

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
12 May 2011 (12.05.2011)

(10) International Publication Number  
**WO 2011/056884 A3**

(51) International Patent Classification:

C07F 1/02 (2006.01) C07C 2/34 (2006.01)  
C07F 3/02 (2006.01) C07C 11/00 (2006.01)  
B01J 31/22 (2006.01)

(21) International Application Number:

PCT/US2010/055313

(22) International Filing Date:

3 November 2010 (03.11.2010)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

61/259,521 9 November 2009 (09.11.2009) US

(71) Applicant (for all designated States except US):

**EXXONMOBIL CHEMICAL PATENTS INC.**  
[US/US]; 5200 Bayway Drive, Baytown, TX 77520 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **HAGADORN, John, R.** [US/US]; 4838 Knickerbocker Street, Houston, TX 77035 (US). **HOLTCAMP, Matthew, W.** [US/US]; 26935 Carol Drive, Huffman, TX 77336 (US). **BEDOYA, Matthew, S.** [US/US]; 5719 Timbers Trail

Drive, Humble, TX 77346 (US). **GANESH, Renuka, N.** [US/US]; 3001 Murworth Street # 1404, Houston, TX 77025 (US).

(74) Agents: **BOONE, Anthony, G.** et al.; Exxonmobil Chemical Company, P.O.Box 2149, Baytown, TX 77522-2149 (US).

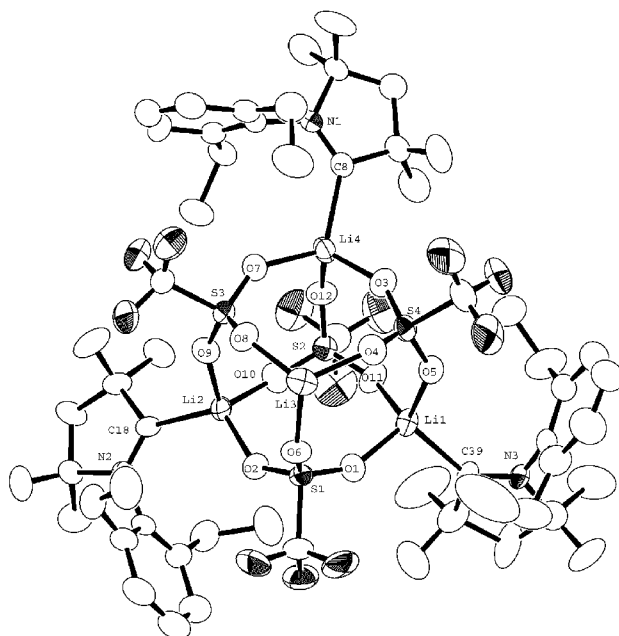
(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, 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, RO, RS, RU, 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.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,

[Continued on next page]

(54) Title: CARBENE COMPLEXES OF LITHIUM AND/OR MAGNESIUM METAL SALTS, AND USES THEREOF

Figure 1



(57) Abstract: This invention relates to a carbene complex of metal salt represented by the formula:  $[T-M(R)_c]_n$  wherein, R is a monoanionic group; c is 1 or 2; M is a Li or Mg; T is a cyclic carbene ligand; and n is selected from the group of integers comprising 1 to 24 wherein the complex has 50% or less decomposition when stored in 0.01 molar benzene at 23°C for a period of 1 hour. This invention also relates to transition-metal-carbene complexes prepared from such carbene complexes of metal salts, where the transition-metal-carbene complex is represented by the formula:  $[M^*(T)(L^0)_q(L^1)_s(L^2)_t]_g^z$ , where M\* is a transition metal from Group 6, 7, 8, 9, 10, 11 or 12, T is a cyclic carbene ligand, L<sup>0</sup> is a neutral ligand, L<sup>1</sup> is a monoanionic ligand, L<sup>2</sup> is a dianionic ligand, q is 0, 1, 2, 3 or 4, s is 0, 1, 2, 3, or 4, t is 0, 1, 2, 3, or 4, g is the overall charge of the molecule. The transition-metal-carbene complexes may be used for synthesis reactions, including metathesis of olefins.



LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

**Declarations under Rule 4.17:**

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

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

9 September 2011

## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/US2010/055313****A. CLASSIFICATION OF SUBJECT MATTER***C07F 1/02(2006.01)i, C07F 3/02(2006.01)i, B01J 31/22(2006.01)i, C07C 2/34(2006.01)i, C07C 11/00(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)

C07F 1/02; C07F 15/00; C07C 209/00

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) &amp; Keywords: cyclic alkyl amino carbene, transition metal carbene complex, Li carbene complex precursor

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Polly L. Arnold et al., Chemical Communications, 2004, pp 1612-1613. See compounds 2b and 3b.	1-3, 15, 16
X	F. Ekkehardt Hahn and Mareike C. Jahnke, Angewandte Chemie International Edition, Vol. 47, 2008, pp 3122-3172. See Schemes 7, 28, 52 and 63.	1-3, 15, 16
X	Polly L. Arnold et al., Angewandte Chemie International Edition, Vol. 42, 2003, pp 5981-5984. See compounds 3 and 6.	1-3, 15, 16
X	Robert Fraenkel et al., Angewandte Chemie International Edition, Vol. 40(10), 2001, pp 1907-1910. See compounds 6-8.	1-3
X	Pierre de Fremont et al., Journal of Organometallic Chemistry, Vol. 694, 2009(available online 6 Nov. 2008), pp 551-560. See compounds 1, 4-10 and 12-15.	15, 16
X	US 7312331 B2 (Guy Bertrand et al.) 25 December 2007. See example 4.	15, 16

 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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

20 JULY 2011 (20.07.2011)

Date of mailing of the international search report

**20 JULY 2011 (20.07.2011)**

Name and mailing address of the ISA/KR

Korean Intellectual Property Office  
Government Complex-Daejeon, 189 Cheongsu-ro,  
Seo-gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

CHANG, BONG HO

Telephone No. 82-42-481-3353



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2010/055313

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.: 12, 17-25  
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:  
i) Claim 12 refers to a multiple dependant claim that refers to other multiple dependant claims, therefore, the meaning of the technical feature to which it refers is vague and unclear. ii) It is difficult to define the meaning of the term 'any of paragraphs 1-14' used in claims 17-25, rendering these claims unclear.
- 3.  Claims Nos.: 4-11, 13, 14, 22-25  
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 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 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.

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2010/055313**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7312331 B2	25.12.2007	CA 2611791 A1	28.12.2006
		CN 101228103 A	23.07.2008
		CN 101228103 G0	23.07.2008
		EP 1910253 A2	16.04.2008
		EP 1910253 A4	07.07.2010
		JP 2008-546693 A	25.12.2008
		JP 2008-546693 T	25.12.2008
		KR 10-2008-0016668 A	21.02.2008
		US 2007-0004917 A1	04.01.2007
		WO 2006-138166 A2	28.12.2006
		WO 2006-138166 A3	28.12.2006