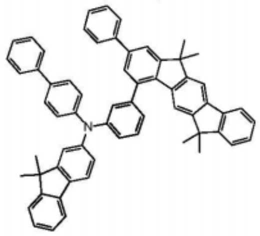
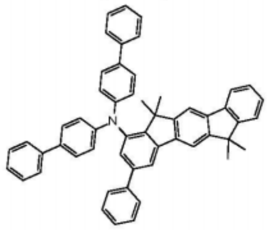
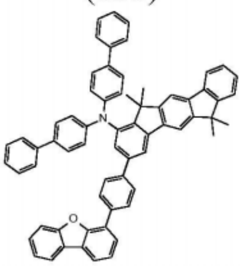
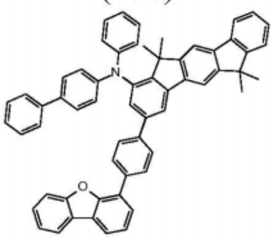
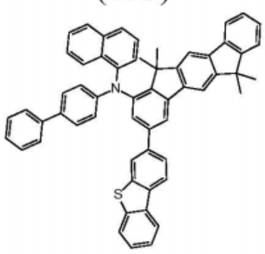
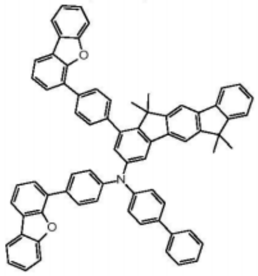
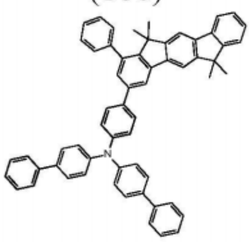
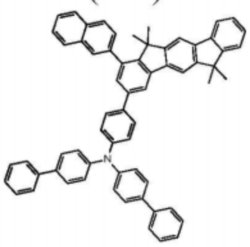
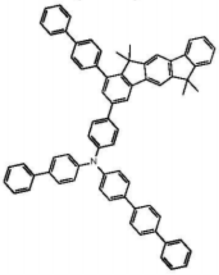
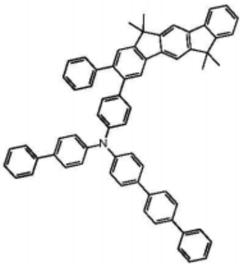
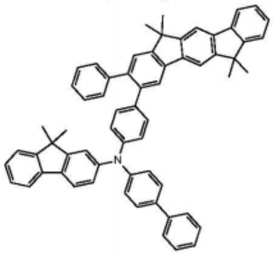
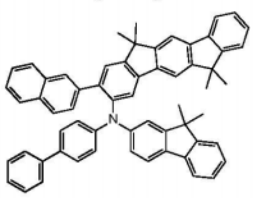
(151) 	(152) 	(153) 
(154) 	(155) 	(156) 
(157) 	(158) 	(159) 
(160) 	(161) 	(162) 
(163) 	(164) 	(165) 

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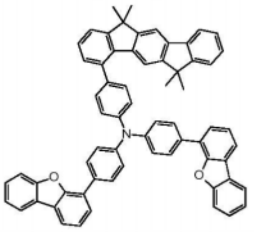
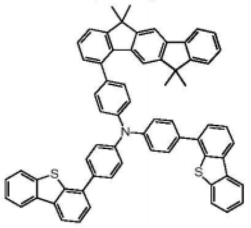
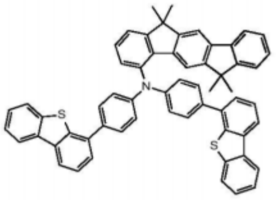
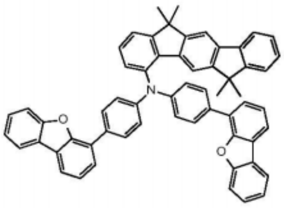
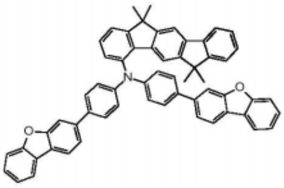
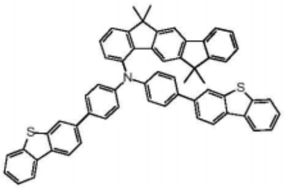
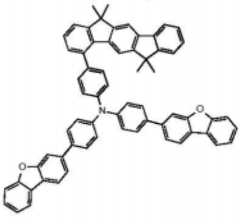
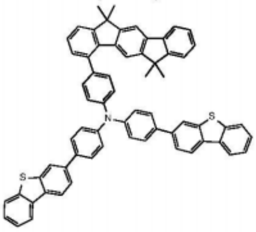
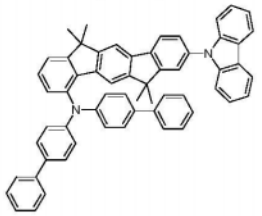
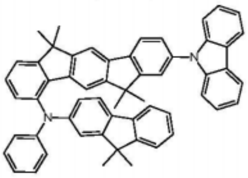
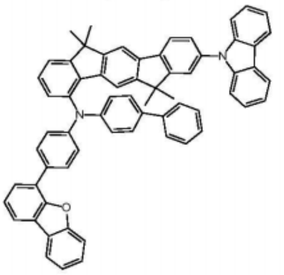
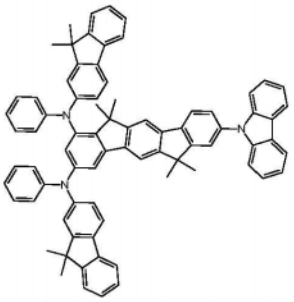
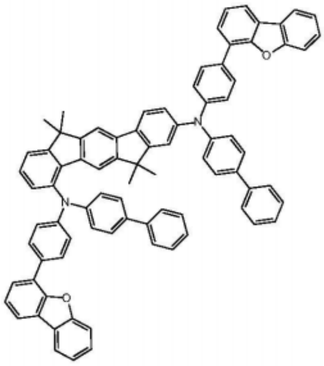
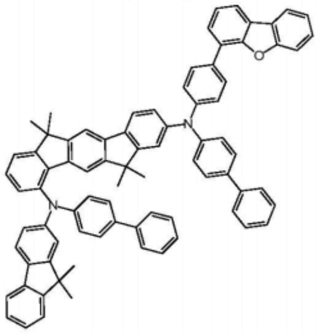
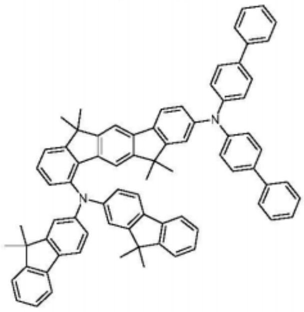
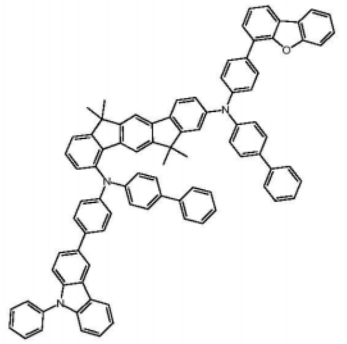
(166) 	(167) 	(168) 
(169) 	(170) 	(171) 
(172) 	(173) 	(174) 
(175) 	(176) 	(177) 
(178) 	(179) 	(180) 

[0181]

(181)



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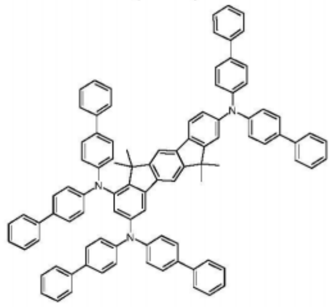

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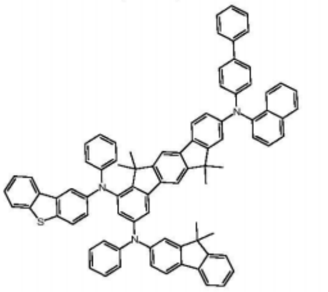


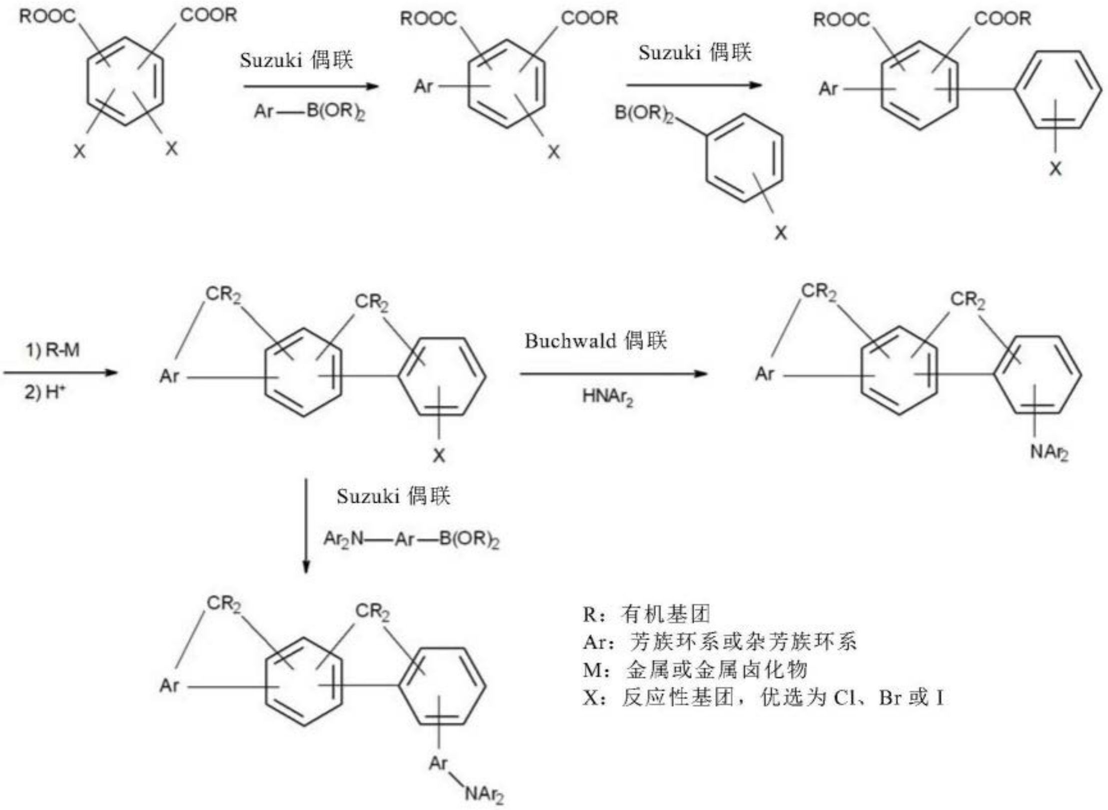
[0182] 式(I)化合物可以通过已知的有机反应，尤其是通过Suzuki反应、Hartwig-Buchwald反应和环化反应制备。

[0183] 在一个优选的方法(方案1)中，由具有两个反应性X基团和两个羧酸酯基的苯化合物，经由两个连续的Suzuki偶联，来制备具有三个芳基(Ar基团和两个苯基)链的化合物，其中末端苯基具有反应性X基团。反应性X基团在与中心苯基连接的键的邻位或间位，或者在反应中的苯基硼酸化合物在硼酸基的邻位或间位。

[0184] 随后，该化合物的羧酸酯基通过与金属烷基化合物，优选烷基锂化合物或格氏(Grignard)烷基化合物反应而转化为叔烷氧基。这些叔烷氧基在酸的作用下环化形成环。最后，经由Buchwald偶联引入氨基，或通过Suzuki反应引入二芳基氨基芳基或二芳基氨基杂芳基，从而获得式(I)化合物。

[0185] 方案1

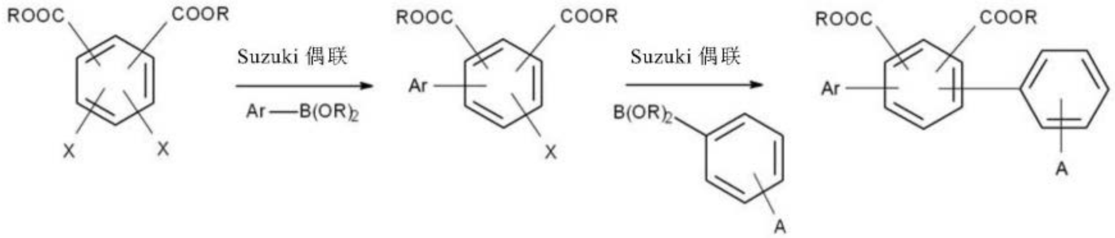
[0186]



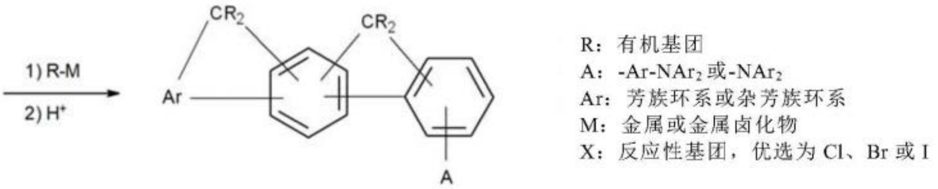
[0187] 在方案1的反应途径的修改(方案2)中，在一个Suzuki偶联中，引入了具有选自-Ar-NAr$_2$和-NAr$_2$基团的A基团而不是反应性X基团的苯基。所讨论的A基团，如方案1中的X基

团,在硼酸基的邻位或间位。在此合成路线中,不需要方案1的最后一步中发生的Suzuki或Buchwald偶联。

[0188]　方案2



[0189]



[0190]　因此,本申请还提供了一种用于制备式(I)化合物的方法,其特征在于带有两个羧酸酯基、芳族或杂芳族环系和反应性基团的苯化合物在Suzuki反应中与含有硼酸基和选自反应性基团、二芳基氨基、二芳基氨基芳基和二芳基氨基杂芳基的基团的苯化合物反应。此处硼酸基和选自反应性基团、二芳基氨基、二芳基氨基芳基和二芳基氨基杂芳基的基团在苯环上彼此处于邻位或间位。

[0191]　此处的反应性基团优选选自Cl、Br、I、三氟甲磺酸酯、甲磺酸酯和甲苯磺酸酯。

[0192]　上述式(I)化合物,尤其是被反应性离去基(诸如溴、碘、氯、硼酸或硼酸酯)取代的化合物,可以用作制备相应的低聚物、树枝状大分子或聚合物的单体。合适的反应性离去基是例如溴、碘、氯、硼酸、硼酸酯、胺、具有末端C-C双键或C-C三键的烯基或炔基、氧杂环丙烷、氧杂环丁烷、进入环加成(例如1,3-偶极环加成)的基团(例如二烯或叠氮化物)、羧酸衍生物、醇和硅烷。

[0193]　因此,本发明还提供了含有一种或多种式(I)化合物的低聚物、聚合物或树枝状大分子,其中一个或多个与聚合物、低聚物或树枝状大分子连接的键可以位于式(I)中被R^1、R^2、R^3、R^4或R^5取代的任何所需位置处。根据式(I)化合物的键联,该化合物是低聚物或聚合物的侧链的一部分或主链的一部分。在本发明的上下文中,低聚物应理解为是指由至少三个单体单元形成的化合物。在本发明的上下文中,聚合物应理解为是指由至少十个单体单元形成的化合物。本发明的聚合物、低聚物或树枝状大分子可以是共轭的、部分共轭的或非共轭的。本发明的低聚物或聚合物可以是线性的、支化的或树枝状的。在具有线性连接的结构中,式(I)的单元可以直接彼此连接,或者它们可以经由二价基团,例如经由取代或未取代的烷亚基、经由杂原子或经由二价芳族或杂芳族基团彼此连接。在支化和树枝状结构中,例如,三个或更多个式(I)单元可以经由三价或更高价的基团,例如经由三价或更高价的芳族或杂芳族基团连接,得到支化或树枝状的低聚物或聚合物。

[0194]　对于低聚物、树枝状大分子和聚合物中的式(I)的重复单元,适用与上述对式(I)化合物相同的优选方式。

[0195]　为了制备低聚物或聚合物,使本发明的单体均聚或与其它单体共聚。合适的和优选的共聚单体选自芴(例如根据EP 842208或WO 2000/22026)、螺二芴(例如根据EP

707020、EP 894107或WO 2006/061181)、对苯亚基(例如根据WO 1992/18552)、咔唑(例如根据WO 2004/070772或WO 2004/113468)、噻吩(例如根据EP 1028136)、二氢菲(例如根据WO 2005/014689或WO 2007/006383)、顺式和反式茚并芴(例如根据WO 2004/041901或WO 2004/113412)、酮(例如根据WO 2005/040302)、菲(例如根据WO 2005/104264或WO 2007/017066)或多种这些单元。聚合物、低聚物和树枝状大分子通常还含有其它单元,例如发光(荧光或磷光)单元,例如乙烯基三芳基胺(例如根据WO 2007/068325)或磷光金属络合物(例如根据WO 2006/003000),和/或电荷传输单元,尤其是基于三芳基胺的那些。

[0196] 本发明的聚合物和低聚物通常通过一种或多种单体类型的聚合来制备,其中至少一种单体导致聚合物中式(I)的重复单元。合适的聚合反应是本领域技术人员已知的,并且在文献中有所描述。导致形成C-C或C-N键的特别合适和优选的聚合反应是Suzuki聚合、Yamamoto聚合、Stille聚合和Hartwig-Buchwald聚合。

[0197] 为了从液相例如通过旋涂或通过印刷方法加工本发明的化合物,需要本发明的化合物的制剂。这些制剂可以是例如溶液、分散液或乳液。为此,可优选使用两种或更多种溶剂的混合物。合适的和优选的溶剂是例如甲苯、苯甲醚、邻、间或对二甲苯、苯甲酸甲酯、均三甲苯、四氢萘、藜芦醚、THF、甲基-THF、THP、氯苯、二噁烷、苯氧基甲苯(尤其是3-苯氧基甲苯)、(-)-葑酮、1,2,3,5-四甲基苯、1,2,4,5-四甲基苯、1-甲基萘、2-甲基苯并噻唑、2-苯氧基乙醇、2-吡咯烷酮、3-甲基苯甲醚、4-甲基苯甲醚、3,4-二甲基苯甲醚、3,5-二甲基苯甲醚、苯乙酮、α-松油醇、苯并噻唑、苯甲酸丁酯、异丙苯、环己醇、环己酮、环己基苯、十氢萘、十二烷基苯、苯甲酸乙酯、茚满、苯甲酸甲酯、NMP、对伞花烃、苯乙醚、1,4-二异丙基苯、二苄基醚、二乙二醇丁基甲基醚、三乙二醇丁基甲基醚、二乙二醇二丁醚、三乙二醇二甲醚、二乙二醇单丁醚、三丙二醇二甲醚、四乙二醇二甲醚、2-异丙基萘、戊基苯、己基苯、庚基苯、辛基苯、1,1-双(3,4-二甲基苯基)乙烷或这些溶剂的混合物。

[0198] 因此,本发明还提供一种制剂,尤其是溶液、分散液或乳液,其包含至少一种式(I)化合物和至少一种溶剂,优选有机溶剂。可以制备这种溶液的方式是本领域技术人员已知的,并且例如在WO 2002/072714、WO 2003/019694和其中引用的文献中进行了描述。

[0199] 本发明的化合物适用于电子器件,尤其是有机电致发光器件(OLED)。取决于取代,化合物用于不同的功能和层。

[0200] 因此,本发明还提供了式(I)化合物在电子器件中的用途。这种电子器件优选选自有机集成电路(OIC)、有机场效应晶体管(OFET)、有机薄膜晶体管(OTFT)、有机发光晶体管(OLET)、有机太阳能电池(OSC)、有机光学检测器、有机感光器、有机场猝熄器件(OFQD)、有机发光电化学电池(OLEC)、有机激光二极管(O-激光),更优选有机电致发光器件(OLED)。

[0201] 如上所述,本发明还提供了一种电子器件,其包含至少一种式(I)化合物。这种电子器件优选选自上述器件。

[0202] 所述电子器件更优选是包含阳极、阴极和至少一个发光层的有机电致发光器件(OLED),其特征在于至少一个可以是发光层、空穴传输层或另一个层的有机层包含至少一种式(I)化合物。

[0203] 除了阴极、阳极和发光层之外,有机电致发光器件还可以包含其它层。这些在每种情况下例如选自一个或多个空穴注入层、空穴传输层、空穴阻挡层、电子传输层、电子注入层、电子阻挡层、激子阻挡层、中间层、电荷产生层(IDMC 2003,中国台湾;Session 21OLED

(5),T.Matsumoto,T.Nakada,J.Endo,K.Mori,N.Kawamura,A.Yokoi,J.Kido,Multiphoton Organic EL Device Having Charge Generation Layer)和/或有机或无机p/n结。

[0204] 包含式(I)化合物的有机电致发光器件的层的顺序优选如下:

[0205] 阳极-空穴注入层-空穴传输层-任选地另外的空穴传输层-任选地电子阻挡层-发光层-任选地空穴阻挡层-电子传输层-电子注入层-阴极。另外可以在OLED中存在其它层。

[0206] 本发明的有机电致发光器件可以含有两个或更多个发光层。更优选地,在这种情况下,这些发光层总共具有多个在380nm与750nm之间的发光峰值,使得总体结果是白色发光;换句话说,在发光层中使用了可以发荧光或发磷光并且发出蓝色、绿色、黄色、橙色或红色光的多种发光化合物。尤其优选的是三层体系,即具有三个发光层的体系,其中三个层显示蓝色、绿色和橙色或红色发光(关于基本构造,参见例如WO 2005/011013)。本发明化合物在此优选存在于空穴传输层、空穴注入层、电子阻挡层和/或发光层中,更优选存在于发光层中作为基质材料和/或存在于电子阻挡层中。

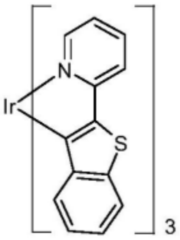
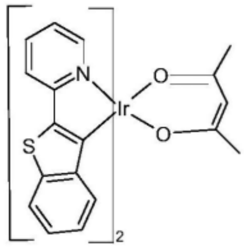
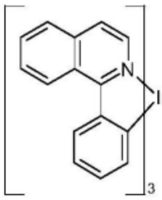
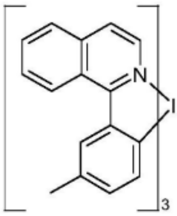
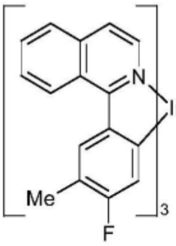
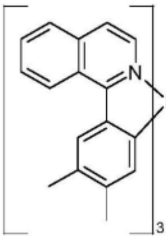
[0207] 根据本发明,优选将式(I)化合物用于包含一种或多种磷光发光化合物的电子器件中。在这种情况下,化合物可以存在于不同的层中,优选存在于空穴传输层、电子阻挡层、空穴注入层和/或发光层中。更优选地,其存在于电子阻挡层中或与磷光发光化合物组合存在于发光层中。在后一种情况下,磷光发光化合物优选选自发射红色或绿色磷光的化合物。其最优选存在于电子阻挡层中。

[0208] 术语“磷光发光化合物”通常包括其中通过自旋禁阻跃迁实现光发光的化合物,所述自旋禁阻跃迁例如是从激发的三重态或具有更高自旋量子数的状态(例如五重态)的跃迁。

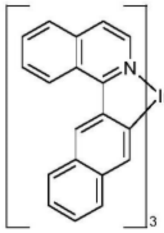
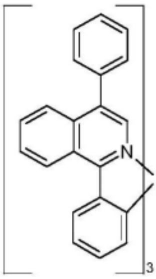
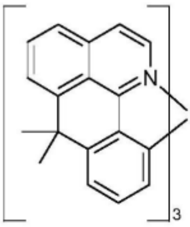
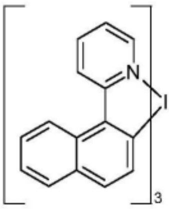
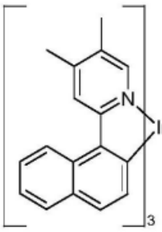
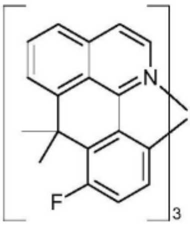
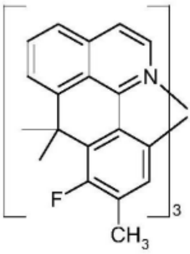
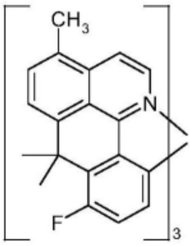
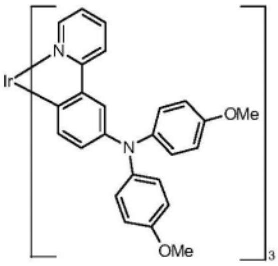
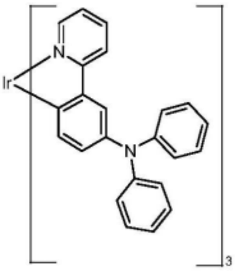
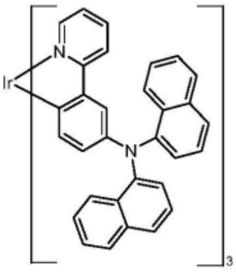
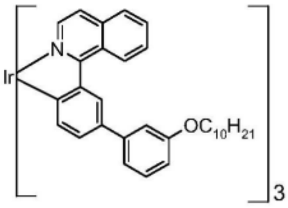
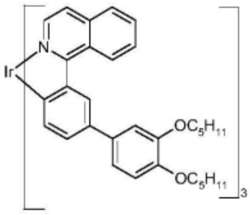
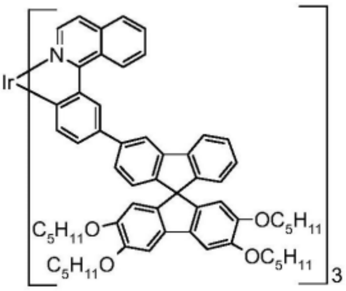
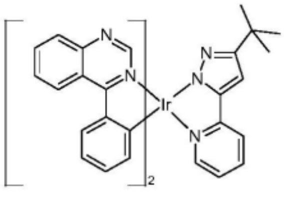
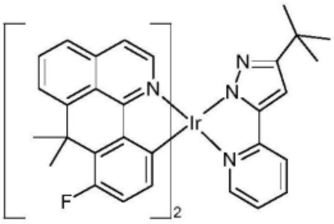
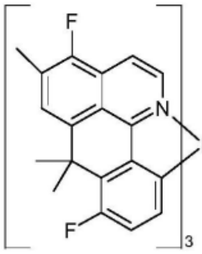
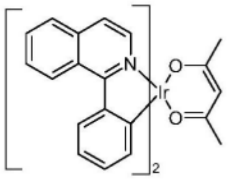
[0209] 合适的磷光发光化合物(=三重态发光体)尤其是这样的化合物,其在适当激发时优选在可见光区发光,并且还含有至少一个原子序数大于20,优选大于38且小于84,更优选大于56且小于80的原子。优选使用含有铜、钼、钨、铼、钌、锇、铑、铱、钯、铂、银、金或铕的化合物,尤其是含有铱、铂或铜的化合物,作为磷光发光化合物。在本发明的上下文中,所有发光的铱、铂或铜络合物被认为是磷光发光化合物。

[0210] 上述发光化合物的实例可以在申请WO 00/70655、WO 01/41512、WO 02/02714、WO 02/15645、EP 1191613、EP 1191612、EP 1191614、WO 05/033244、WO 05/019373和US2005/0258742中找到。通常,用于现有技术的磷光OLED以及有机电致发光器件领域的技术人员已知的所有磷光络合物都是合适的。对于本领域技术人员而言,也可以在不付出创造性劳动的情况下在有机电致发光器件中与式(I)化合物组合来使用其它磷光络合物。其它实例列于下表中:

[0211]

[0212]

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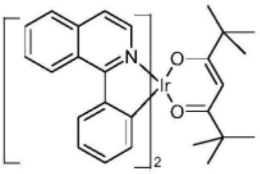	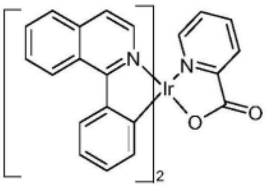	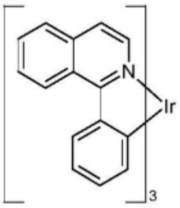
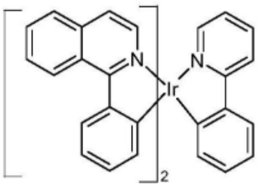	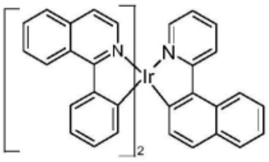	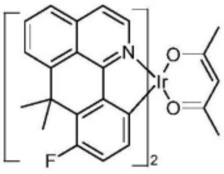
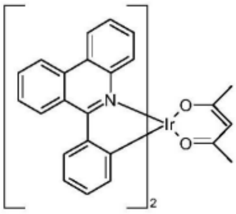	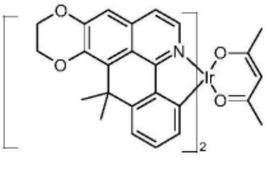	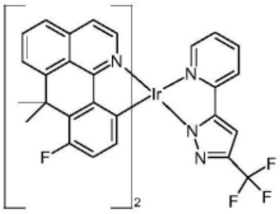
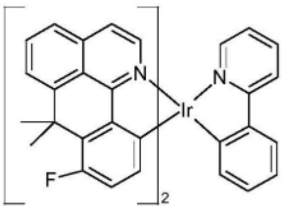	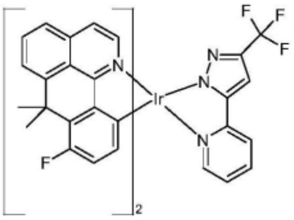	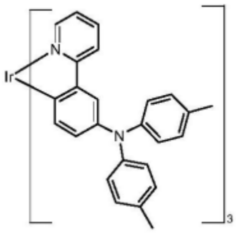
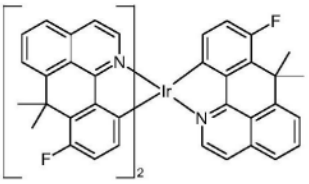	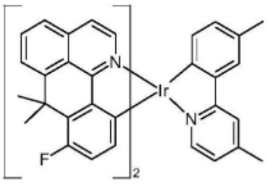	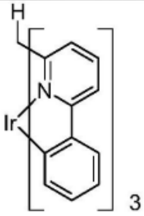
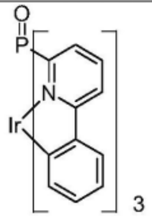	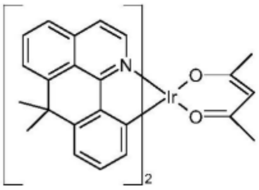	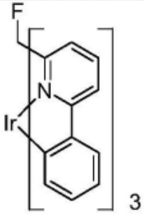
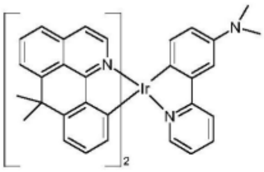	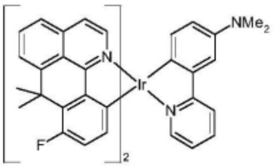	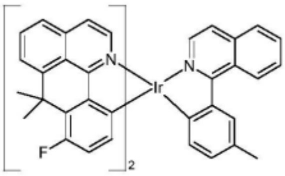
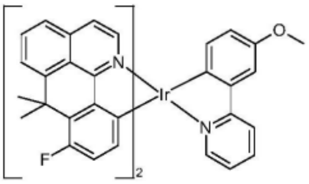	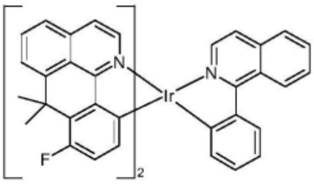	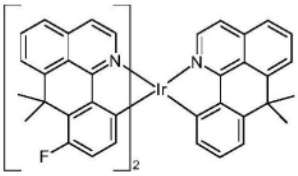

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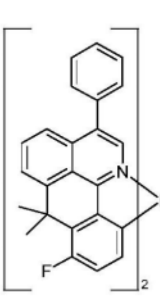	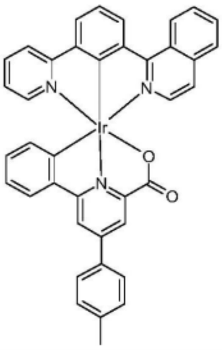	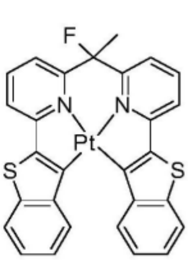
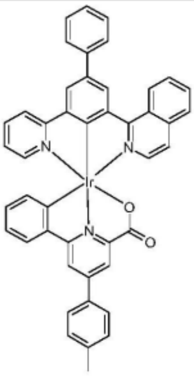	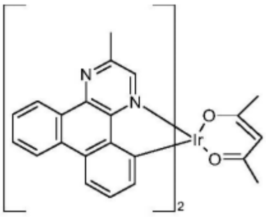	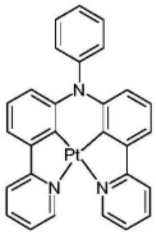
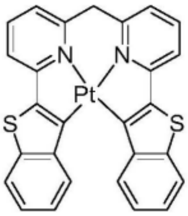	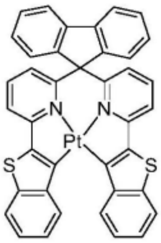	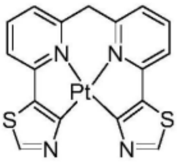
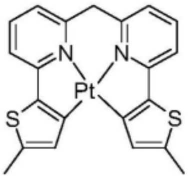	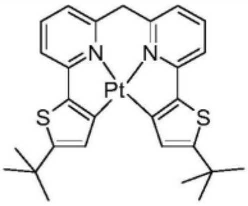	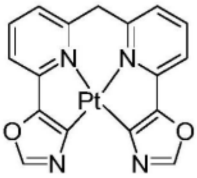
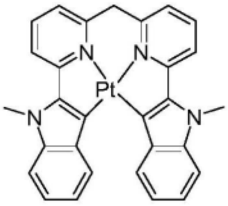	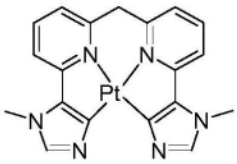	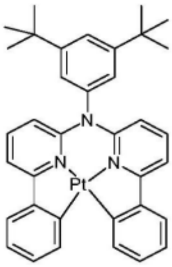
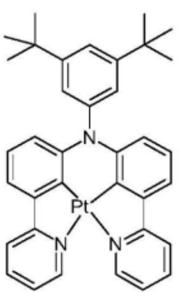	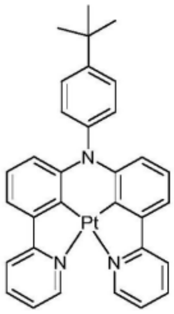	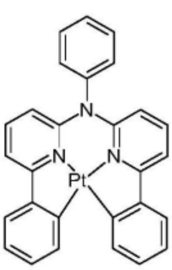

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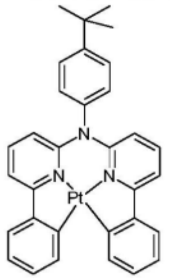	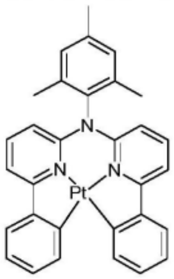	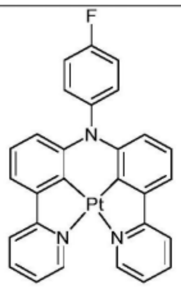
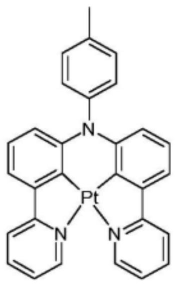	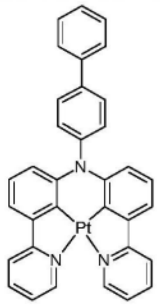	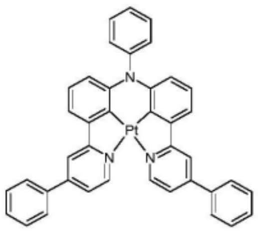
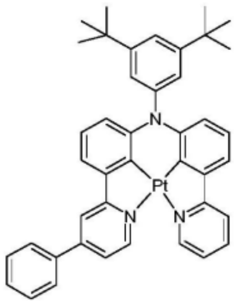	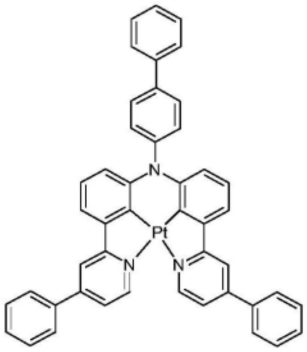	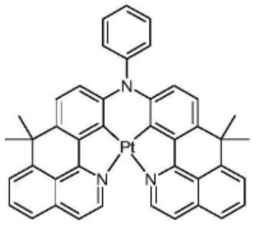
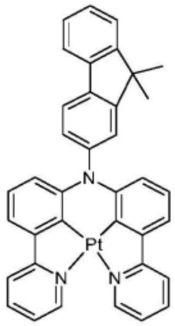	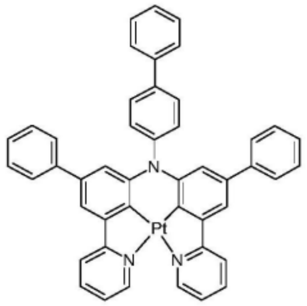	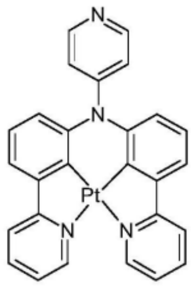
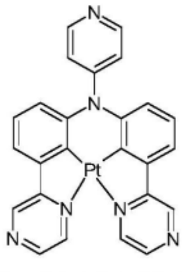	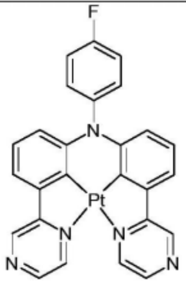	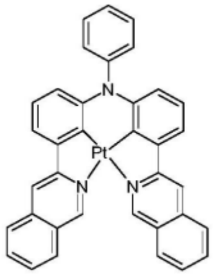
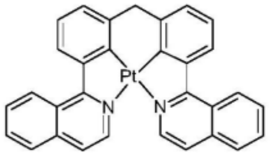	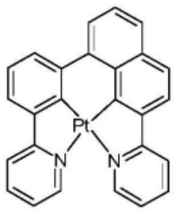	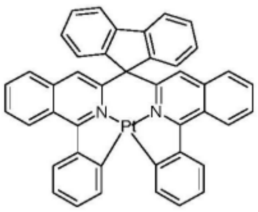

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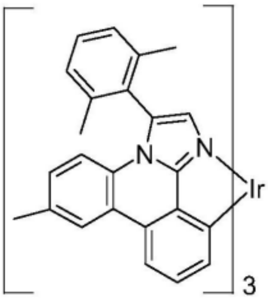	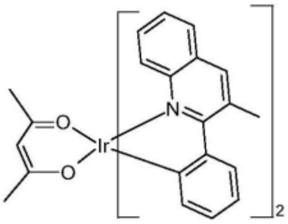	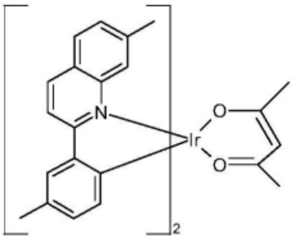
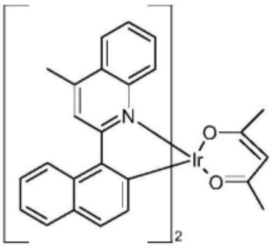	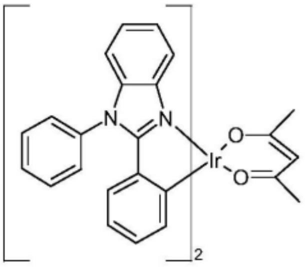	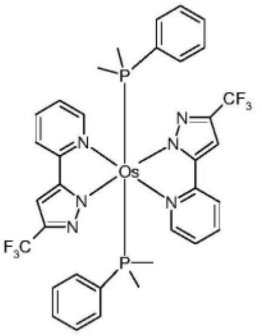
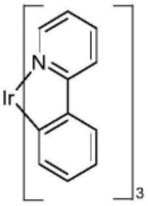	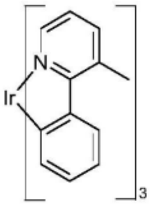	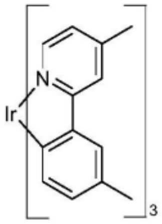
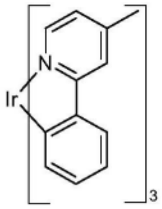	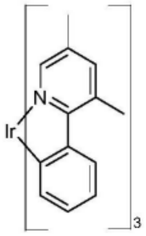	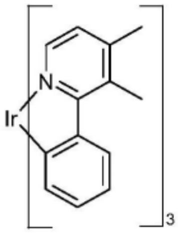
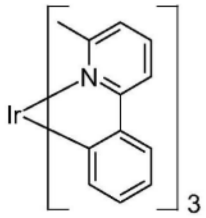	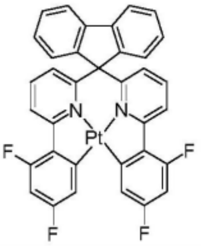	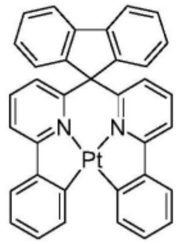
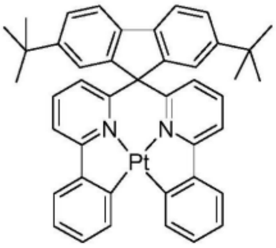	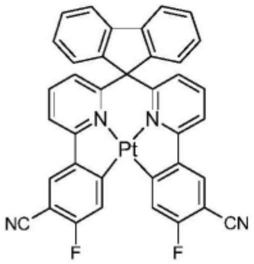	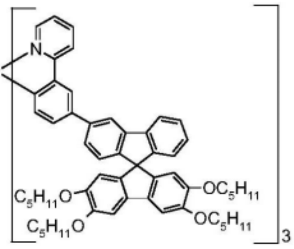

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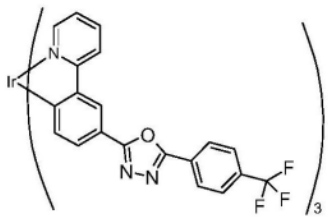	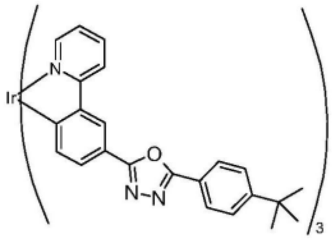	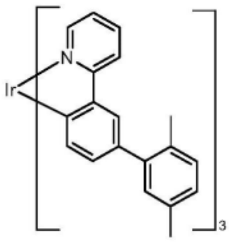
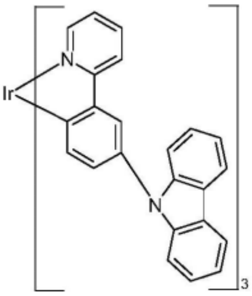	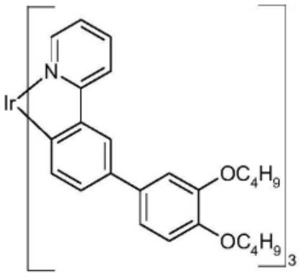	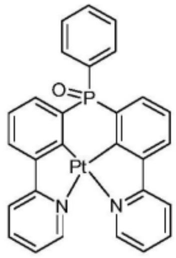
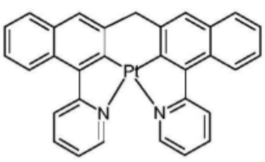	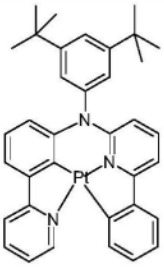	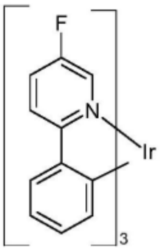
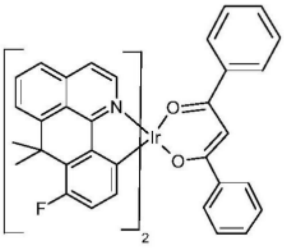	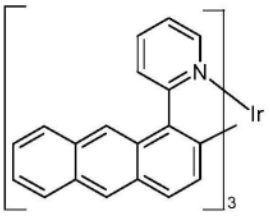	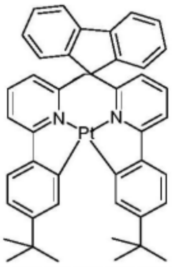
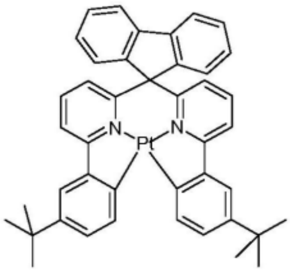	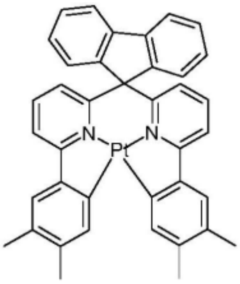	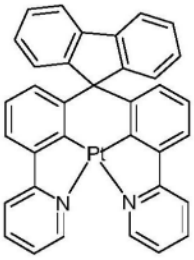
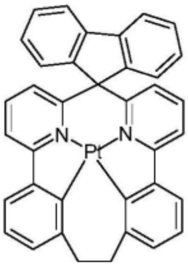	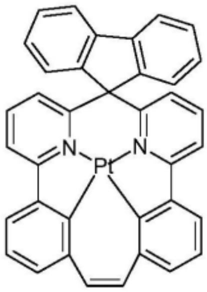	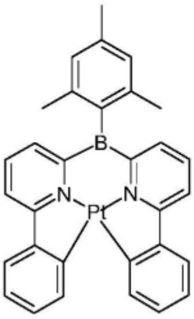

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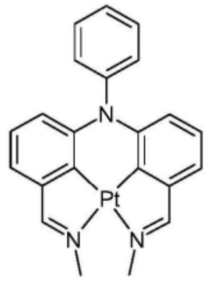	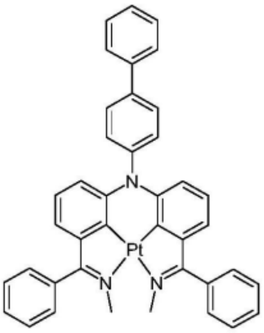	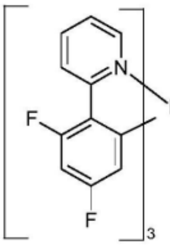
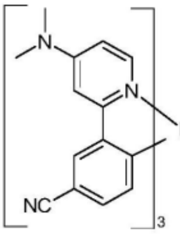	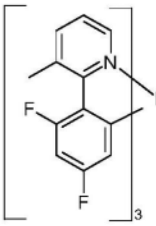	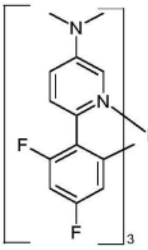
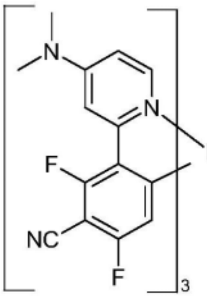	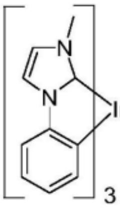	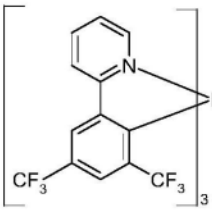
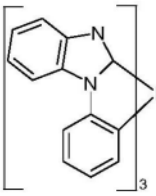	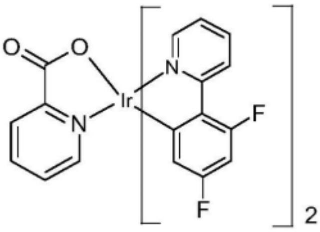	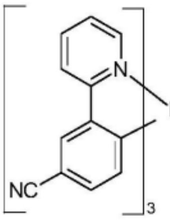
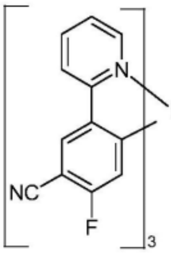	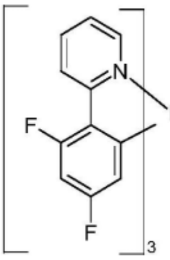	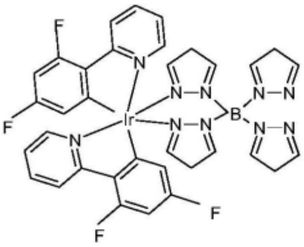
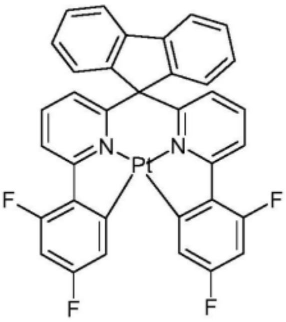	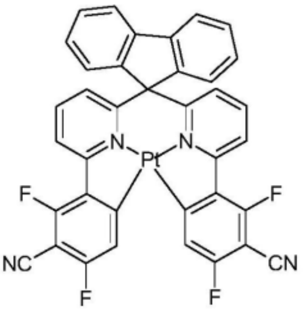	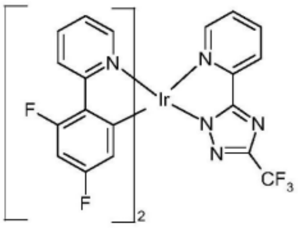

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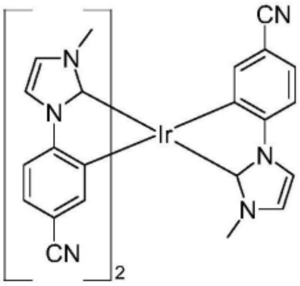	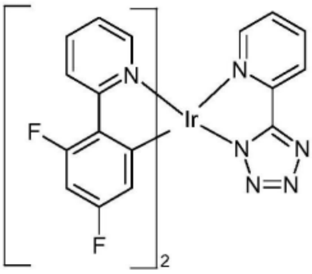	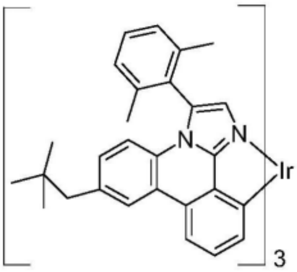
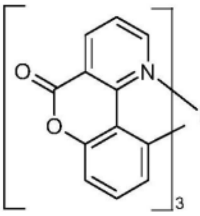	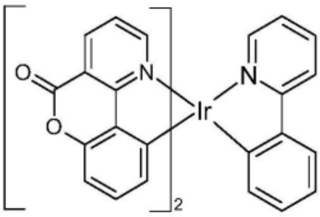	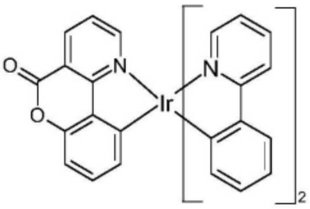
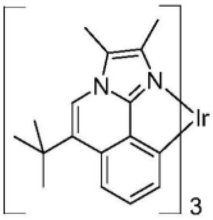	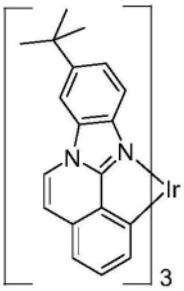	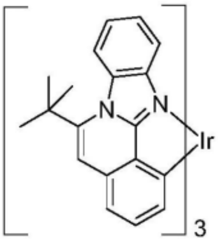
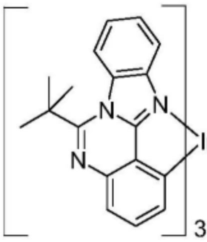	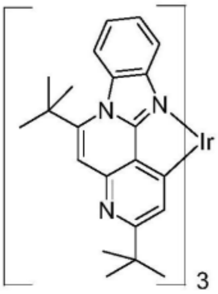	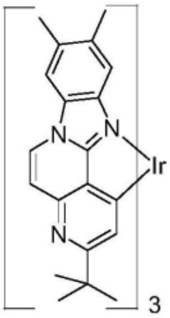
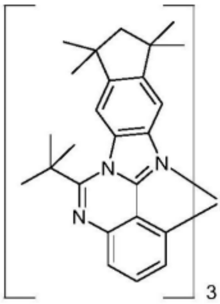	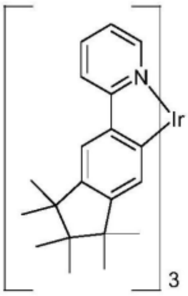	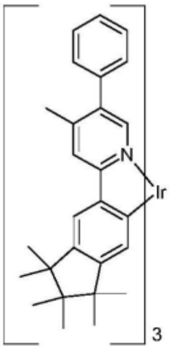

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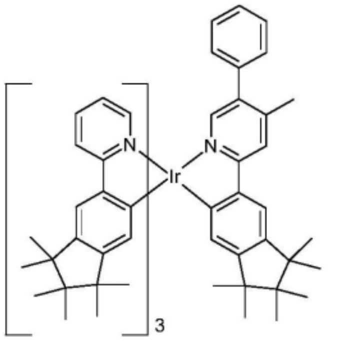
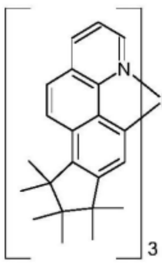
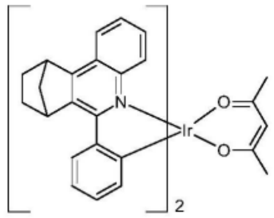
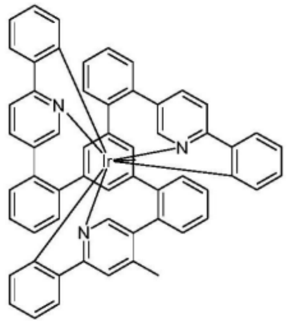
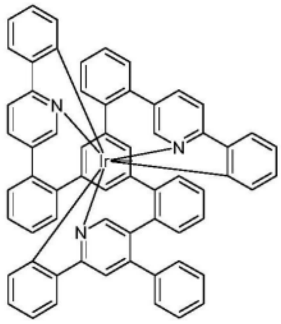
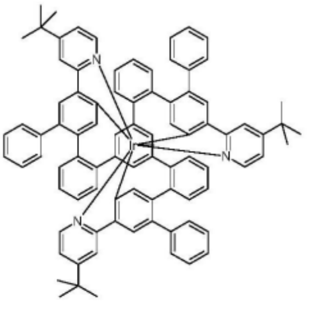
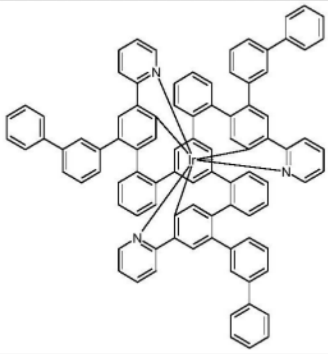
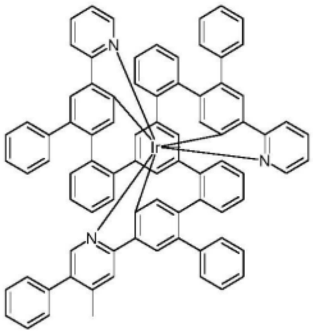
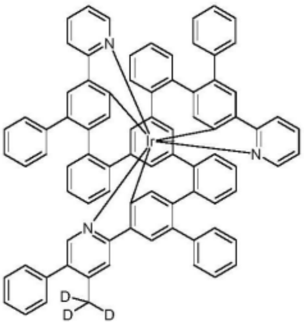
		
		
		

[0221] 在本发明的一个优选实施方式中，式(I)化合物用作空穴传输性材料。所述化合物则优选在空穴传输性层中。空穴传输性层的优选实施例是空穴传输层、电子阻挡层和空穴注入层。当式(I)化合物存在于空穴传输性层中时，则空穴传输性层优选是电子阻挡层。其优选在阳极侧直接邻接发光层。

[0222] 根据本申请的空穴传输层是在阳极与发光层之间的具有空穴传输功能的层。更具体地说，其是并不是空穴注入层也不是电子阻挡层的空穴传输性层。

[0223] 在本申请的上下文中，空穴注入层和电子阻挡层被理解为空穴传输性层的具体实施方式。在阳极与发光层之间有多个空穴传输性层的情况下，空穴注入层是直接邻接于阳极或仅由阳极的单个涂层与阳极隔开的空穴传输性层。在阳极与发光层之间有多个空穴传输性层的情况下，电子阻挡层是在阳极侧与发光层直接邻接的空穴传输性层。优选地，本发明的OLED在阳极与发光层之间包含两个、三个或四个空穴传输性层，其中至少一个空穴传输性层优选地含有式(I)化合物，并且更优选地，确切地一个或两个空穴传输性层含有式(I)化合物。

[0224] 如果式(I)化合物用作空穴传输层、空穴注入层或电子阻挡层中的空穴传输材料，那么所述化合物可以纯材料形式，即以100％的比例用于空穴传输层中，或者其可以与一种或多种其它化合物组合使用。在一个优选的实施方式中，包含式(I)化合物的有机层则另外

含有一种或多种p型掺杂剂。根据本发明使用的p型掺杂剂优选是那些能够氧化混合物中的一种或多种其它化合物的有机电子受体化合物。

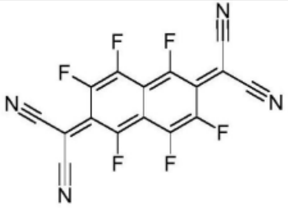
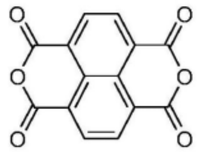
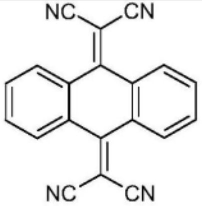
[0225] p型掺杂剂的特别优选的实施方式是在WO 2011/073149、EP 1968131、EP 2276085、EP 2213662、EP 1722602、EP 2045848、DE 102007031220、US 8044390、US 8057712、WO 2009/003455、WO 2010/094378、WO 2011/120709、US2010/0096600、WO 2012/095143和DE 102012209523中公开的化合物。

[0226] 特别优选的p型掺杂剂是醌二甲烷化合物、氮杂茚并芴二酮、氮杂萉、氮杂联三苯叉、I_2、金属卤化物(优选过渡金属卤化物)、金属氧化物(优选含有至少一种过渡金属或第3主族的金属的金属氧化物)和过渡金属络合物(优选Cu、Co、Ni、Pd和Pt与含有至少一个氧原子作为结合位点的配体的络合物)。还优选过渡金属氧化物,优选铼、钼和钨的氧化物,更优选Re_2O_7、MoO_3、WO_3和ReO_3,作为掺杂剂。

[0227] p型掺杂剂优选在p型掺杂层中基本上均匀分布。这可以例如通过p型掺杂剂和空穴传输材料基质的共蒸发来实现。

[0228] 优选的p型掺杂剂尤其是以下化合物:

[0229]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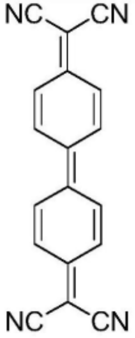	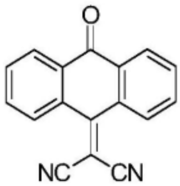	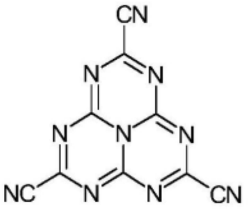
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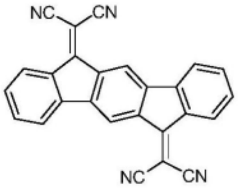
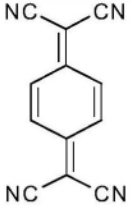
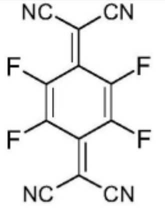
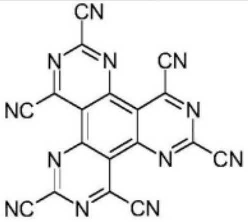
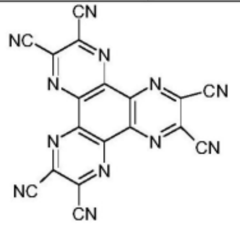
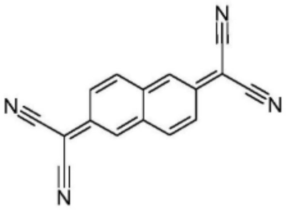
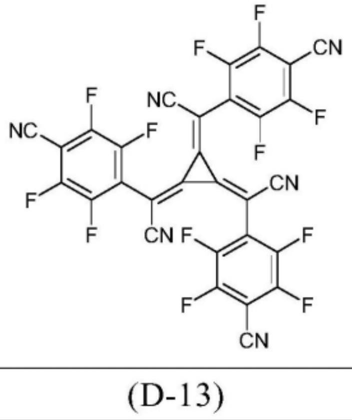
		
(D-7)	(D-8)	(D-9)
		
(D-10)	(D-11)	(D-12)
		
(D-13)		

[0230]　在本发明的另一个优选实施方式中，式(I)化合物与六氮杂联三苯叉衍生物一起在OLED中用作空穴传输材料，如US2007/0092755中所述的。在此特别优选在单独的层中使用六氮杂联三苯叉衍生物。

[0231]　在本发明的一个优选实施方式中，式(I)化合物在发光层中用作基质材料，与一种或多种发光化合物，优选磷光发光化合物组合。在此，磷光发光化合物优选选自红色磷光和

绿色磷光化合物。

[0232] 在这种情况下，基质材料在发光层中的比例是按体积计在50.0％与99.9％之间，优选按体积计在80.0％与99.5％之间，更优选按体积计在85.0％与97.0％之间。

[0233] 相应地，发光化合物的比例是按体积计在0.1％与50.0％之间，优选按体积计在0.5％与20.0％之间，更优选按体积计在3.0％与15.0％之间。

[0234] 有机电致发光器件的发光层还可以含有包含多种基质材料(混合基质体系)和/或多种发光化合物的体系。同样在这种情况下，发光化合物通常是在体系中份额较小的那些化合物，而基质材料是在体系中份额较大的那些化合物。然而，在个别情况下，体系中单一基质材料的比例可能小于单一发光化合物的比例。

[0235] 优选将式(I)化合物用作混合基质体系的组分，优选用于磷光发光体的混合基质体系的组分。混合基质体系优选包含两种或三种不同的基质材料，更优选两种不同的基质材料。优选地，在这种情况下，两种材料中的一种是具有空穴传输性质的材料，而另一种材料是具有电子传输性质的材料。式(I)化合物优选是具有空穴传输性质的基质材料。相应地，当将式(I)化合物用作OLED的发光层中的磷光发光体的基质材料时，具有电子传输性质的第二基质化合物存在于发光层中。两种不同的基质材料可以按1:50至1:1，优选1:20至1:1，更优选1:10至1:1，并且最优选1:4至1:1的比率存在。关于混合基质体系的更具体的细节尤其在申请WO 2010/108579中给出，该申请的相应技术教导在此被结合作为参考。

[0236] 然而，混合基质组分的所需电子传输和空穴传输性质也可以主要或完全组合在单个混合基质组分中，在这种情况下，其它混合基质组分还具有其它功能。

[0237] 混合基质体系可包含一种或多种发光化合物，优选一种或多种磷光发光化合物。通常，混合基质体系优选用于磷光有机电致发光器件中。

[0238] 可以与本发明化合物组合用作混合基质体系的基质组分的特别合适的基质材料选自以下针对磷光发光化合物指定的优选基质材料，并且其中尤其是选自具有电子传输性质的那些。

[0239] 在下文中列出了电子器件中不同功能材料的优选实施方式。

[0240] 优选的荧光发光化合物选自芳基胺类。在本发明的上下文中，芳基胺或芳族胺应理解为是指含有三个直接键合于氮的取代或未取代的芳族或杂芳族环系的化合物。优选地，这些芳族或杂芳族环系中的至少一个是稠合环系，更优选具有至少14个芳族环原子。这些的优选实例是芳族蒽胺、芳族蒽二胺、芳族芘胺、芳族芘二胺、芳族䓛胺或芳族䓛二胺。芳族蒽胺应理解为是指其中二芳基氨基直接键合到蒽基上，优选键合到蒽基的9位上的化合物。芳族蒽二胺应理解为是指其中两个二芳基氨基直接键合到蒽基上，优选键合到蒽基的9,10位上的化合物。芳族芘胺、芳族芘二胺、芳族䓛胺和芳族䓛二胺类似地定义，其中二芳基氨基优选在1位或1,6位键合到芘。其它优选的发光化合物是茚并芴胺或茚并芴二胺，例如根据WO 2006/108497或WO 2006/122630，苯并茚并芴胺或苯并茚并芴二胺，例如根据WO 2008/006449，和二苯并茚并芴胺或二苯并茚并芴二胺，例如根据WO2007/140847，以及WO 2010/012328中公开的具有稠合的芳基的茚并芴衍生物。同样优选的是WO 2012/048780和WO 2013/185871中公开的芘芳基胺。同样优选的是WO 2014/037077中公开的苯并茚并芴胺、WO 2014/106522中公开的苯并芴胺、WO 2014/111269和WO 2017/036574中公开的扩展的苯并茚并芴、WO 2017/028940和WO 2017/028941中公开的吩噁嗪以及WO 2016/150544中

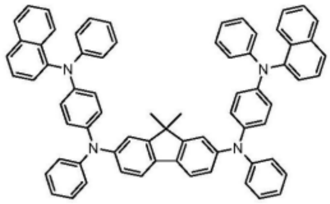
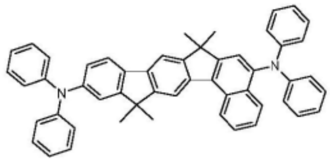
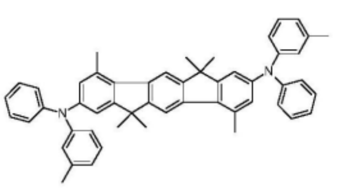
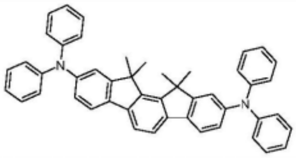
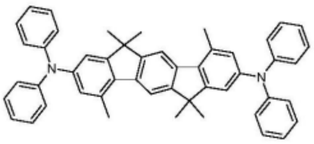
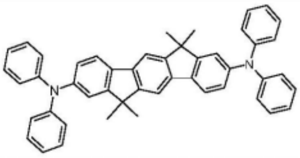
公开的键合至呋喃单元或噻吩单元的芴衍生物。

[0241] 优选用于荧光发光化合物的有用的基质材料,包括各种物质类别的材料。优选的基质材料选自低聚芳亚基的类别(例如根据EP 676461的2,2’,7,7’-四苯基螺二芴,或二萘基蒽),尤其是含有稠合芳族基团的低聚芳亚基、低聚芳亚基乙烯亚基(例如根据EP 676461的DPVBi或螺-DPVBi)、多足金属络合物(例如根据WO 2004/081017)、空穴传导化合物(例如根据WO 2004/058911)、电子传导化合物(尤其是酮、氧化膦、亚砜等)(例如根据WO 2005/084081和WO 2005/084082)、阻转异构体(例如根据WO 2006/048268)、硼酸衍生物(例如根据WO 2006/117052)或苯并蒽(例如根据WO 2008/145239)。特别优选的基质材料选自包含萘、蒽、苯并蒽和/或芘或这些化合物的阻转异构体的低聚芳亚基、低聚芳亚基乙烯亚基、酮、氧化膦和亚砜的类别。非常特别优选的基质材料选自包含蒽、苯并蒽、苯并菲和/或芘或这些化合物的阻转异构体的低聚芳亚基的类别。在本发明的上下文中,低聚芳亚基应理解为是指其中至少三个芳基或芳亚基彼此键合的化合物。还优选WO 2006/097208、WO 2006/131192、WO 2007/065550、WO 2007/110129、WO 2007/065678、WO 2008/145239、WO 2009/100925、WO 2011/054442和EP 1553154中公开的蒽衍生物,EP 1749809、EP 1905754和US 2012/0187826中公开的芘化合物,WO 2015/158409中公开的苯并蒽基蒽化合物,WO 2017/025165中公开的茚并苯并呋喃化合物,和WO 2017/036573中公开的菲基蒽。

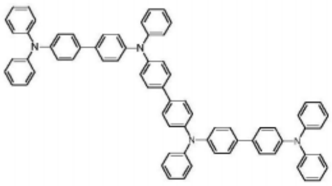
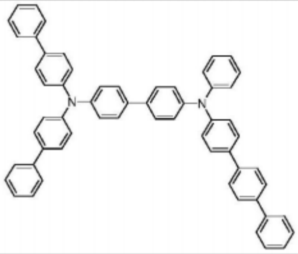
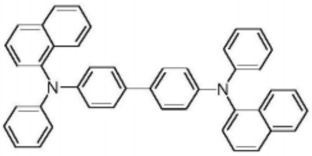
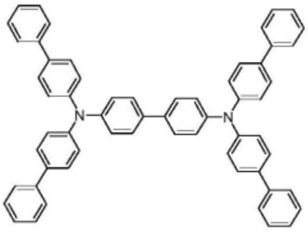
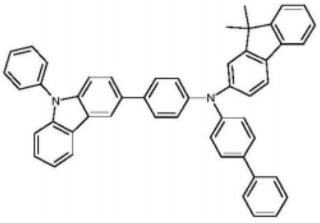
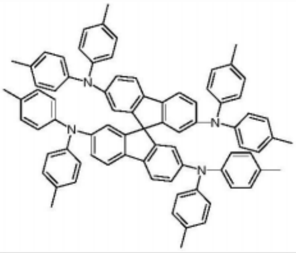
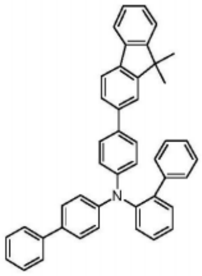
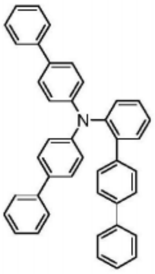
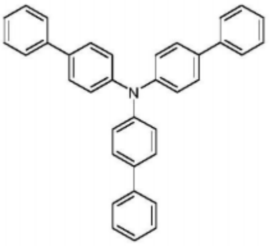
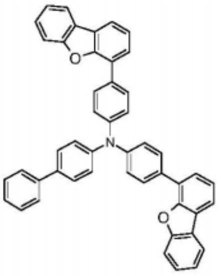
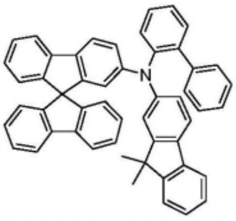
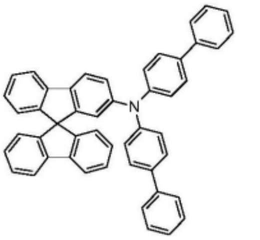
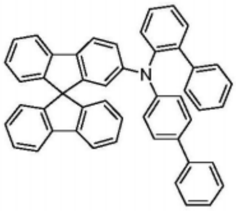
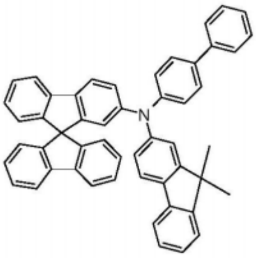
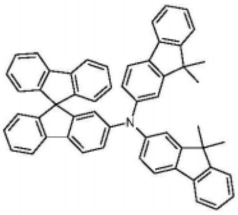
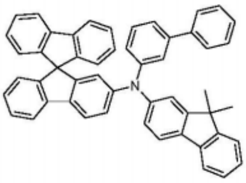
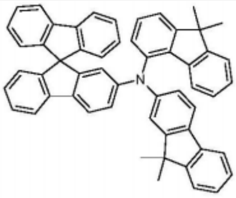
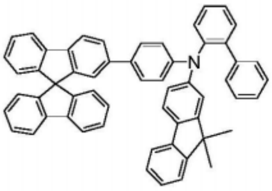
[0242] 除了式(I)化合物之外,磷光发光化合物的优选基质材料是芳族酮、芳族氧化膦或芳族亚砜或砜,例如根据WO 2004/013080、WO 2004/093207、WO 2006/005627或WO 2010/006680,三芳基胺,咔唑衍生物,例如CBP(N,N-双咔唑基联苯)或WO 2005/039246、US 2005/0069729、JP 2004/288381、EP 1205527或WO 2008/086851中公开的咔唑衍生物,吲哚并咔唑衍生物,例如根据WO 2007/063754或WO 2008/056746,茚并咔唑衍生物,例如根据WO 2010/136109、WO 2011/000455或WO 2013/041176,氮杂咔唑衍生物,例如根据EP 1617710、EP 1617711、EP 1731584、JP 2005/347160,双极性基质材料,例如根据WO 2007/137725,硅烷,例如根据WO 2005/111172,硼氮杂环戊熳或硼酸酯,例如根据WO 2006/117052,三嗪衍生物,例如根据WO 2010/015306、WO 2007/063754或WO 2008/056746,锌络合物,例如根据EP 652273或WO 2009/062578,硅二氮杂环戊熳或硅四氮杂环戊熳衍生物,例如根据WO 2010/054729,磷二氮杂环戊熳衍生物,例如根据WO 2010/054730,桥接咔唑衍生物,例如根据US 2009/0136779、WO 2010/050778、WO 2011/042107、WO 2011/088877或WO 2012/143080,联三苯叉衍生物,例如根据WO 2012/048781,或内酰胺,例如根据WO 2011/116865或WO 2011/137951。

[0243] 除了式(I)化合物之外,可用于本发明的电子器件的空穴注入或空穴传输层或电子阻挡层或电子传输层中的合适的电荷传输材料是例如Y.Shirota等人,Chem.Rev.2007,107(4),953-1010中公开的化合物或根据现有技术在这些层中使用的其它材料。空穴传输和空穴注入层的优选材料尤其选自以下材料:

[0244]

[0245]

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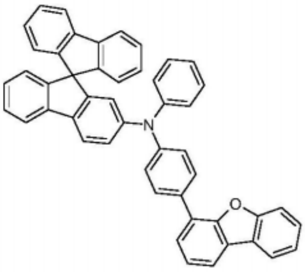	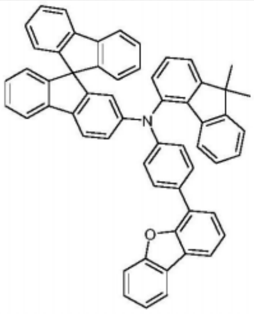	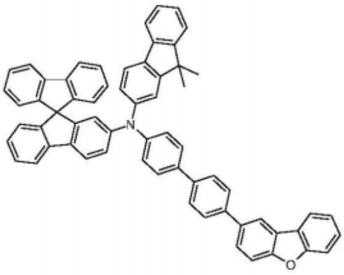
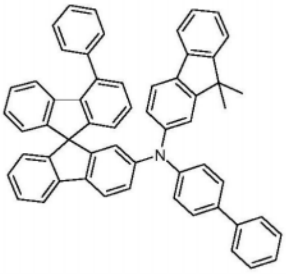	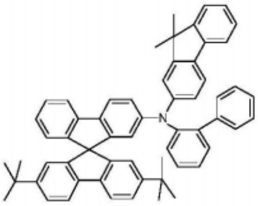	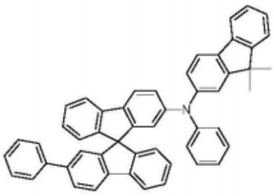
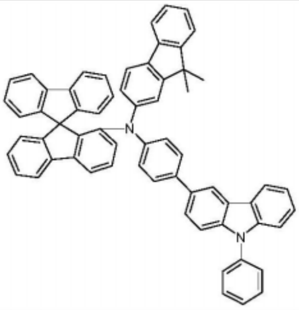	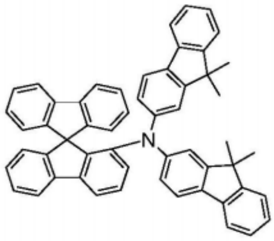	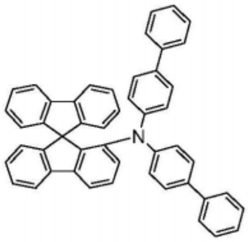
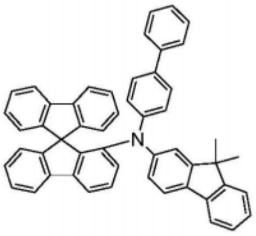	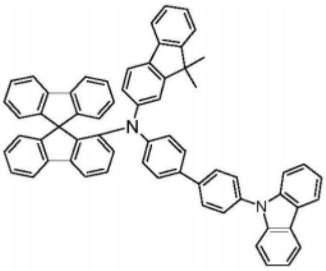	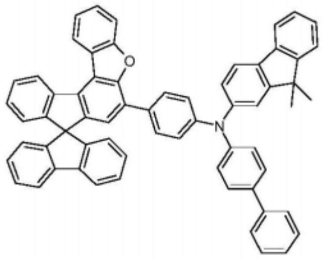
	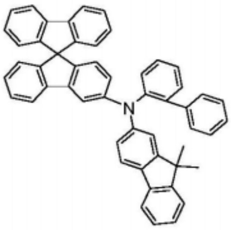	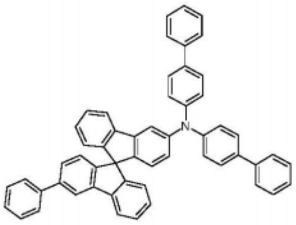
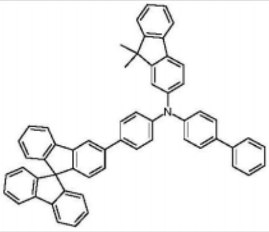	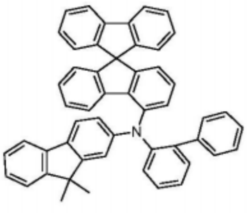	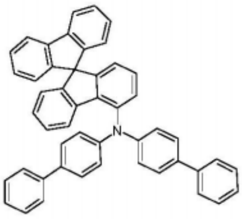

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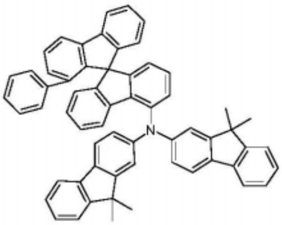
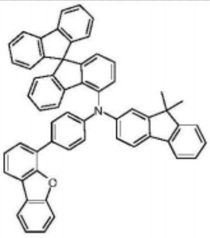
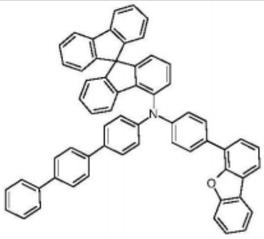
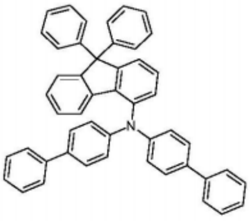
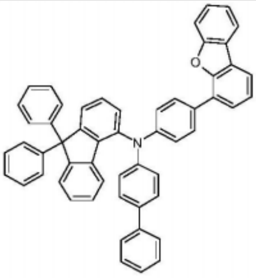
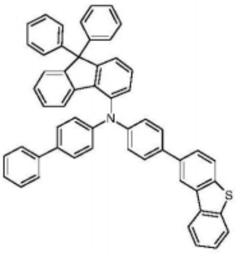
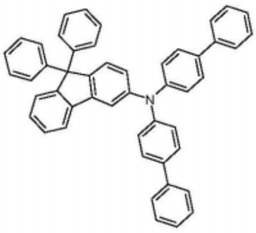
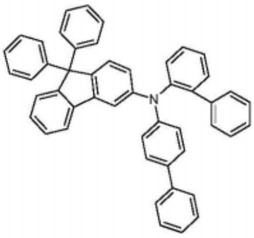
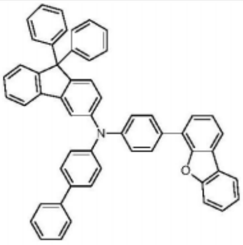
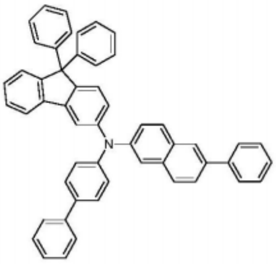
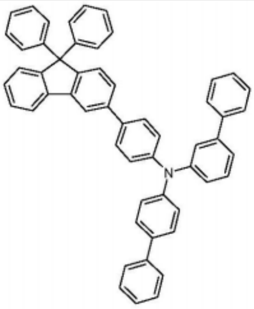
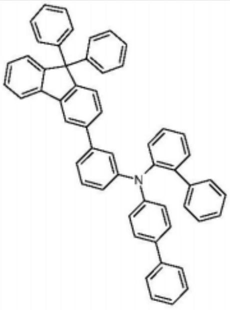
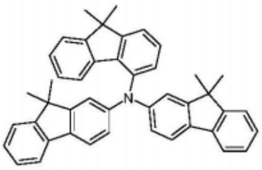
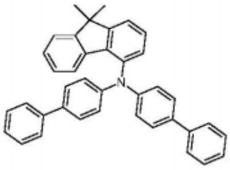
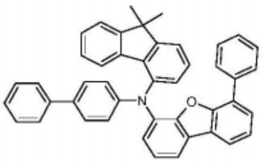
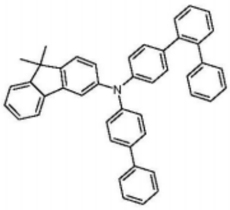
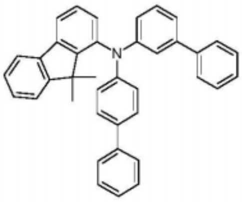
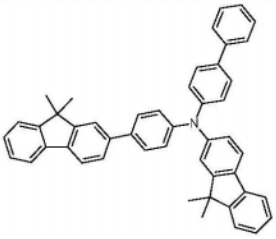
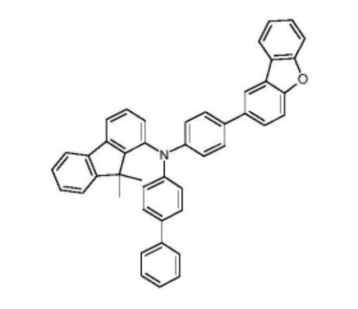
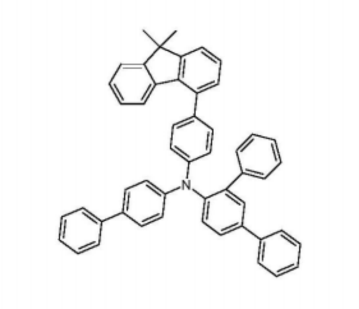
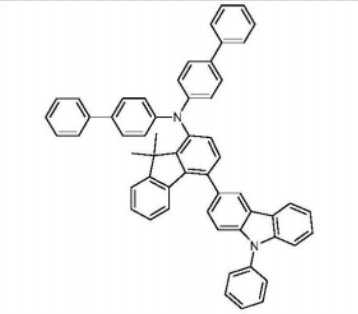
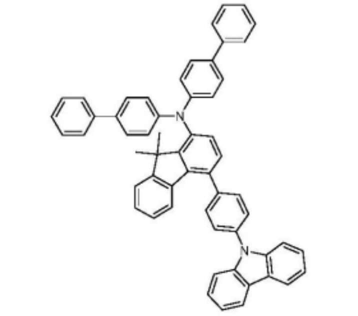
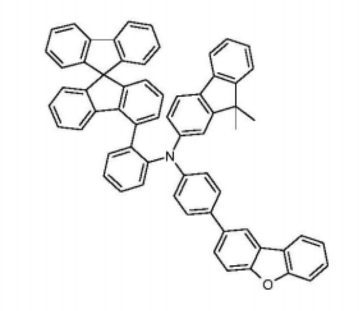
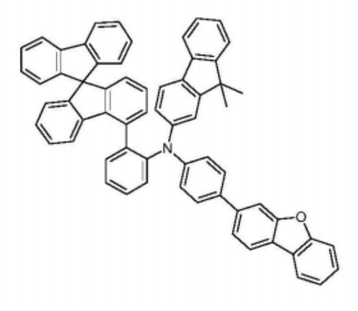
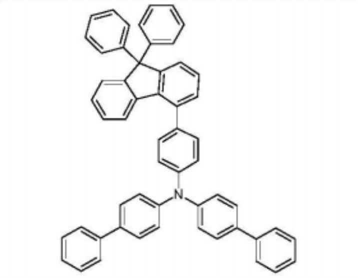
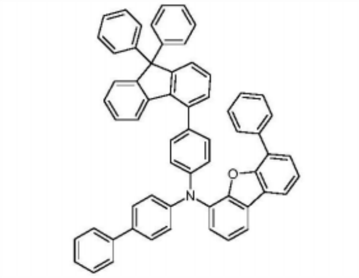
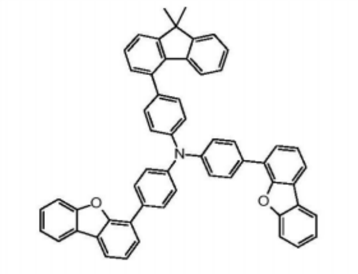
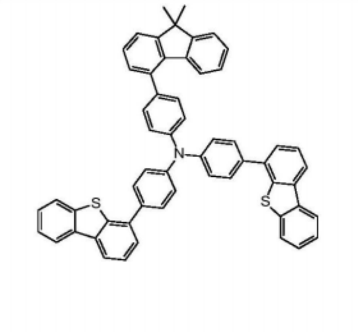
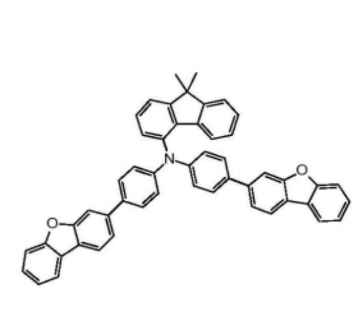
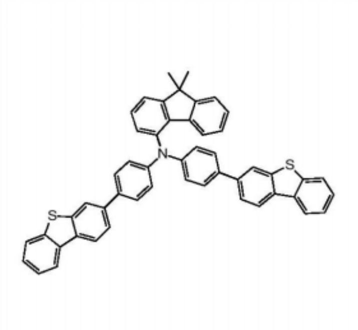
		
		
		
		
		
		

[0248]

[0249] 优选地，本发明OLED包含两个或更多个不同的空穴传输层。式(I)化合物在此可以在一个或多个或所有空穴传输层中使用。在一个优选实施方式中，式(I)化合物在正好一个或正好两个空穴传输层中使用，并且其它化合物，优选芳族胺化合物，在存在的另外的空穴传输层中使用。与式(I)化合物一起使用的，优选在本发明的OLED的空穴传输层中使用的其它化合物尤其是茚并芴胺衍生物(例如根据WO 06/122630或WO 06/100896)、EP 1661888中公开的胺衍生物、六氮杂联三苯叉衍生物(例如根据WO 01/049806)、具有稠合芳族化合物的胺衍生物(例如根据US 5,061,569)、WO 95/09147中公开的胺衍生物、单苯并茚并芴胺(例如根据WO 08/006449)、二苯并茚并芴胺(例如根据WO 07/140847)、螺二芴胺(例如根据WO 2012/034627或WO 2013/120577)、芴胺(例如根据WO 2014/015937、WO 2014/015938、WO 2014/015935和WO 2015/082056)、螺二苯并吡喃胺(例如根据WO 2013/083216)、二氢吖啶衍生物(例如根据WO 2012/150001)、螺二苯并呋喃和螺二苯并噻吩(例如根据WO 2015/022051、WO 2016/102048和WO 2016/131521)、菲二芳基胺(例如根据WO 2015/131976)、螺

三苯并环庚三烯酚酮(例如根据WO 2016/087017)、具有间苯二胺基的螺二芴(例如根据WO 2016/078738)、螺双吖啶(例如根据WO 2015/158411)、呫吨二芳基胺(例如根据WO 2014/072017)和具有二芳基氨基的9,10-二氢蒽螺化合物(根据WO 2015/086108)。

[0250] 用于电子传输层的材料可以是根据现有技术用作电子传输层中的电子传输材料的任何材料。特别合适的是铝络合物(例如Alq_3)、锆络合物(例如Zrq_4)、锂络合物(例如Liq)、苯并咪唑衍生物、三嗪衍生物、嘧啶衍生物、吡啶衍生物、吡嗪衍生物、喹喔啉衍生物、喹啉衍生物、噁二唑衍生物、芳族酮、内酰胺、硼烷、磷二氮杂环戊熳衍生物和氧化膦衍生物。其它合适的材料是在JP 2000/053957、WO 2003/060956、WO 2004/028217、WO 2004/080975和WO 2010/072300中公开的上述化合物的衍生物。

[0251] 电子器件的优选阴极是具有低逸出功的金属、由多种金属组成的金属合金或多层结构,所述多种金属例如是碱土金属、碱金属、主族金属或镧系元素(例如Ca、Ba、Mg、Al、In、Mg、Yb、Sm等)。另外,合适的是由碱金属或碱土金属和银组成的合金,例如由镁和银组成的合金。在多层结构的情况下,除了提到的金属外,还可以使用其它具有相对高逸出功的金属,例如Ag或Al,在这种情况下,通常使用金属的组合,诸如Ca/Ag、Mg/Ag或Ba/Ag。在金属阴极与有机半导体之间引入高介电常数的材料的薄中间层也可以是优选的。用于此目的的有用材料的实例是碱金属或碱土金属的氟化物,但也包括相应的氧化物或碳酸盐(例如LiF、Li_2O、BaF_2、MgO、NaF、CsF、Cs_2CO_3等)。为此也可以使用喹啉锂(LiQ)。该层的层厚度优选在0.5与5nm之间。

[0252] 优选的阳极是具有高逸出功的材料。优选地,阳极相对于真空具有大于4.5eV的逸出功。首先,具有高氧化还原电势的金属例如Ag、Pt或Au适合于该目的。其次,金属/金属氧化物电极(例如$Al/Ni/NiO_x$、Al/PtO_x)也可以是优选的。对于一些应用,至少一个电极必须是透明的或部分透明的,以便能够辐照有机材料(有机太阳能电池)或发光(OLED、O-LASER)。这里优选的阳极材料是导电混合金属氧化物。特别优选氧化锡铟(ITO)或氧化铟锌(IZO)。还优选导电掺杂的有机材料,尤其是导电掺杂的聚合物。另外,阳极也可以由两个或更多个层组成,例如由ITO的内层和金属氧化物的外层组成,所述金属氧化物优选为氧化钨、氧化钼或氧化钒。

[0253] 所述器件被适当地结构化(根据应用)、设置接触连接并最终密封,以排除水和空气的破坏作用。

[0254] 在一个优选实施方式中,电子器件的特征在于通过升华工艺涂布一个或多个层。在这种情况下,通过在真空升华系统中的气相沉积以小于10^{-5}毫巴,优选小于10^{-6}毫巴的初始压力施加材料。然而,在这种情况下,初始压力甚至可以更低,例如小于10^{-7}毫巴。

[0255] 同样优选如下电子器件,其特征在于通过OVPD(有机气相沉积)方法或借助于载气升华来涂布一个或多个层。在这种情况下,以10^{-5}毫巴与1巴之间的压力施加材料。这种方法的一种特殊情况是OVJP(有机蒸汽喷射印刷)方法,在所述方法中,材料直接通过喷嘴施加,从而结构化(例如M.S.Arnold等人,Appl.Phys.Lett.2008,92,053301)。

[0256] 另外优选如下电子器件,其特征在于从溶液中产生一个或多个层,例如通过旋涂或通过任何印刷方法,例如丝网印刷、柔性版印刷、喷嘴印刷或胶版印刷,但是更优选LITI(光诱导热成像、热转移印刷)或喷墨印刷,来产生一个或多个层。为此,需要可溶性式(I)化合物。通过化合物的适当取代可以实现高溶解度。

[0257] 还优选本发明的电子器件通过从溶液中施加一个或多个层并通过升华法施加一个或多个层来制造。

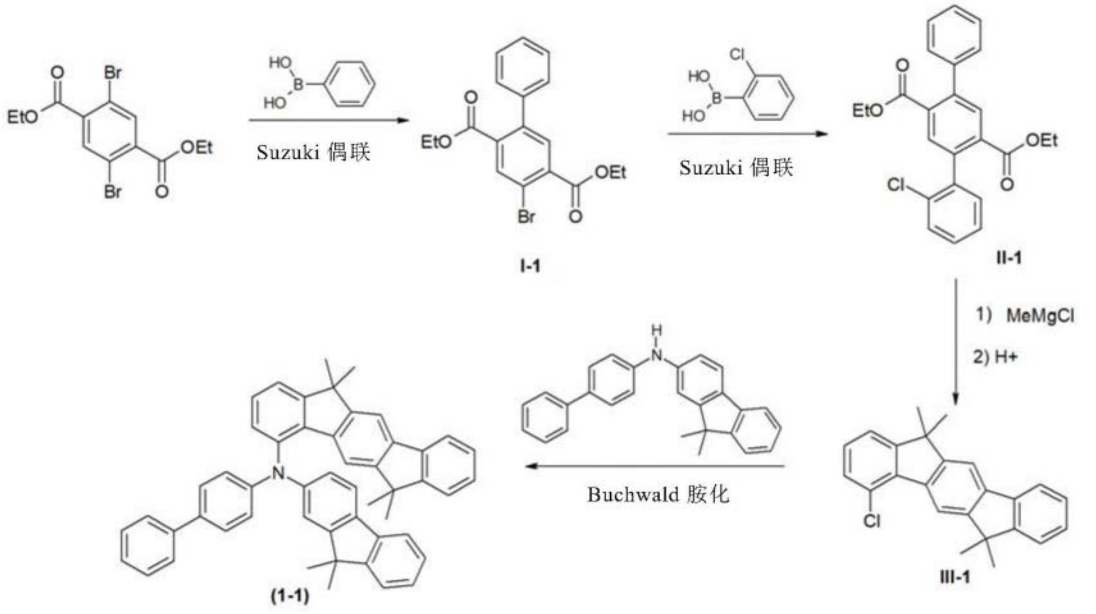
[0258] 根据本发明,包含一种或多种式(I)化合物的电子器件可以用于显示器中,用作照明应用中的光源,以及用作医学和/或美容应用(例如光疗法)中的光源。

实施例

[0259] A)合成实施例

[0260] 实施例1-1:合成本发明化合物1-1和变体

[0261]



[0262] 中间体I-1

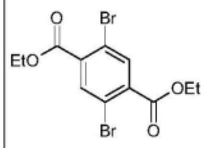
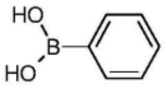
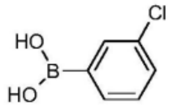
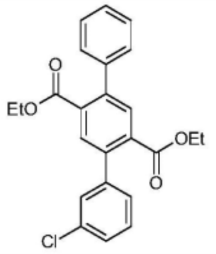
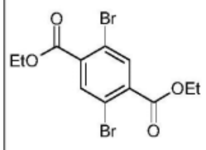
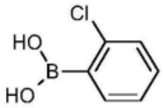
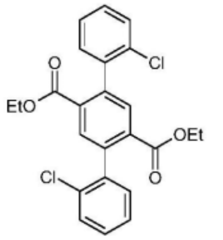
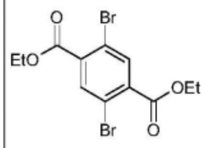
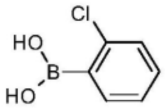
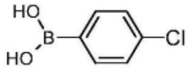
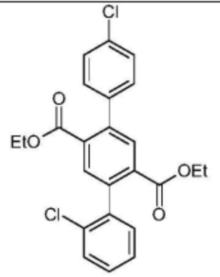
[0263] 将10g苯基硼酸(81mmol)和30g二溴二羧酸酯(CAS编号18013-97-3)(77mmol)悬浮于750ml THF中。缓慢逐滴添加160ml的2M碳酸钾溶液。将溶液脱气并用N_2饱和。之后添加0.89g(0.8mmol)的$Pd(Ph_3P)_4$。将反应混合物在保护气氛下加热至沸腾16小时。随后将混合物在甲苯与水之间分配,并将有机相用水洗涤三次,并经Na_2SO_4干燥,并通过旋转蒸发浓缩。剩余的残余物通过柱色谱法纯化。产率是15.3g(理论值的52%)。

[0264] 中间体II-1

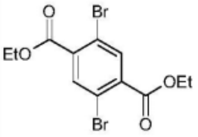
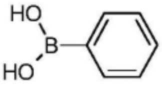
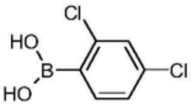
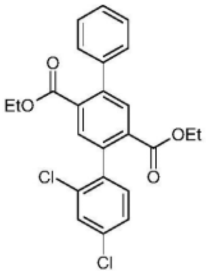
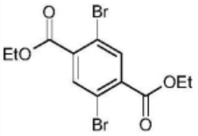
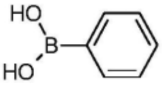
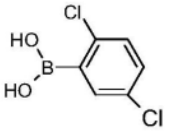
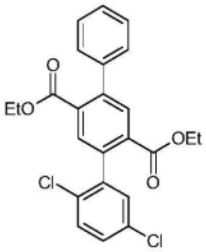
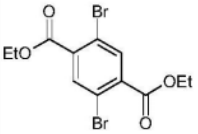
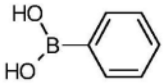
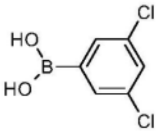
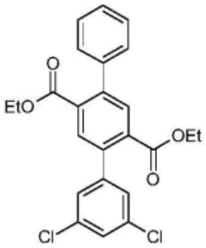
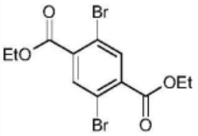
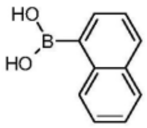
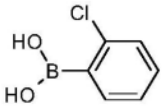
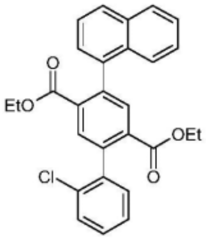
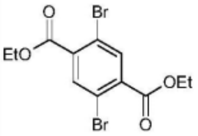
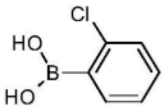
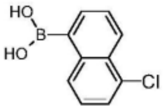
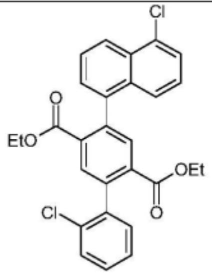
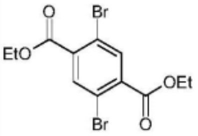
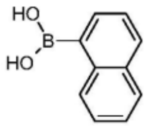
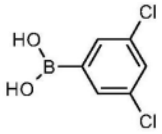
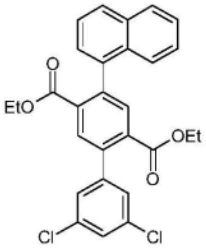
[0265] 将7g 4-氯苯基硼酸(44.6mmol)和15.3g溴衍生物I-1(40.56mmol)悬浮于300ml THF中。缓慢逐滴添加81ml的1M碳酸钾溶液。将溶液脱气并用N_2饱和。之后添加0.45g(0.4mmol)的$Pd(Ph_3P)_4$。将反应混合物在保护气氛下加热至沸腾12小时。随后将混合物在甲苯与水之间分配,并将有机相用水洗涤三次,并经Na_2SO_4干燥,并通过旋转蒸发浓缩。在将粗产物用甲苯通过硅胶过滤后,将剩余的残余物从MeOH中重结晶。产率是14.5g(理论值的80%)。

[0266] 类似地,制备以下化合物(产率为理论值的30-90%):

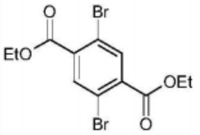
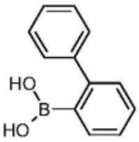
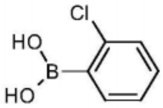
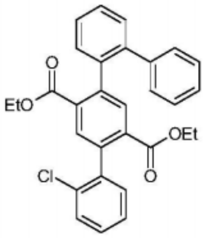
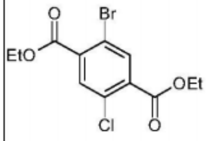
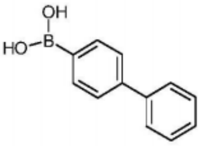
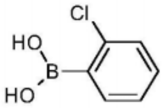
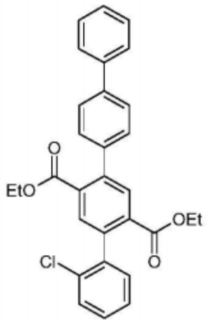
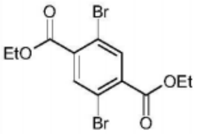
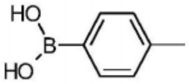
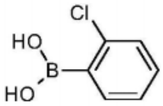
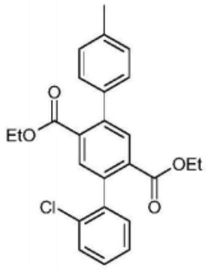
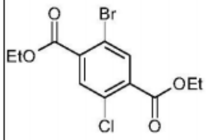
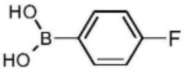
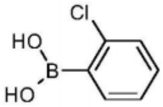
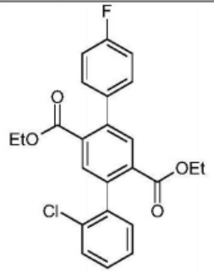
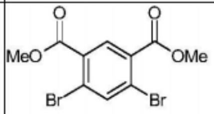
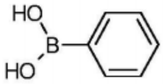
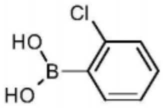
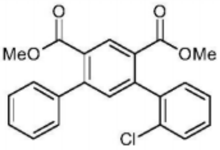
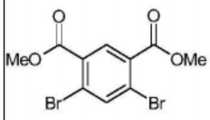
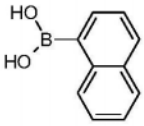
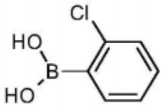
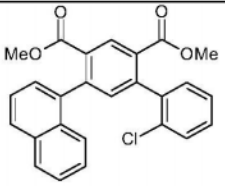
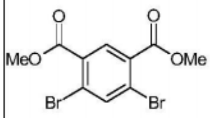
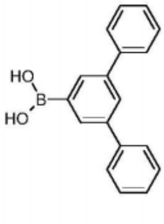
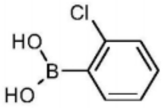
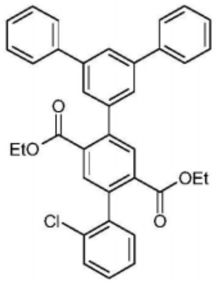
[0267]

	反应物 1	硼酸衍生物 1	硼酸衍生物 2	产物
II-2				
II-3		 (2 当量)		
II-4				

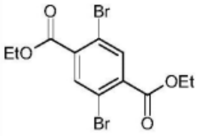
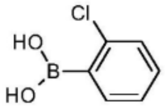
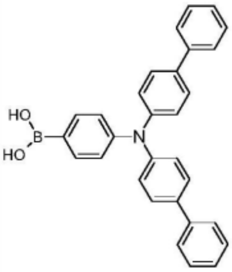
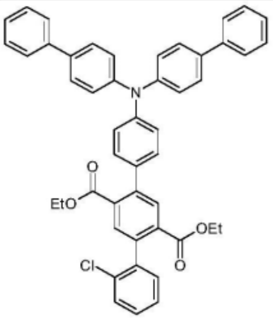
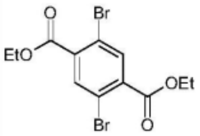
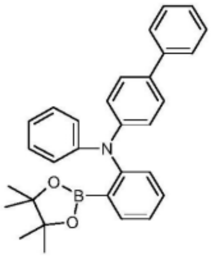
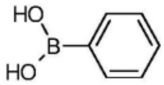
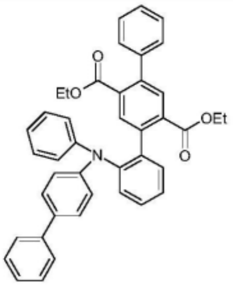
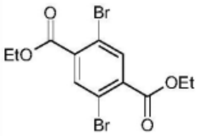
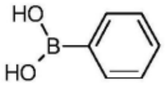
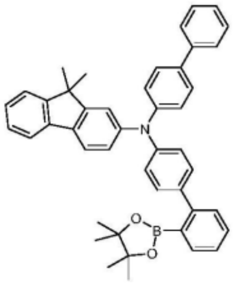
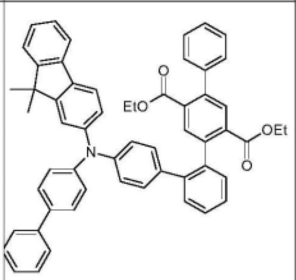
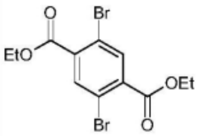
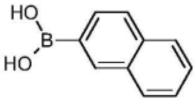
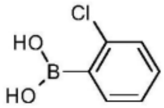
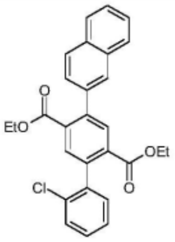
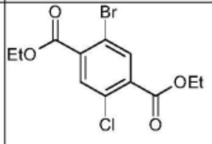
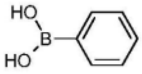
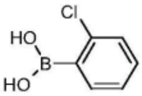
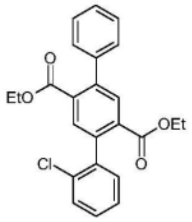
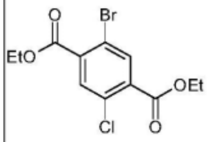
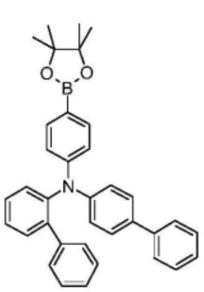
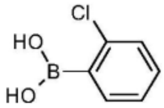
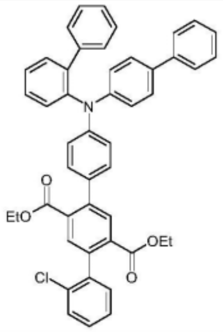
[0268]

II-5				
II-6				
II-7				
II-8				
II-9				
II-10				

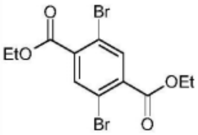
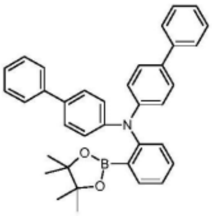
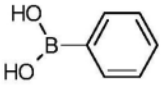
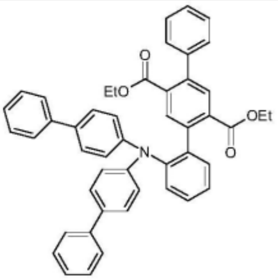
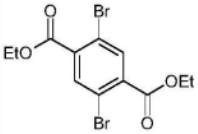
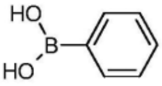
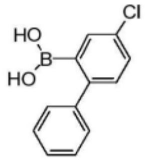
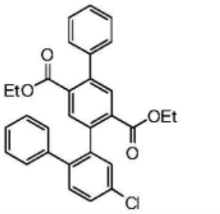
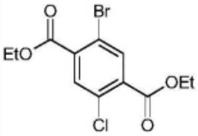
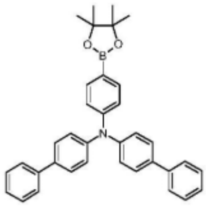
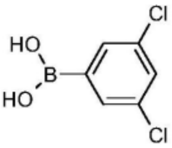
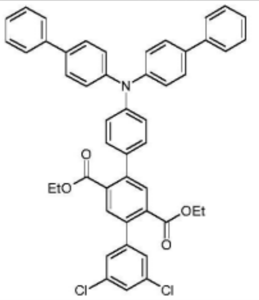
[0269]

II-11				
II-12	 (340148-60-9)			
II-13				
II-14	 (340148-60-9)			
II-15	 (90766-77-1)			
II-16				
II-17				

[0270]

II-18				
II-19				
II-20				
II-21				
II-22	 (340148-60-9)			
II-23	 (340148-60-9)			

[0271]

II-24				
II-25				
II-26				

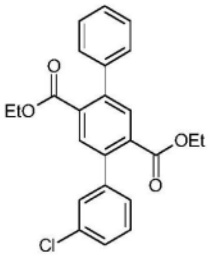
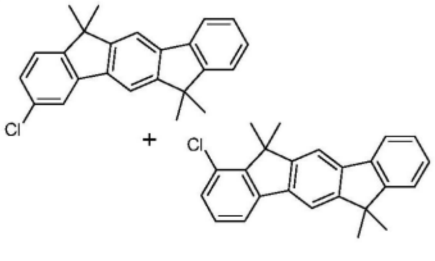
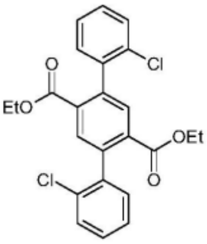
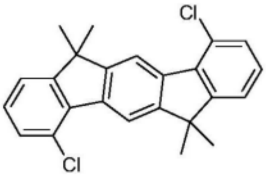
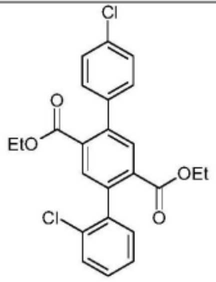
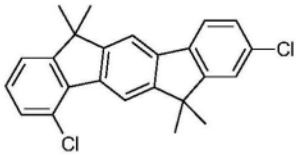
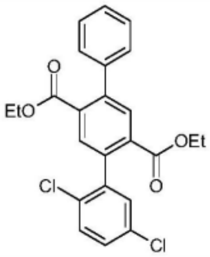
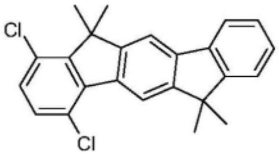
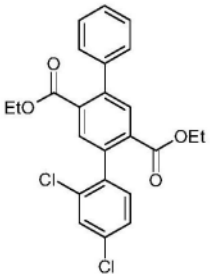
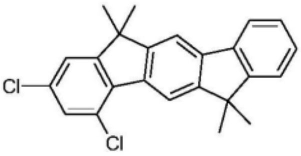
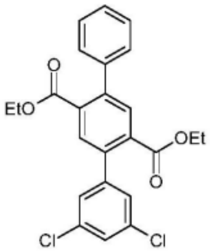
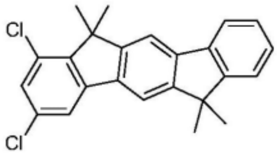
[0272] 中间体III-1

[0273] 将14.0g(34.2mmol)中间体II-1溶解于烘烤烧瓶中的250ml干燥的THF中。将溶液用N_2饱和。将澄清溶液冷却至-5℃,然后添加68.5ml(205mmol)的3M甲基氯化镁溶液。将反应混合物逐渐温热至室温,然后用氯化铵淬灭。随后将混合物在乙酸乙酯与水之间分配,并将有机相用水洗涤三次,经Na_2SO_4干燥,并通过旋转蒸发浓缩。

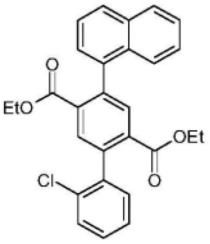
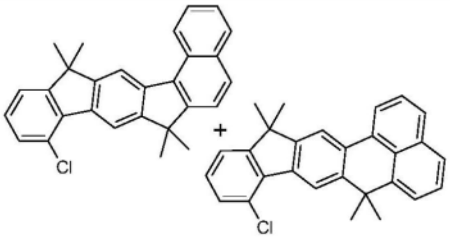
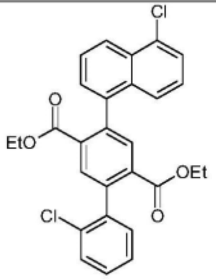
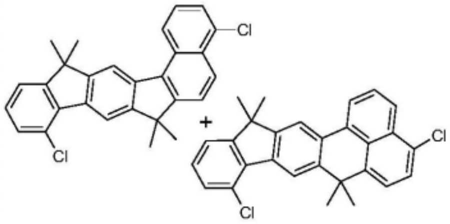
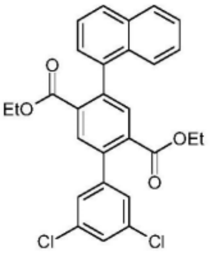
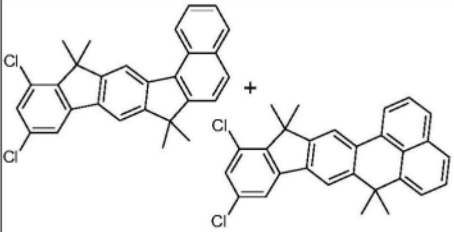
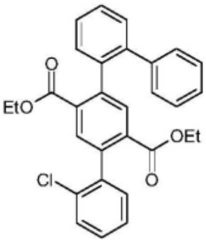
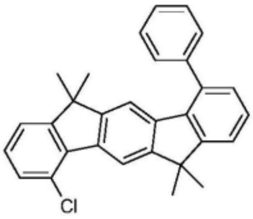
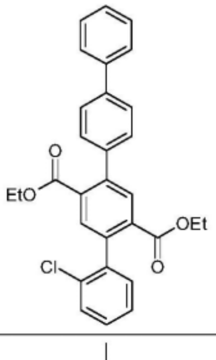
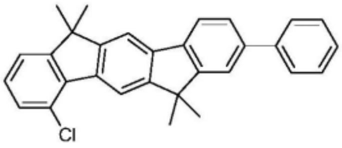
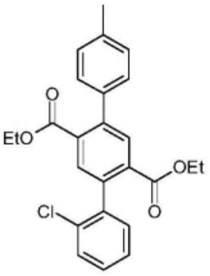
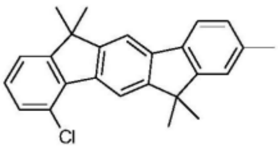
[0274] 将通过旋转蒸发浓缩的溶液溶解于甲苯中,并添加6.6g的Amberlyst 15。将混合物加热至110℃并在该温度下保持8小时。在此期间,白色固体沉淀出来。然后将混合物冷却至室温,并将沉淀的固体抽滤出并用庚烷洗涤。将残余物在40℃减压干燥。将粗产物用庚烷:乙酸乙酯(1:1)通过硅胶过滤后,得到10.2g(理论值的86%)的产物III-1。

[0275] 类似地,制备以下化合物(产率为理论值的50-95%):

[0276]

	反应物 1	反应物 2	产物
III-2		MeMgBr	 ＃
III-3		MeMgBr	
III-4		MeMgCl	
III-5		MeMgCl	
III-6		MeMgCl	
III-7		MeMgBr	

[0277]

III-8		MeMgCl	 #
III-9		MeMgCl	 #
III-10		MeLi	 #
III-11		MeMgBr	
III-12		MeMgCl	
III-13		MeMgCl	

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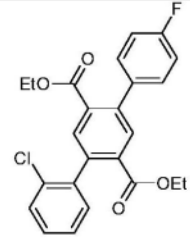
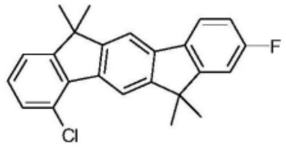
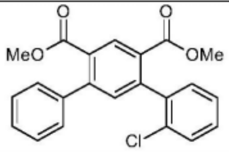
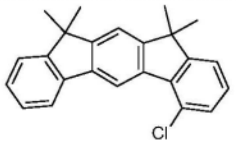
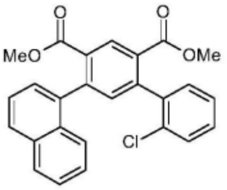
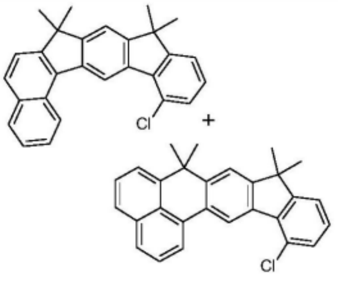
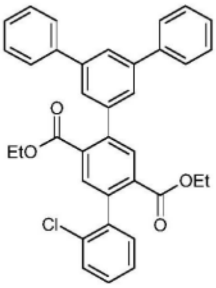
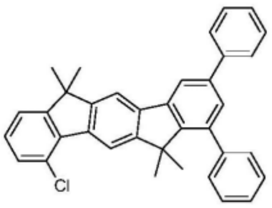
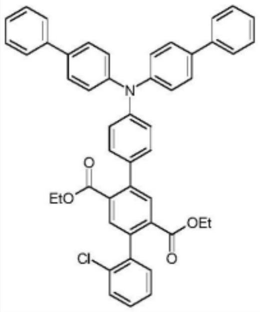
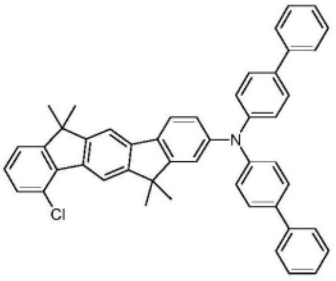
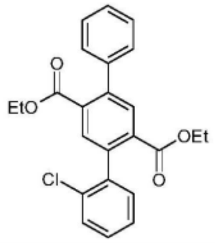
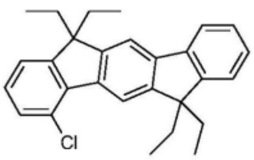
III-14		MeMgCl	
III-15		MeMgCl	
III-16		MeMgBr	 ＃
III-17		MeLi	
III-18		MeMgCl	
III-19		EtMgBr	

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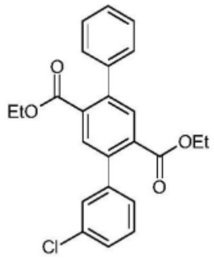
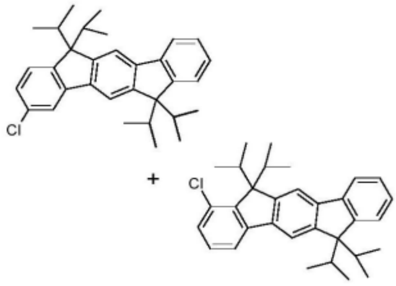
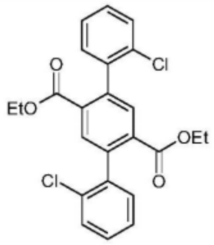
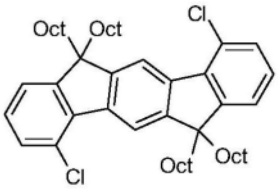
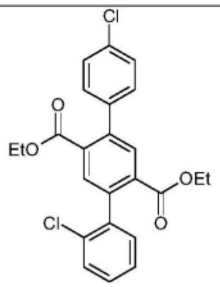
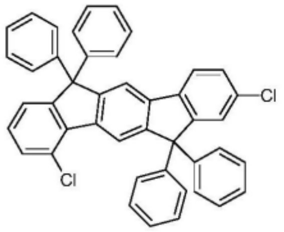
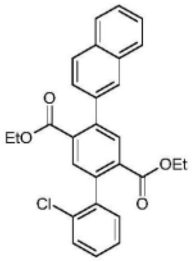
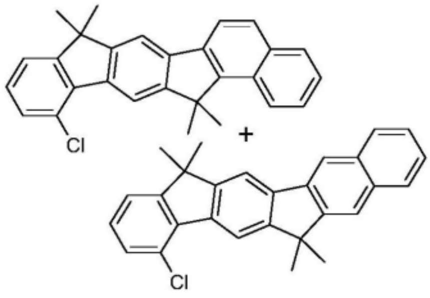
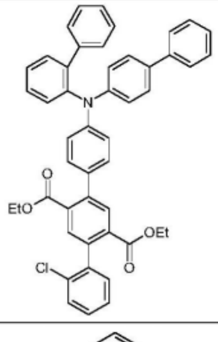
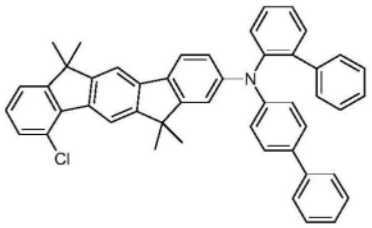
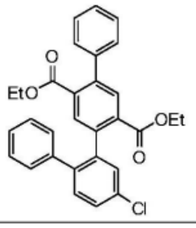
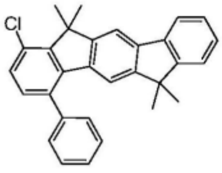
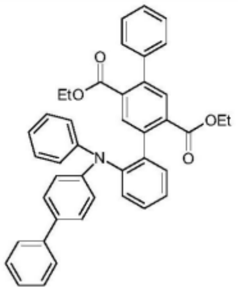
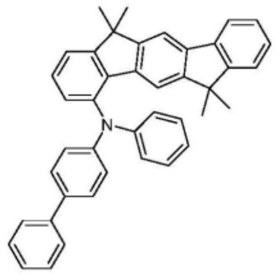
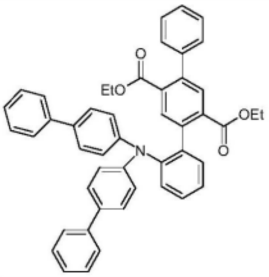
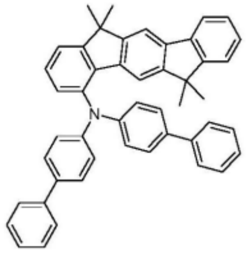
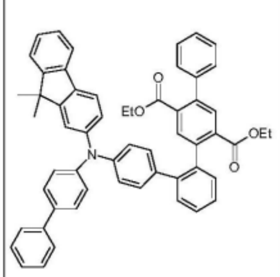
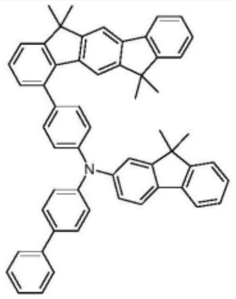
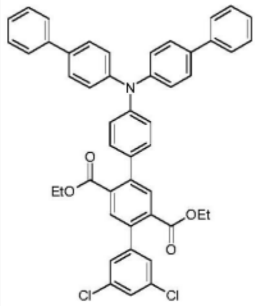
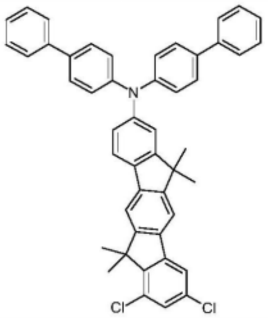
III-20		i-PrMgBr	 ＃
III-21		i-OctMgBr	
III-22		PhLi	
III-23		MeMgBr	 ＃
III-24		MeMgBr	
III-25		MeMgCl	

[0280]

1-33		MeMgBr	
1-34		MeMgBr	
2-18		MeMgCl	
2-19		MeMgBr	

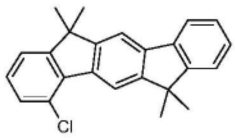
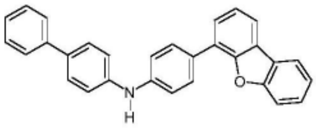
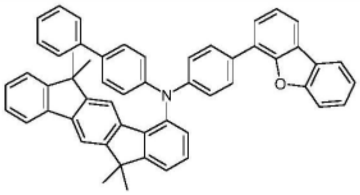
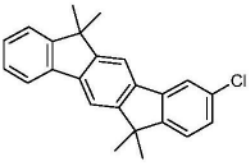
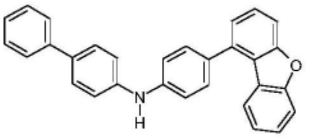
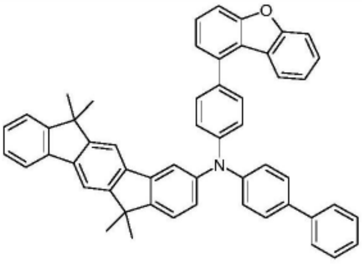
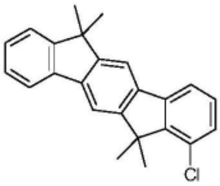
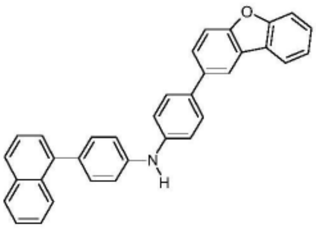
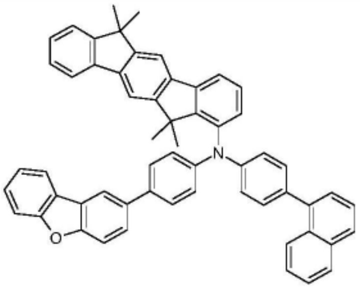
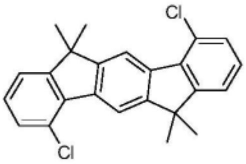
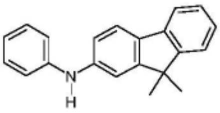
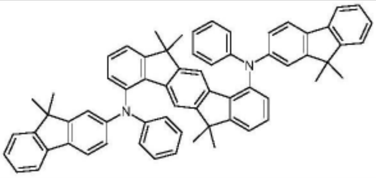
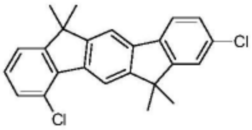
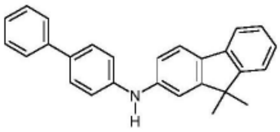
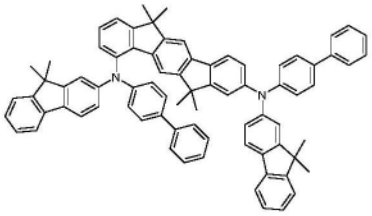
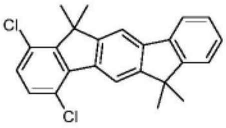
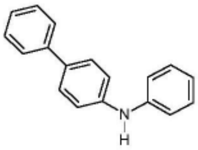
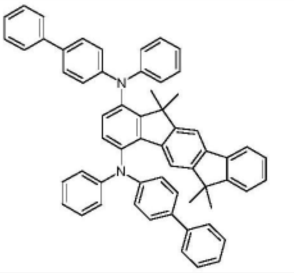
[0281] #:化合物可以通过色谱法或通过重结晶分离。

[0282] 化合物1-1

[0283] 将14.6g 4-联苯(9,9-二甲基-9H-芴-2-基)胺(40.6mmol)和14g中间体III-1(40.6mmol)溶解于400ml甲苯中。将溶液脱气并用N_2饱和。之后向其中添加0.33g(0.81mmol)的S-Phos和0.46g(1.75mmol)的$Pd_2(dba)_3$,然后添加5.85g叔丁醇钠(80.9mol)。将反应混合物在保护气氛下加热至沸腾6小时。随后将混合物在甲苯与水之间分配,并将有机相用水洗涤三次,并经Na_2SO_4干燥,并通过旋转蒸发浓缩。在将粗产物通过硅胶用甲苯过滤之后,将剩余的残余物从庚烷/甲苯中重结晶。产率是20g(理论值的75%)。最后,将材料在高真空下升华。纯度是99.9%。

[0284] 类似地,制备以下化合物(产率为理论值的20-80%):

[0285]

	反应物 1	反应物 2	产物
1-2			
1-3			
1-4			
1-5		2 当量 	
1-6		2 当量 	
1-7		2 当量 	

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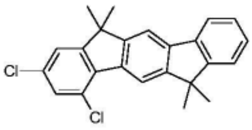
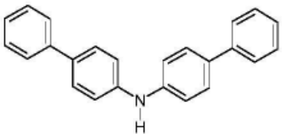
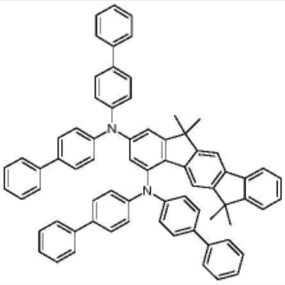
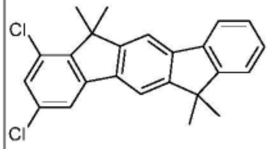
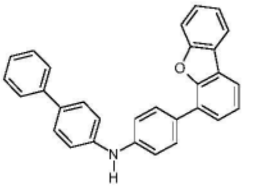
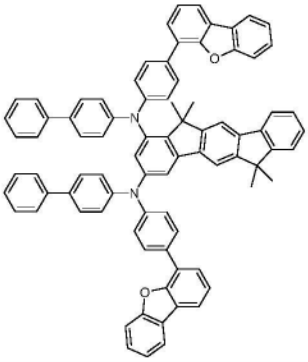
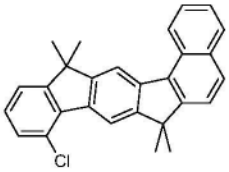
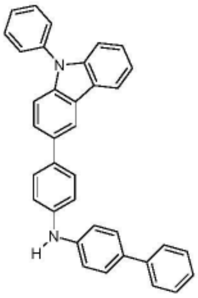
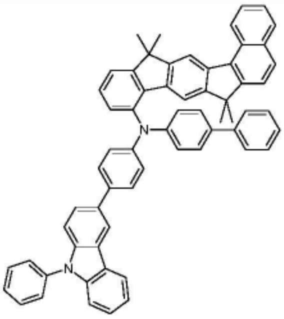
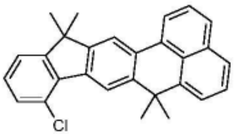
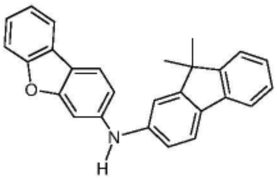
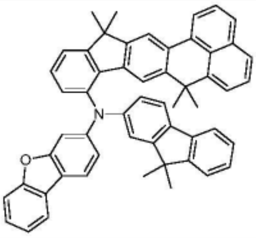
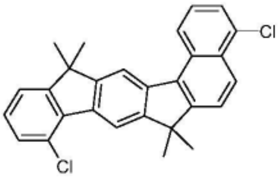
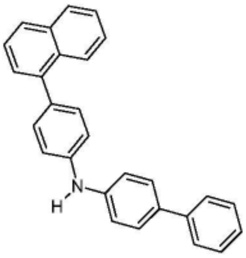
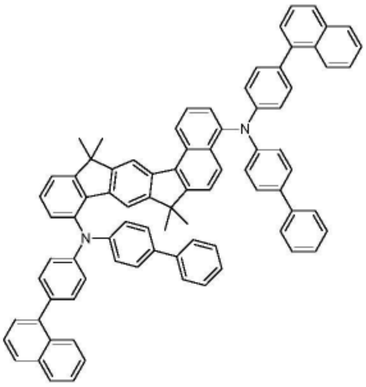
1-8		2 当量 	
1-9		2 当量 	
1-10			
1-11			
1-12		2 当量 	

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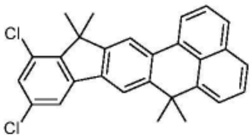
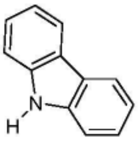
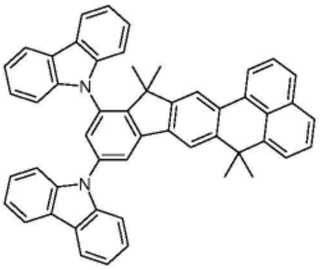
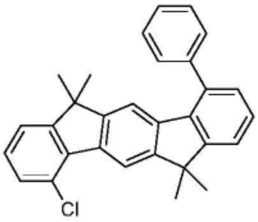
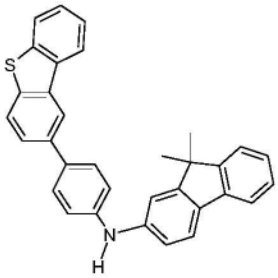
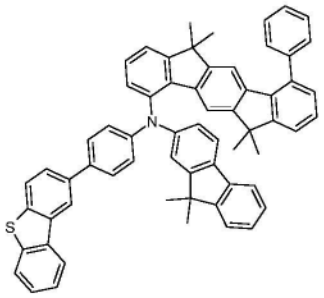
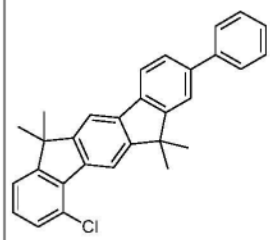
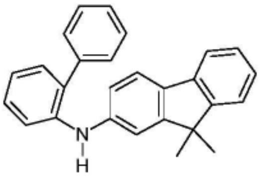
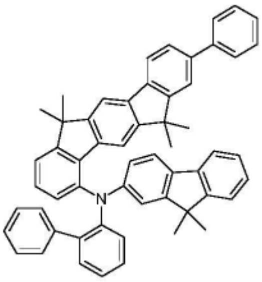
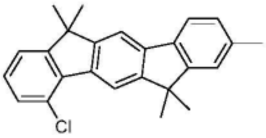
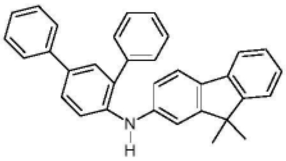
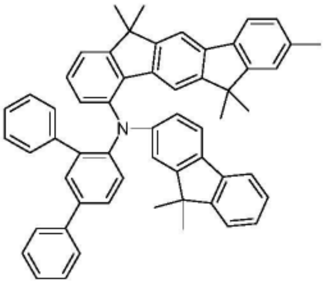
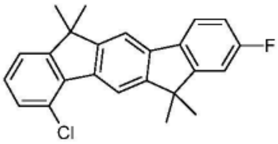
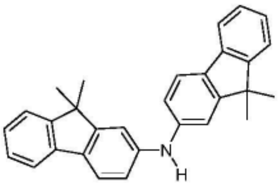
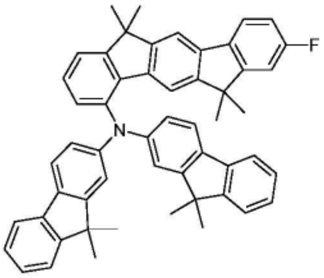
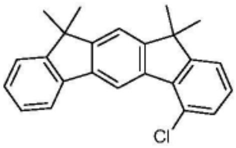
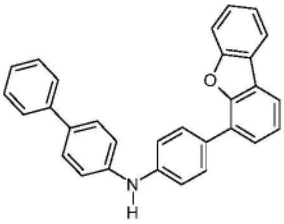
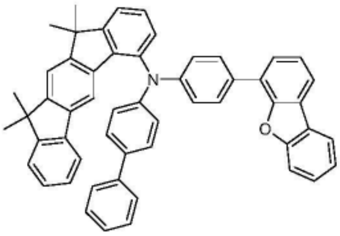
1-13		2 当量 	
1-14			
1-15			
1-16			
1-17			
1-18			

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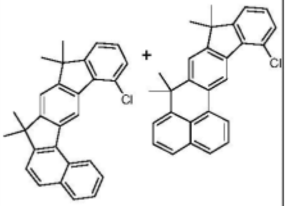
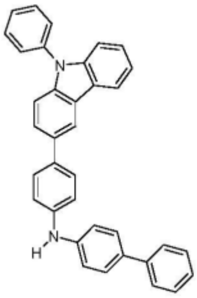
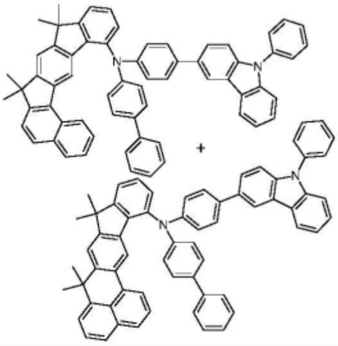
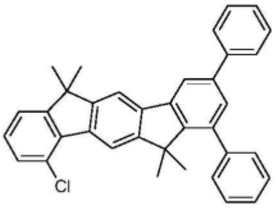
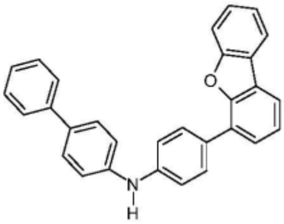
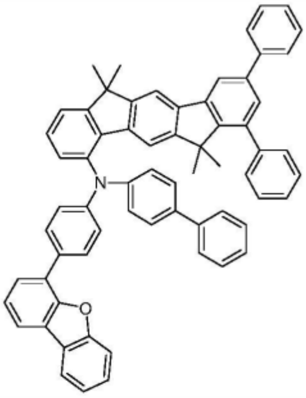
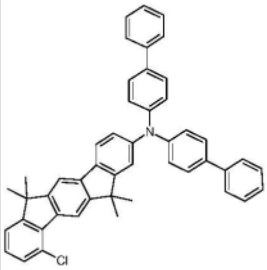
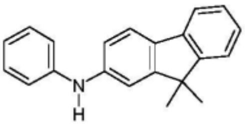
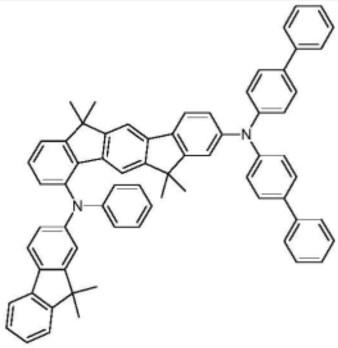
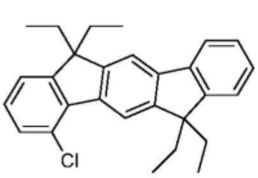
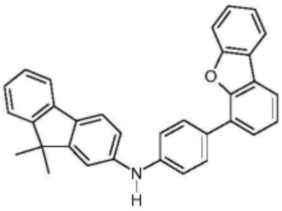
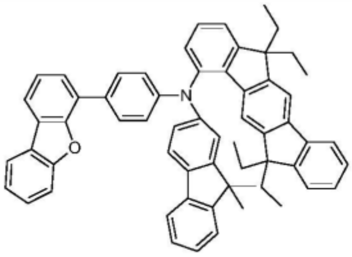
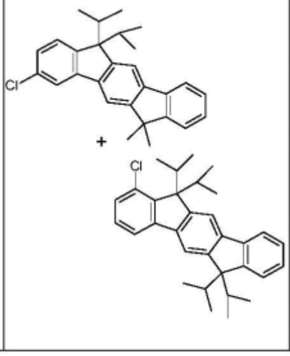
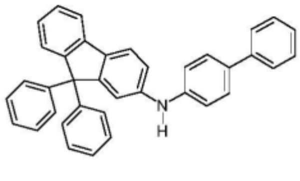
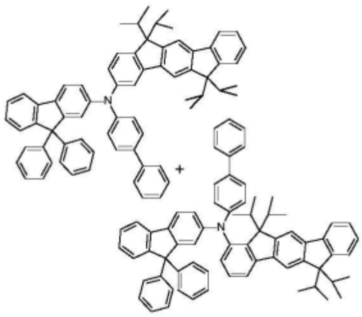
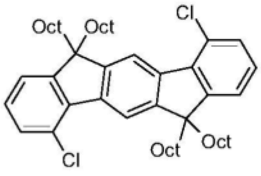
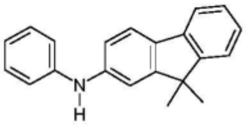
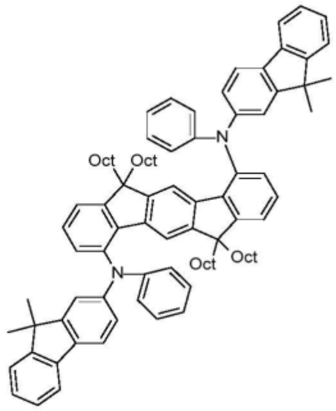
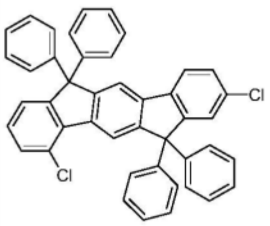
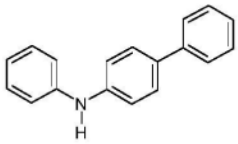
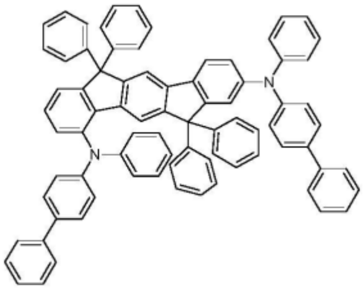
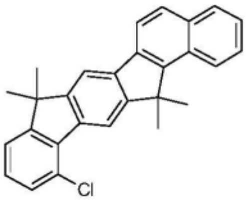
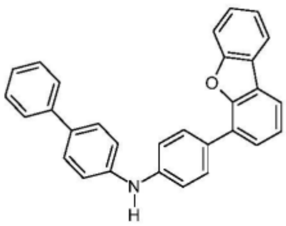
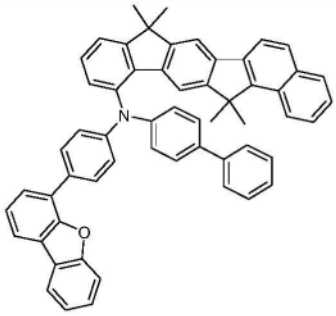
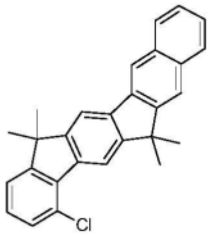
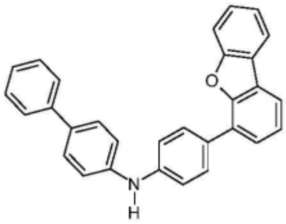
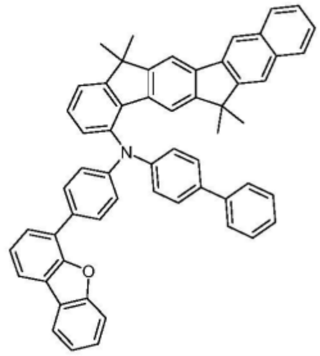
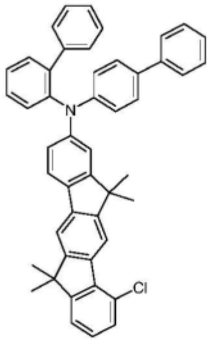
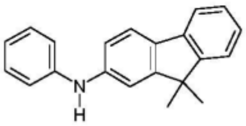
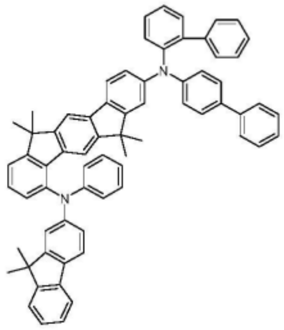
1-19			# 
1-20			
1-21			
1-22			
1-23			# 

[0289]

1-24		2 当量 	
1-25		2 当量 	
1-26			
1-27			
1-28			

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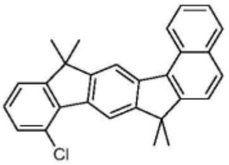
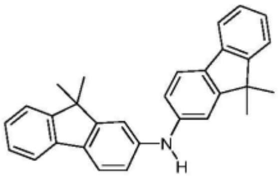
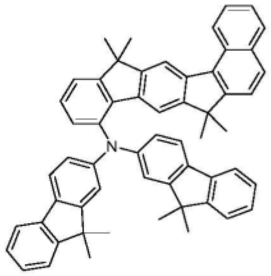
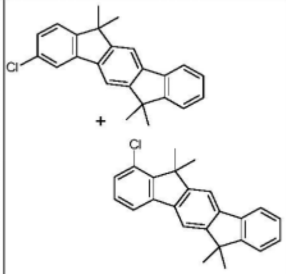
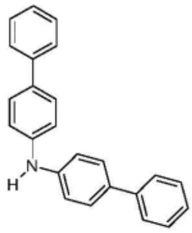
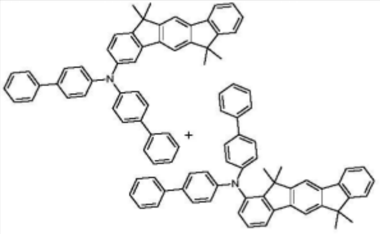
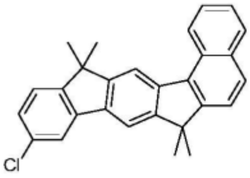
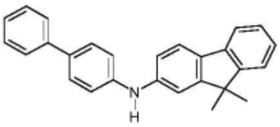
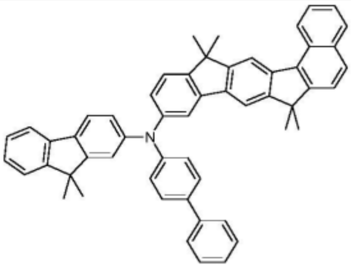
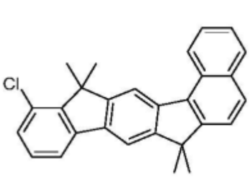
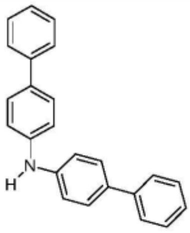
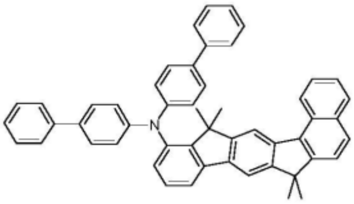
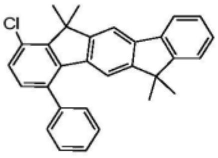
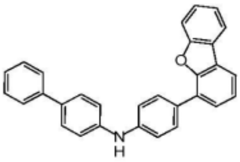
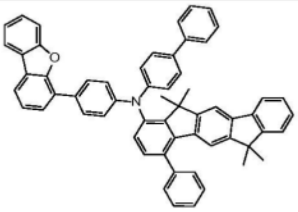
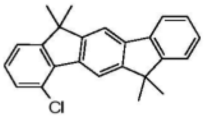
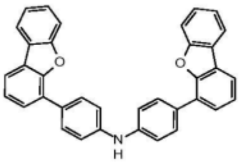
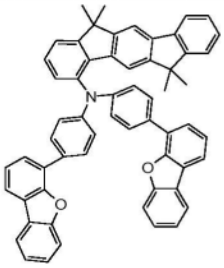
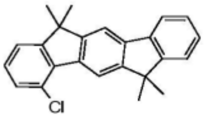
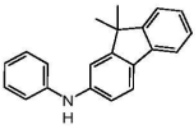
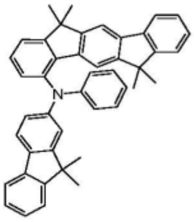
1-29			
1-30			 #
1-31			
1-32			
1-35			
1-36			
1-37			

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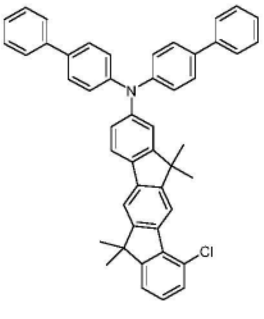
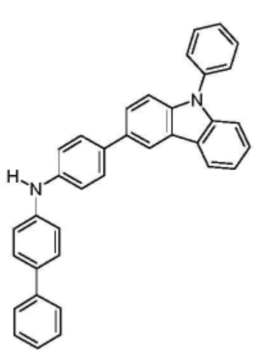
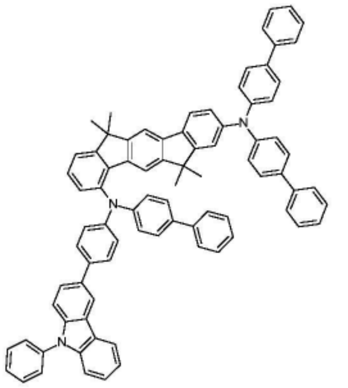
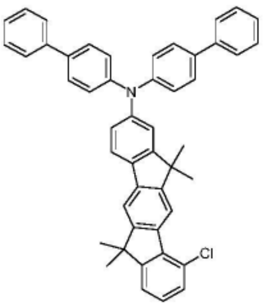
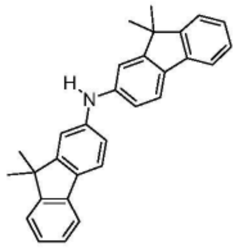
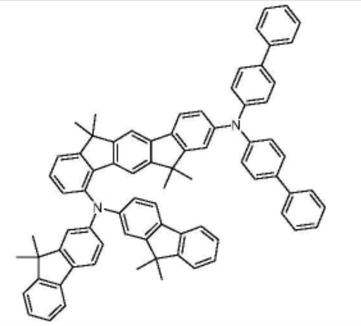
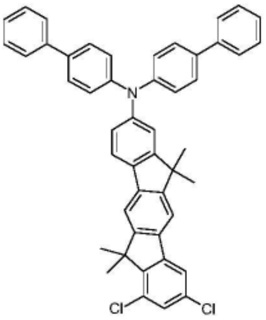
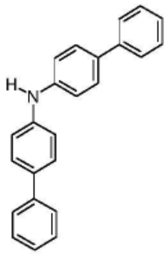
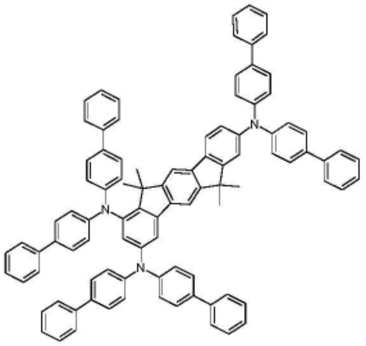
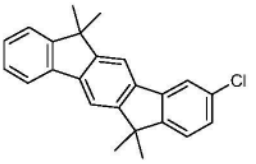
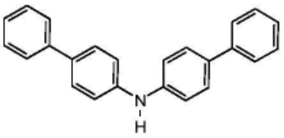
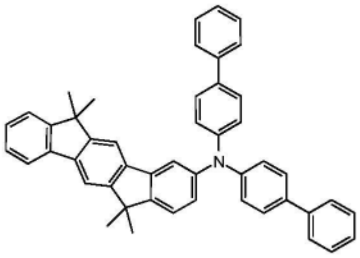
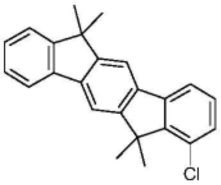
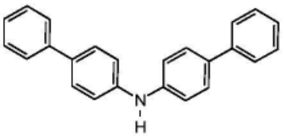
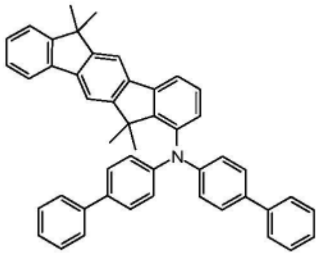
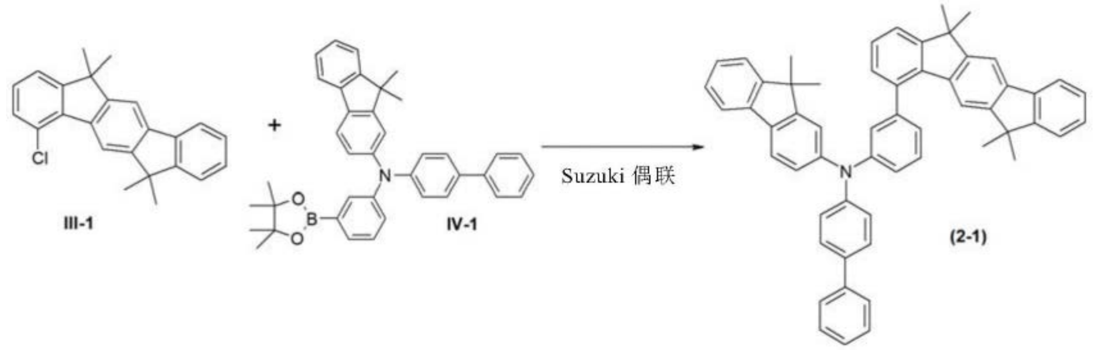
1-38			
1-39			
1-40			
1-41			
1-42			

[0292] #:化合物可以通过色谱法或通过重结晶分离。

[0293] 实施例2-1:合成本发明化合物2-1和变体

[0294]

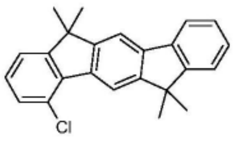
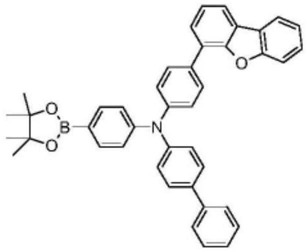
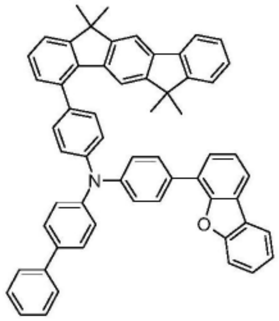


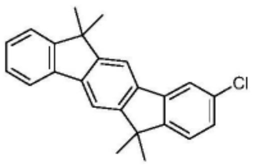
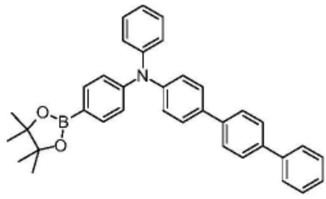
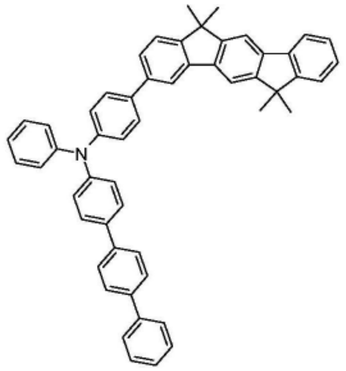
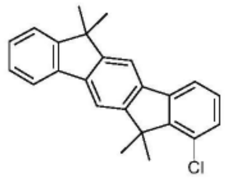
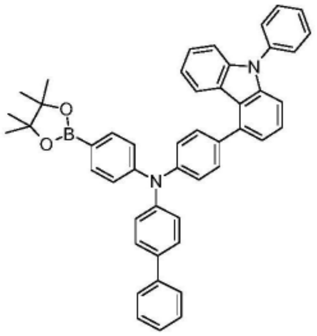
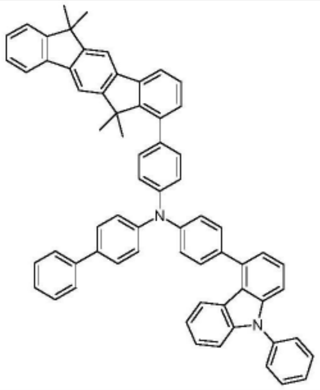
[0295] 化合物2-1

[0296] 将19.6g(34.8mmol)频哪醇硼酸酯衍生物(CAS编号:1616632-73-5)和12.05g(45mmol)中间体III-1悬浮于350ml二噁烷和10.6g氟化铯(69.9mmol)中。添加1.02g(1.39mmol)双(三环己基膦)二氯化钯至此悬浮液中,并将反应混合物在回流下加热18小时。冷却后,将有机相移出,通过硅胶过滤,用80ml水洗涤三次,然后浓缩至干燥。在将粗产物通过硅胶用甲苯过滤之后,将剩余的残余物从庚烷/甲苯中重结晶。产率是20g(理论值的78%)。最后,将材料在高真空下升华。纯度是99.9%。

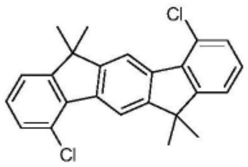
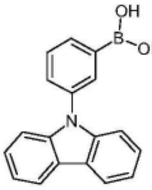
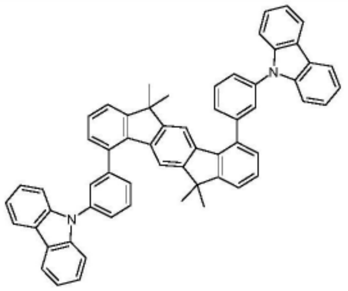
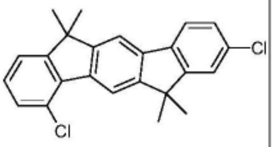
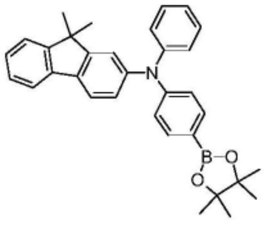
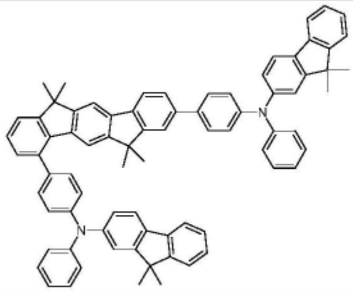
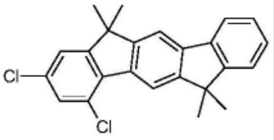
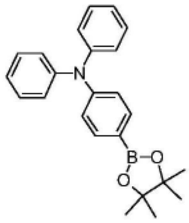
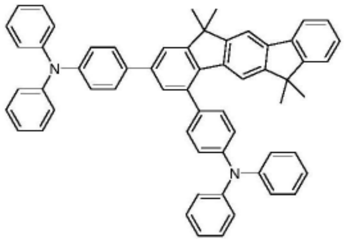
[0297] 类似地,制备以下化合物(产率为理论值的60-85%):

[0298]

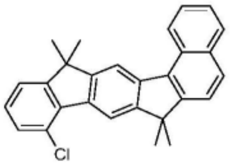
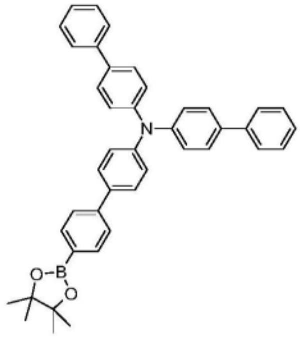
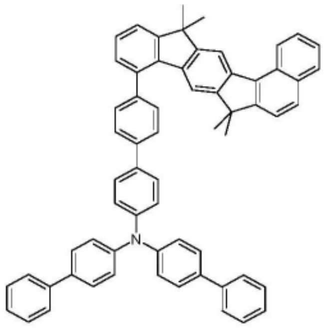
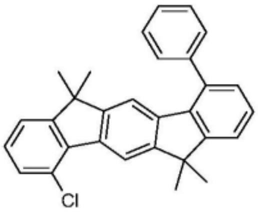
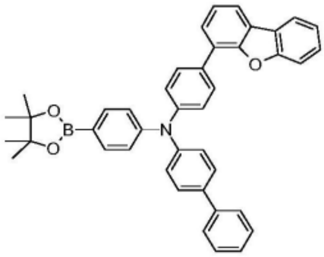
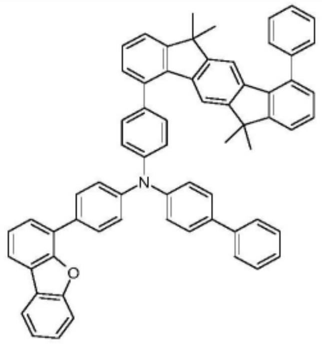
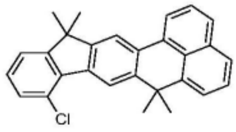
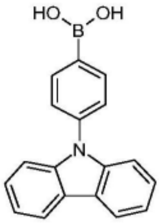
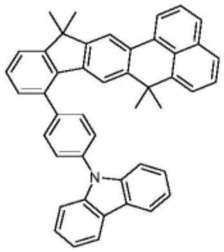
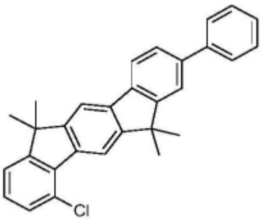
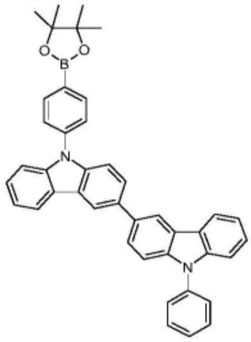
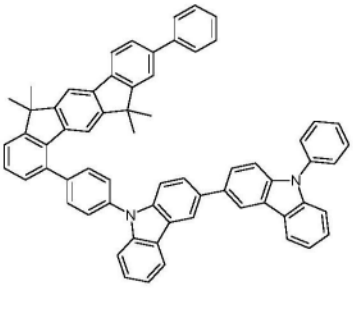
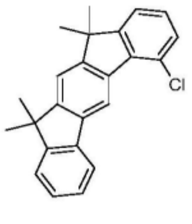
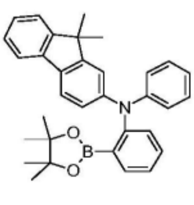
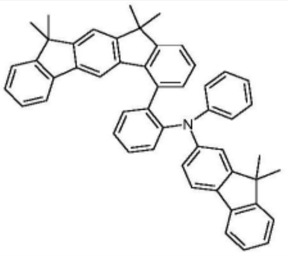
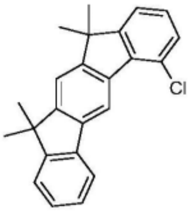
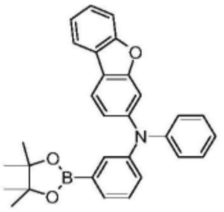
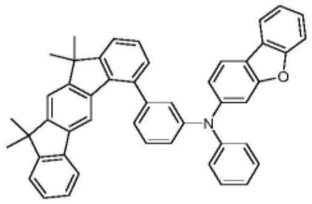
	反应物 2	反应物 2	产物
2-2			

2-3			
2-4			

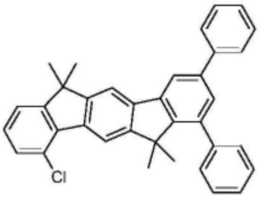
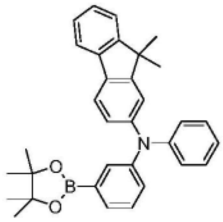
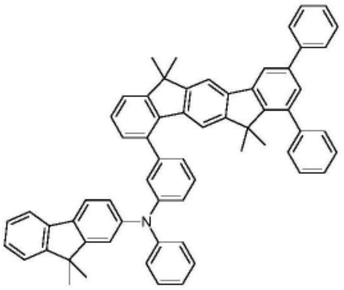
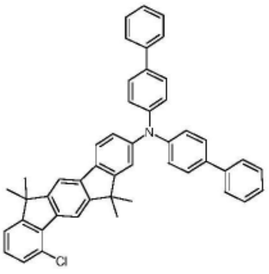
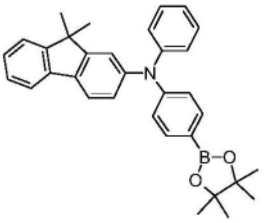
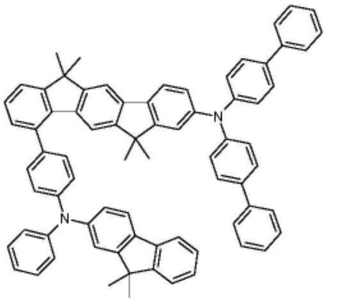
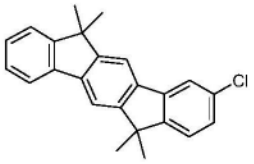
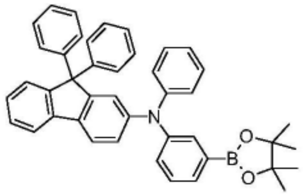
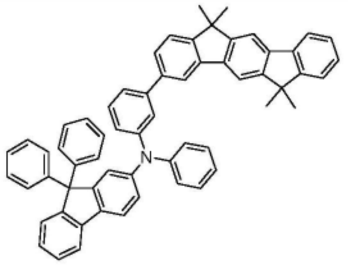
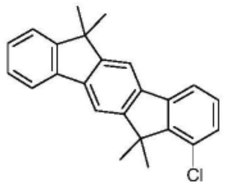
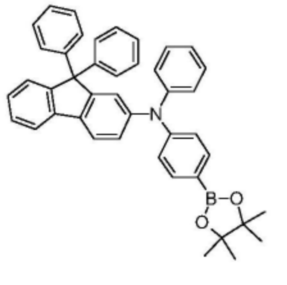
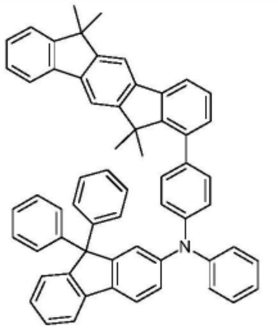
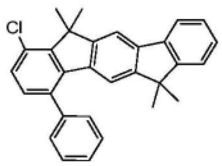
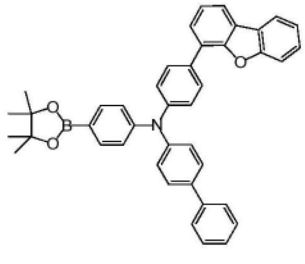
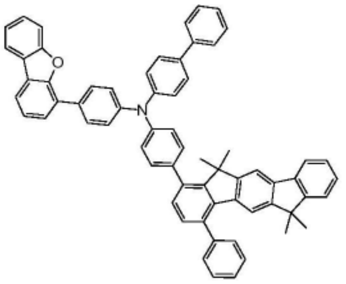
[0299]

2-5			
2-6			
2-7			

[0300]

2-8			
2-9			
2-10			
2-11			
2-12			
2-13			

[0301]

2-14			
2-15			
2-16			
2-17			
2-19			

[0302] B)器件实施例

[0303] 实施例OLED根据以下通用方法制备:

[0304] 所使用的基底是玻璃板,玻璃板上涂有50nm厚的结构化ITO(氧化锡铟)层。向其施加以下层结构:空穴注入层(HIL)/空穴传输层(HTL)/电子阻挡层(EBL)/发光层(EML)/电子传输层(ETL)/电子注入层(EIL)/阴极。阴极由厚度为100nm的铝层组成。表1中指定了实施例OLED的相应层中使用的材料,表3中列出了这些材料的化学结构。

[0305] 通过在真空室中的热气相沉积来施加材料。在此,发光层总是由至少一种基质材

料(主体材料)和发光掺杂剂(发光体)组成,所述发光掺杂剂通过共蒸发以特定的体积比添加到基质材料。表述TMM:TEG(12%)在此意味着TMM材料以88%的体积比存在于层中,并且TEG材料以12%的体积比存在。这同样适用于除发光层以外的层。这些同样可以相应地含有两种或更多种材料。

[0306] OLED以标准方式表征。为此,确定电致发光光谱和由电流-电压-亮度特性(IUL特性)计算出的作为亮度的函数的外量子效率(EQE,以%测量)。这是在假设Lambertian发光特性的情况下完成的。另外,确定工作电压(U,以V为单位)。

[0307] $10mA/cm^2$下的EQE是工作电流密度为$10mA/cm^2$时的外量子效率。$40mA/cm^2$下的LT80是在不考虑任何加速因子下OLED的$5000cd/m^2$的初始亮度下降到该亮度的80%,即$4000cd/m^2$的时间。

[0308] B-1)本发明化合物在绿色荧光OLED中的用途

[0309] OLED实施例E-0至E-17具有表1所示的层结构,在每种情况下,本发明化合物EBL-0至EBL-17(表3)之一存在于EBL中。

[0310] 在所有情况下,本发明的OLED在工作电压、寿命和EQE方面达到良好的结果(表2)。

[0311]

表1:器件构造

实施例	HIL	HTL	EBL	EML	ETL	EIL
	厚度/nm	厚度/nm	厚度/nm	厚度/nm	厚度/nm	厚度/nm
E-0	HTM:p型掺杂剂(5%) 20 nm	HTM 220 nm	EBL-0 10 nm	TMM-1:TMM-2(28%):TEG(12%) 30 nm	ETM:LiQ(50%) 30 nm	LiQ 1 nm
E-1	见上	见上	EBL-1 10 nm	见上	见上	见上
E-2	见上	见上	EBL-2 10 nm	见上	见上	见上
E-3	见上	见上	EBL-3 10 nm	见上	见上	见上
E-4	见上	见上	EBL-4 10 nm	见上	见上	见上
E-5	见上	见上	EBL-5 10 nm	见上	见上	见上
E-6	见上	见上	EBL-6 10 nm	见上	见上	见上
E-7	见上	见上	EBL-7 10 nm	见上	见上	见上
E-8	见上	见上	EBL-8 10 nm	见上	见上	见上
E-9	见上	见上	EBL-9 10 nm	见上	见上	见上
E-10	见上	见上	EBL-10 10 nm	见上	见上	见上
E-15	见上	见上	EBL-15 10 nm	见上	见上	见上
E-16	见上	见上	EBL-16 10 nm	见上	见上	见上
E-17	见上	见上	EBL-17 10 nm	见上	见上	见上

[0312]

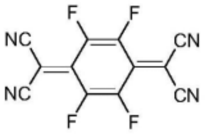
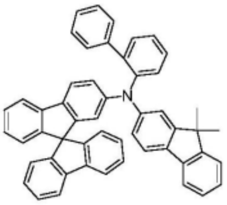
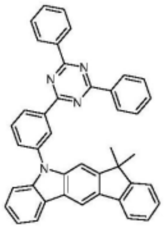
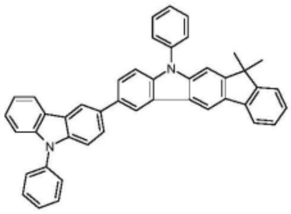
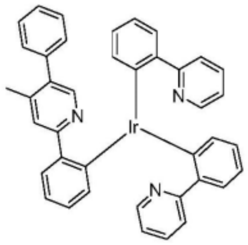
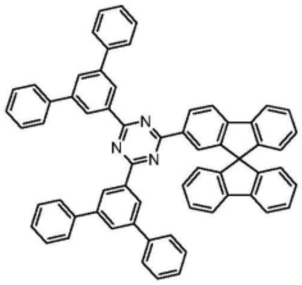
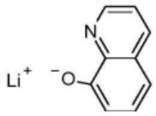
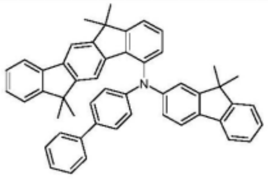
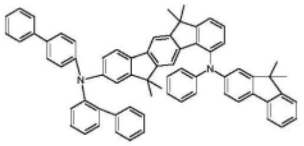
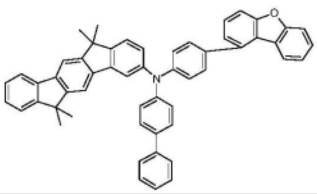
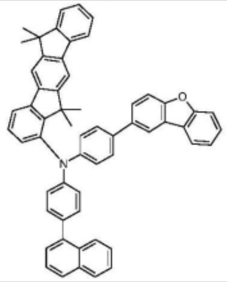
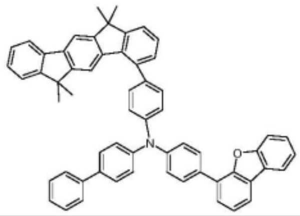
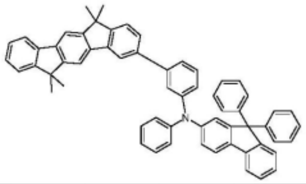
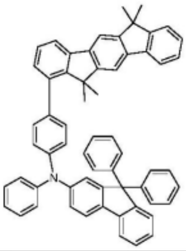
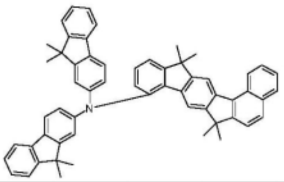
表 2：OLED 的数据

实施例	U	10 mA/cm^2 下的 EQE	40 mA/cm^2 下的 LT80
	[V]	[%]	[h]
E-0	3.9	>16.5	>250
E-1	3.7	>16.0	>300
E-2	4.1	>17.0	>300
E-3	4.1	>18.0	>200
E-4	4.1	>16.0	>250
E-5	4.0	>16.5	>200
E-6	4.0	>17.0	>250
E-7	3.9	>15.5	>250
E-8	3.8	>15.0	>250
E-9	4.1	>15.5	>300
E-10	4.0	>17.0	>250

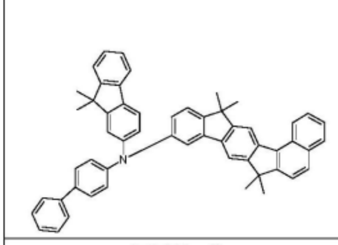
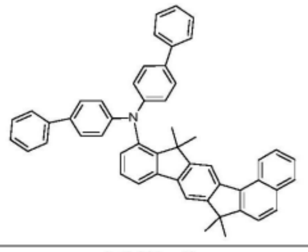
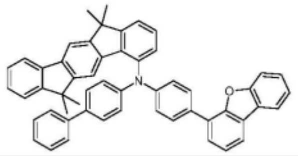
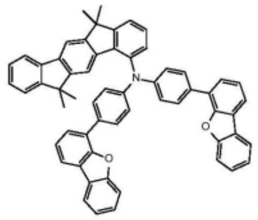
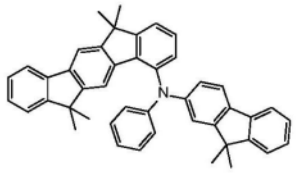
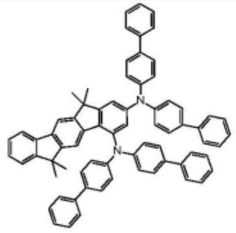
[0313]

E-15	4.2	>16.0	>350
E-16	4.1	>16.0	>250
E-17	4.1	>14.0	>300

[0314]

表 3：所用材料		
		
p 型掺杂剂	HTM	TMM-1
		
TMM-2	TEG	ETM
		
LiQ	EBL-0	EBL-1
		
EBL-2	EBL-3	EBL-4
		
EBL-5	EBL-6	EBL-7

[0315]

		
EBL-8	EBL-9	EBL-10
		
EBL-15	EBL-16	EBL-17

[0316] B-2)本发明化合物EBL-12、EBL-13和EBL-14与根据现有技术的化合物EBL-11的比较

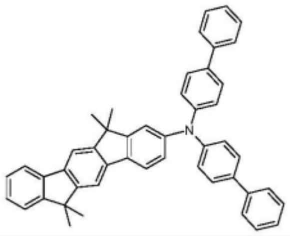
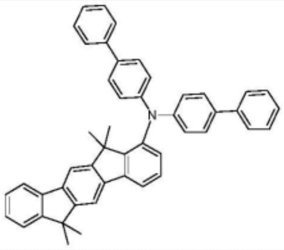
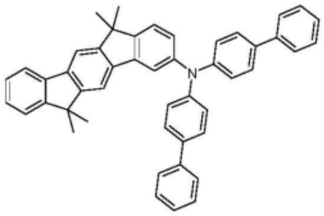
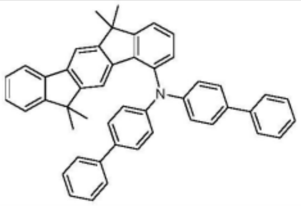
[0317] OLED实施例E-12、E-13和E-14在电子阻挡层中各自含有本发明化合物EBL-12、EBL-13和EBL-14之一。比较实施例OLED E-11在电子阻挡层中含有化合物EBL-11。与比较OLED E11相比，发现OLED E-12、E-13和E-14的EQE值更高。更具体地说，在本发明OLED E-14的情况下，获得大于16％的在10mA/cm^{2}下的EQE，而在比较实施例E-11的情况下，获得小于15％的在10mA/cm^{2}下的EQE，两种情况下的电压均为4.1V。

[0318]

表 1b：器件构造

实施例	HIL	HTL	EBL	EML	ETL	EIL
	厚度/nm	厚度/nm	厚度/nm	厚度/nm	厚度/nm	厚度/nm
E-11 (比较)	HTM:p 型掺杂剂(5%) 20 nm	HTM 220 nm	EBL-11 10 nm	TMM-1:TMM-2 (28%):TEG (12%) 30 nm	ETM:LiQ (50%) 30 nm	LiQ 1 nm
E-12	见上	见上	EBL-12 10 nm	见上	见上	见上
E-13	见上	见上	EBL-13 10 nm	见上	见上	见上
E-14	见上	见上	EBL-14 10 nm	见上	见上	见上

[0319]

表 3b：所用材料		
		
EBL-11	EBL-12	EBL-13
		
EBL-14		

[0320] B-3)本发明化合物在蓝色荧光OLED中的用途

[0321] OLED实施例E-19和E-20具有表1c中所示的层结构，在每种情况下，本发明化合物EBL-15或EBL-16(参见表3c)之一存在于EBL中。

[0322] 在所有情况下，本发明的OLED在工作电压、寿命和EQE方面都达到良好的结果(表2c)。

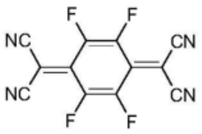
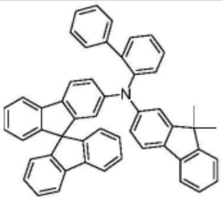
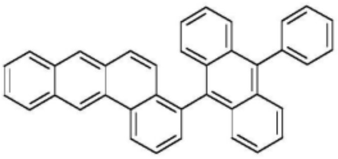
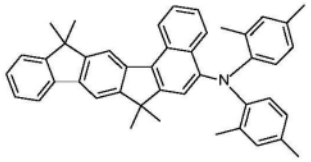
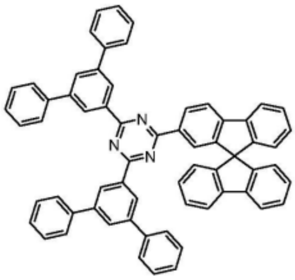
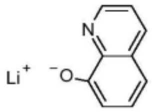
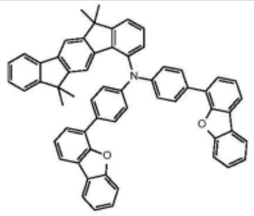
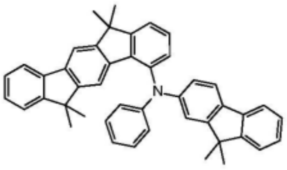
[0323]

表 1c：器件构造						
实施例	HIL	HTL	EBL	EML	ETL	EIL
	厚度/nm	厚度/nm	厚度/nm	厚度/nm	厚度/nm	厚度/nm
E-19	HTM:p 型掺杂剂(5%) 20 nm	HTM 180 nm	EBL-15 10 nm	SMB-1:SEB-1 (5%) 20 nm	ETM:LiQ (50%) 30 nm	LiQ 1 nm
E-20	见上	见上	EBL-16 10 nm	见上	见上	见上

[0324]

表 2c：OLED 的数据			
实施例	U	10 mA/cm^2 下的 EQE	60 mA/cm^2 下的 LT80
	[V]	[%]	[h]
E-19	4.0	约 8.5	约 350
E-20	4.0	约 8.5	约 350

[0325]

表 3c：所用材料		
		
p 型掺杂剂	HTM	SMB-1
		
SEB-1	ETM	LiQ
		
EBL-15	EBL-16	