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(54) Title: POLYMERIZATION CATALYSTS FOR PRODUCING POLYMERS WITH HIGH COMONOMER INCORPORATION

(57) Abstract: The present techniques relate to catalyst compositions, methods, and polymers encompassing a Group 4 metallocene compound comprising bridged 5-cyclopentadienyl-type ligands, typically in combination with a cocatalyst, and an activator. The bridged 5-cyclopentadienyl-type ligands are connected by a cyclic substituent. The catalysts of the present techniques may be more effective at the incorporation of comonomers into the backbone of a polyolefin polymer.



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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2008/011055

A. CLASSIFICATION OF SUBJECT MATTER

INV. C08F10/00 C08F4/6592 C07F17/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C08F C07F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ALT, HELMUT G. ET AL: "Syndiospecific polymerization of propylene: new metallocene complexes of type (C ₁₃ H ₈ -nR _n CR'R''C ₅ H ₄)MC ₁₂ (n = 0,2; R = Alkyl, Aryl, Hal; R', R'' = H, Alkyl, Aryl; M = Zr, Hf) with special regard for different bridge substituents" JOURNAL OF ORGANOMETALLIC CHEMISTRY, 518(1-2), 7-15 CODEN: JORCAI; ISSN: 0022-328X, 1996, XP008098921 examples 3b,3c; table 4	1,2,8, 12,15, 17,20
X	EP 1 138 687 A1 (MITSUI CHEMICALS, INC., JAPAN MITSUI CHEMICALS, INC., JAPAN) 4 October 2001 (2001-10-04) page 232 - page 233; example 22 ----- -/--	1,2,8, 12,15, 17,20,22

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *Z* document member of the same patent family

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26/05/2009

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2007/179044 A1 (YANG QING [US] ET AL) 2 August 2007 (2007-08-02) figure 1 -----	1-25
A	WO 92/09640 A (IDEMITSU KOSAN CO [JP]) 11 June 1992 (1992-06-11) page 7, line 5 - line 17 examples 9-18 -----	1-25

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2008/011055

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
1-25 (in part)

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=C, Cyc=C5 and one substituent on X1 or X2 is an alkyl group

2. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=C, Cyc=C5 and one substituent on X1 or X2 is an alkyl group

3. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=C, Cyc=C6 and one substituent on X1 or X2 is an alkyl group

4. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=C, Cyc=C4 and one substituent on X1 or X2 is an alkenyl group

5. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=C, Cyc=C5 and one substituent on X1 or X2 is an alkenyl group

6. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=C, Cyc=C6 and one substituent on X1 or X2 is an alkenyl group

7. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Si, Cyc=C4 and one substituent on X1 or X2 is an alkyl group

8. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Si, Cyc=C5 and one substituent on X1 or X2 is an alkyl group

9. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Si, Cyc=C6 and one substituent on X1 or X2 is an alkyl group

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

10. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Si,
Cyc= C4 and one substituent on X1 or X2 is an alkenyl group

11. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Si,
Cyc= C5 and one substituent on X1 or X2 is an alkenyl group

12. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Si,
Cyc= C6 and one substituent on X1 or X2 is an alkenyl group

13. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Ge,
Cyc= C4 and one substituent on X1 or X2 is an alkyl group

14. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Ge,
Cyc= C5 and one substituent on X1 or X2 is an alkyl group

15. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Ge,
Cyc= C6 and one substituent on X1 or X2 is an alkyl group

16. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Ge,
Cyc= C4 and one substituent on X1 or X2 is an alkenyl group

17. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Ge,
Cyc= C5 and one substituent on X1 or X2 is an alkenyl group

18. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Ge,
Cyc= C6 and one substituent on X1 or X2 is an alkenyl group

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

19. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Sn,
Cyc= C4 and one substituent on X1 or X2 is an alkyl group

20. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Sn,
Cyc= C5 and one substituent on X1 or X2 is an alkyl group

21. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Sn,
Cyc= C6 and one substituent on X1 or X2 is an alkyl group

22. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Sn,
Cyc= C4 and one substituent on X1 or X2 is an alkenyl group

23. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Sn,
Cyc= C5 and one substituent on X1 or X2 is an alkenyl group

24. claims: 1-25 (in part)

The subject matter of claims 1-25 (in part) where E=Sn,
Cyc= C6 and one substituent on X1 or X2 is an alkenyl group

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1138687	A1	04-10-2001	CN 1327448 A 19-12-2001
			DE 60034308 T2 20-12-2007
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