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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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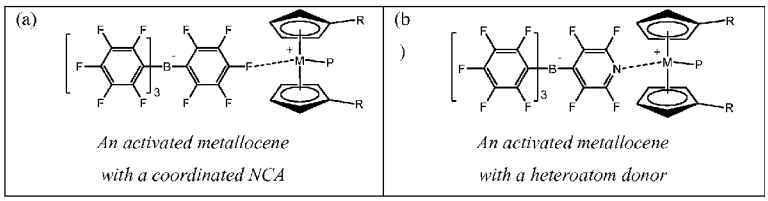
4 April 2013

(54) Title: CATALYST SYSTEMS COMPRISING MULTIPLE NON-COORDINATING ANION ACTIVATORS AND METHODS FOR POLYMERIZATION THEREWITH

Figure 1

Ion pairing between activated catalysts and NCAs.



(57) Abstract: This invention relates to a method to polymerize olefins comprising contacting olefins with a catalyst system comprising a transition metal catalyst compound and at least two boron containing NCA activators represented by the formula: Z_d^+ (A^{d-}), where Z is (L- H) or a reducible Lewis acid, wherein L is a neutral Lewis base; H is hydrogen; (L-H) is a Bronsted acid; A^{d-} is a boron containing non-coordinating anion having the charge d-; d is 1, 2, or 3; and where in the first NCA activator Z is a Bronsted acid and in the second NCA activator Z is a reducible Lewis acid. This invention also relates to a method to polymerize olefins comprising contacting olefins with a catalyst system comprising a transition metal catalyst compound and at least two NCA activators, where at least one NCA activator is as described in Formula I and at least one NCA activator is not as described in Formula I. This invention also relates to a method to polymerize olefins where the two NCA activators are as described in Formula I except that the N in the second NCA in the ArNHal is at a different position in the nitrogen containing aromatic ring than the N in the first NCA.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

B01J 31/12(2006.01)i, C07F 5/02(2006.01)i, C07F 7/08(2006.01)i

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)

B01J 31/12; C07F 17/00; C08F 4/80; C08F 4/72; C08F 4/655; B01J 31/00; C08F 4/44; B01J 32/00

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

Korean utility models and applications for utility models
Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: catalyst, non-coordinating anion, activator, boron, transition metal, Lewis acd, Lewis base, Bronsted acid

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2006-0009595 A1 (FRANCIS C. RIX et al.) 12 January 2006 See claims 1, 40-41, 46, 50, 111	1-3,11-15,22-24
A	US 2009-0264608 A1 (YASUO WAKATSUKI et al.) 22 October 2009 See abstract; tables 1-3; claims 1-5	1-3,11-15,22-24
A	US 6211105 B1 (MATTHEW W. HOLTCAMP) 03 April 2001 See abstract; column 2, line 43 - column 3, line 27; claims 1-2	1-3,11-15,22-24
A	US 05153157 A (GREGORY G. HLATKY et al.) 06 October 1992 See abstract; claims 1-12	1-3,11-15,22-24

☐ 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 application or patent 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 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
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 DECEMBER 2012 (26.12.2012)	**27 DECEMBER 2012 (27.12.2012)**

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/039075

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.: 8,19,27
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:

Claims 8, 19 and 27 refer to claims 7, 18 and 26, respectively. However, claims 7, 18 and 26 do not comply with PCT Rule 6.4(a), and thus they are not searchable, nor are their dependent claims 8, 19 and 27.

3. ☒ Claims Nos.: 4-7,9-10,16-18,20-21,25-26,28-29
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:

1. ☐ As all required addtional 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 fee, this Authority did not invite payment of any additional fee.

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.:

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.

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