



(51) International Patent Classification:

C07C 5/333 (2006.01) *C07C 11/06* (2006.01)
C07C 5/32 (2006.01) *B01J 21/18* (2006.01)

(21) International Application Number:

PCT/US2012/039146

(22) International Filing Date:

23 May 2012 (23.05.2012)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

PCT/US2011/0038334	27 May 2011 (27.05.2011)	US
PCT/US2011/0038327	27 May 2011 (27.05.2011)	US
61/496,326	13 June 2011 (13.06.2011)	US
61/502,390	29 June 2011 (29.06.2011)	US
61/523,059	12 August 2011 (12.08.2011)	US
61/564,126	28 November 2011 (28.11.2011)	US
61/564,135	28 November 2011 (28.11.2011)	US

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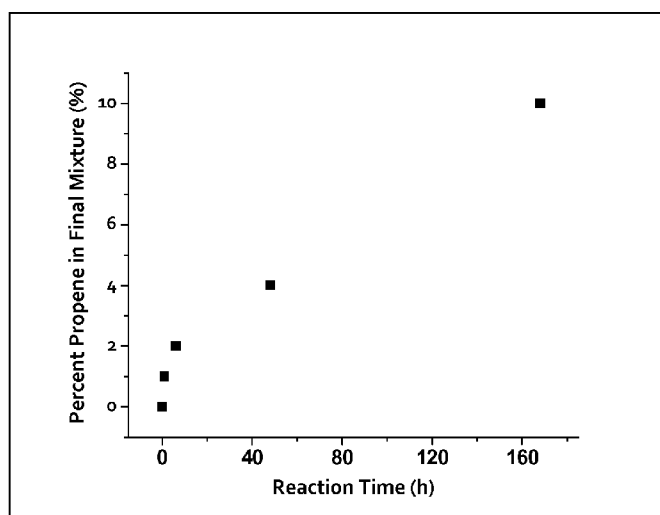
(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG,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

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH,

[Continued on next page]

(54) Title: PRODUCTION OF PROPENE

FIGURE 4



Propane-to-propene conversion as a function of reaction time.

(57) Abstract: The disclosure relates to catalytically active carbocatalysts, e.g., a graphene oxide or graphite oxide catalyst suitable for use in production of propene.



GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, 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, 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 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:

7 March 2013

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/039146**A. CLASSIFICATION OF SUBJECT MATTER***C07C 5/333(2006.01)i, C07C 5/32(2006.01)i, C07C 11/06(2006.01)i, B01J 21/18(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)

C07C 5/333; C07C 45/28; C07C 51/25

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: propane, propene, graphene oxide, graphite oxide, surface-modified, carbocatalyst.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
T	TANG, SHAOBIN et al., "Site-dependent catalytic activity of graphene oxides towards oxidative dehydrogenation of propane", Phys. Chem. Chem. Phys. 2012, Vol. 14, 16558-16565. (19 June 2012) See the whole document, especially abstract.	1-16, 19-38
PX	CHAUHAN, SHIVE MURAT SINGH et al., "Use of Graphite Oxide and Graphene Oxide as Catalysts in the Synthesis of Dipyrromethane and Calix[4]pyrrole", Molecules 2011, Vol. 16, 7256-7266. (25 August 2011)	19
PA	See abstract.	1-16, 20-38
X	US 7723549 B2 (DIEFENBACHER, ARMIN et al.) 25 May 2010 See column 12, lines 43-44; column 46, line 57-column 48, line 47;	13-16, 20, 36, 38
A	claim 1.	1-12, 19, 21-35, 37
X	DREYER, DANIEL R. et al., "Graphene Oxide: A Convenient Carbocatalyst for Facilitating Oxidation and Hydration Reactions", Angew. Chem. 2010, Vol. 122, 6965-6968.	19
A	See Figure 1.	1-16, 20-38



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

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"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

27 DECEMBER 2012 (27.12.2012)

Date of mailing of the international search report

02 JANUARY 2013 (02.01.2013)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
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City, 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

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Telephone No. 82-42-481-8647



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2012/039146

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ZHU, YANWU et al., "Graphene and Graphene Oxide: Synthesis, Properties, and Applications", Advanced Materials 2010, Vol. 22, 3906-3924.	19
A	See "Introduction".	1-16,20-38
A	LIANG, CHENGDU et al., "Open-Cage Fullerene-like Graphitic Carbons as Catalysts for Oxidative Dehydrogenation of Isobutane", J. Am. Chem. Soc. 2009, Vol. 131, 7735-7741. See the whole document.	1-16,19-38
A	ZHANG, JIAN et al., "Surface-Modified Carbon Nanotubes Catalyze Oxidative Dehydrogenation of n-Butane", Science 2008, Vol. 322, 73-77. See the whole document.	1-16,19-38

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2012/039146**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.: **17-18**
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/US2012/039146

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7723549 B2	25.05.2010	CN 101175708 A0 EP 1881952 A1 JP 2008-540492 A KR 10-2008-0015104 A US 2006-0258529 A1 WO 2006-120233 A1	07.05.2008 30.01.2008 20.11.2008 18.02.2008 16.11.2006 16.11.2006