

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
27 March 2008 (27.03.2008)

PCT

(10) International Publication Number
WO 2008/036594 A3

- (51) **International Patent Classification:**
C08F 10/00 (2006.01) *C08F 4/659* (2006.01)
- (21) **International Application Number:**
PCT/US2007/078629
- (22) **International Filing Date:**
17 September 2007 (17.09.2007)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
60/846,065 20 September 2006 (20.09.2006) US
60/869,967 14 December 2006 (14.12.2006) US
- (71) **Applicant (for all designated States except US):** **ALBEMARLE CORPORATION** [US/US]; 451 Florida Street, Baton Rouge, LA 70801-1765 (US).
- (72) **Inventors; and**
- (75) **Inventors/Applicants (for US only):** **LUO, Lubin** [US/US]; 649 Charnforth Drive, Baton Rouge, LA 70810 (US). **DIEFENBACH, Steven, P.** [US/US]; 1457 Bullrush Drive, Baton Rouge, LA 70810 (US).
- (74) **Agents:** **HOEFLING, Marcy, M.** et al.; Albemarle Corporation, 451 Florida Street, Baton Rouge, LA 70801-1765 (US).

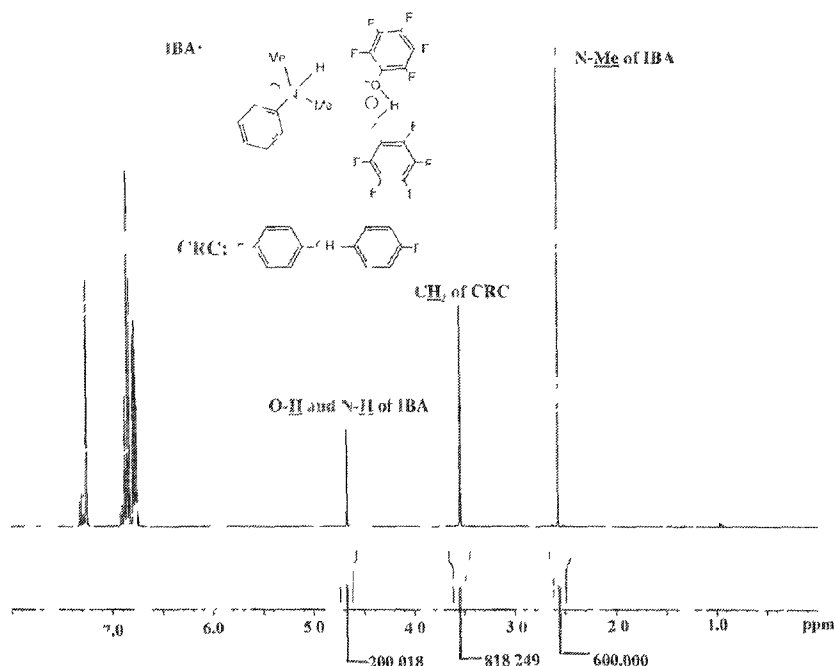
- (81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FT, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW
- (84) **Designated States (unless otherwise indicated, for every kind of regional protection available):** ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, **DK**, EE, ES, FI, FR, GB, GR, HU, IE, **IS**, IT, LT, LU, LV, MC, MT, NL, PL, PT, **RO**, SE, **SI**, SK, TR), OAPI (BF, **BJ**, CF, CG, CI, CM, GA, GN, GQ, GW, ML, **MR**, NE, SN, TD, TG).

Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(U))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(Hi))

[Continued on next page]

(54) **Title:** CATALYST ACTIVATORS, PROCESSES FOR MAKING SAME, AND USE THEREOF IN CATALYSTS AND POLYMERIZATION OF OLEFINS



(57) **Abstract:** Compositions useful for activating catalysts for olefin polymerization are provided. The compositions are derived from at least carrier having at least two hydrogen bonded hydroxyl groups, organoaluminum compound, Lewis base, and Bronsted acid, wherein the Lewis base and the Bronsted acid form at least one ionic Bronsted acid.



Published:

- *with international search report*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(88) Date of publication of the international search report:

24 July 2008

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/078629

A. CLASSIFICATION OF SUBJECT MATTER
INV. C08F10/00 C08F4/659

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

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 D.ata

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category ¹	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No
X	WO 01/90112 A (BASELL POLYOLEFINE GMBH [DE]; SCHOTTEK JOERG [DE]) 29 November 2001 (2001-11-29) page 66 - page 69 -----	1-5
A	DATABASE CAPLUS [Online] CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; FUJITA, MASAYUKI ET AL: "Catalysts for polymerization of .alpha.-olefins and manufacture of .alpha.-olefin polymers" XP002385149 retrieved from STN Database accession no. 2001:842313 abstract & JP 2001 323009 A (SUMITOMO CHEMICAL CO., LTD., JAPAN) 20 November 2001 (2001-11-20) ----- -/--	1-5

☒ 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

"&" document member of the same patent family

Date of the actual completion of the international search

13 February 2008

Date of mailing of the international search report

02/06/2008

Name and mailing address of the ISA/
European Patent Office, P B 5818 Palenlaan 2
NL - 2280 HV Rijswijk
Tel (+31-70) 340-2040 Tx 31 651 epo nl
Fax (+31-70) 340-3016

Authorized officer

Parry, Julian

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2007/078629

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document with indication where appropriate of the relevant passages	Relevant to claim No
A	<p>DATABASE CAPLUS [Online] CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; ISHIHARA, NOBUHIDE ET AL: "Al umi noxane-contai ni ng polymeri zati on catalysts for olefi ns" XP002385148 retrieved from STN Database accessi on no. 1995: 408683 abstract 6 JP 06 329714 A (IDEMITSU KOSAN CO, JAPAN) 29 November 1994 (1994-11-29)</p> <p>-----</p>	1-5
A	<p>STAPLETON R A ET AL: "BULKY ALUMINUM ALKYL SCAVENGERS IN OLEFIN POLYMERIZATION WITH GROUP 4 CATALSYSTS" JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, AMERICAN CHEMICAL SOCIETY, WASHINGTON, DC, US, vol . 125, no. 31, 7 December 2003 (2003-12-07), pages 9246-9247, XP008063176 ISSN: 0002-7863 the whole document</p> <p>-----</p>	1-5
P,A	<p>WO 2007/005921 A (ALBEMARLE CORP [US]; LUO LUBIN [US]; DIEFENBACH STEVEN P [US]; MATHUR) 11 January 2007 (2007-01-11) paragraph [0135] paragraph [0151]</p> <p>-----</p>	1-5
P,A	<p>WO 2007/005676 A (ALBEMARLE CORP [US]; LUO LUBIN [US]; LEE JOHN Y [US]; DIEFENBACH STEVE) 11 January 2007 (2007-01-11) figure 1</p> <p>-----</p>	1-5
P,A	<p>WO 2007/076398 A (ALBEMARLE CORP [US]; LUO LUBIN [US]; DIEFENBACH STEVEN P [US]; WANG ZH) 5 July 2007 (2007-07-05) page 49 - page 51</p> <p>-----</p>	1-5

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/078629

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 allsearchable claimft. -
- 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 reportcovers only those clams 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

1-5

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: 1-5

The subject matter of claims 1-5.

2. claims: 6-21,25,31 and 32

The subject matter of claims 6-21,25,31 and 32.

3. claims: 22-23

The subject matter of claims 22-23.

4. claim: 24

The subject matter of claim 24.

5. claims: 26-29

The subject matter of claims 26-29.

6. claim: 30

The subject matter of claim 30.

7. claim: 33

The subject matter of claim 33.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2007/078629

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0190112	A	29-11-2001	AT 258178 T	15-02--2004
			AU 6599701 A	03-12--2001
			BR 0110099 A	14-01--2003
			CN 1427842 A	02-07--2003
			DE 10025412 A1	29-11--2001
			EP 1290002 A1	12-03--2003
			ES 2214428 T3	16-09--2004
			JP 2003534346 T	18-11--2003
			US 2003144434 A1	31-07--2003
<hr/>				
JP 2001323009	A	20-11-2001	NONE	
<hr/>				
JP 6329714	A	29-11-1994	JP 3196419 B2	06-08-2001
<hr/>				
WO 2007005921	A	11-01-2007	NONE	
<hr/>				
WO 2007005676	A	11-01-2007	NONE	
<hr/>				
WO 2007076398	A	05-07-2007	NONE	
<hr/>				