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**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))

**Published:**

- with international search report (Art. 21(3))

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16 July 2015

(54) Title: CATALYST COMPOSITION AND PROCESS FOR OLIGOMERIZATION OF ETHYLENE

(57) Abstract: A catalyst composition including: (a) a chromium compound; (b) a ligand of the general structure (A) R<sub>1</sub>R<sub>2</sub>P-N(R<sub>3</sub>)-P(R<sub>4</sub>)-NR<sub>5</sub>R<sub>6</sub> or (B) R<sub>1</sub>R<sub>2</sub>P-N(R<sub>3</sub>)-P(XR<sub>7</sub>)R<sub>8</sub> or R<sub>1</sub>R<sub>2</sub>P-N(R<sub>3</sub>)-P(XR<sub>7</sub>)<sub>2</sub>, with X = O or S, wherein R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>4</sub>, R<sub>5</sub>, R<sub>6</sub>, R<sub>7</sub> and R<sub>8</sub> are independently C<sub>1</sub>-C<sub>10</sub>-alkyl, C<sub>6</sub>-C<sub>20</sub>-aryl, C<sub>3</sub>-C<sub>10</sub>-cycloalkyl, aralkyl, alkylaryl, or trialkylsilyl, or any cyclic derivatives of (A) and (B), wherein at least one of the P or N atoms of the PNP-unit or PNP-unit is a member of the ring system, the ring system being formed from one or more constituent compounds of structures (A) or (B) by substitution; and (c) an activator or co-catalyst; and a process for tri- and/or tetramerization.



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# INTERNATIONAL SEARCH REPORT

International application No PCT/IB2014/063485
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<b>A. CLASSIFICATION OF SUBJECT MATTER</b> INV. B01J31/18      B01J31/14      C07C2/36 ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) B01J C07C
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 practicable, search terms used)
EPO-Internal, CHEM ABS Data, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/173226 A1 (BLANN KEVIN [ZA] ET AL) 3 August 2006 (2006-08-03) paragraphs [0029], [0038], [0041], [0042], [0051]; claims 2,16,18,19,25,27-32,34,41,43,46,48-55 -----	1-15
X	WO 02/04119 A1 (BP CHEM INT LTD [GB]; WASS DUNCAN FRANK [GB]) 17 January 2002 (2002-01-17) page 4, lines 2-18; claims 7-10,17,19,26 -----	1-15
X	EP 2 106 854 A1 (SAUDI BASIC IND CORP [SA]; LINDE AG [DE]) 7 October 2009 (2009-10-07) paragraphs [0016], [0042], [0043], [0047] - [0050]; claims 1,14,15 ----- -/--	1-15

<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.	<input checked="" type="checkbox"/> See patent family annex.
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* 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 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
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Date of the actual completion of the international search  29 December 2014	Date of mailing of the international search report  02/04/2015
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Goebel, Matthias
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**INTERNATIONAL SEARCH REPORT**

International application No PCT/IB2014/063485
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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.
A	EP 2 167 231 B1 (LINDE AG [DE]; SAUDI BASIC IND CORP [SA]; MUELLER BERND H [DE] LINDE A) 26 September 2012 (2012-09-26) the whole document -----	1-15
A	WO 2008/077908 A1 (SHELL INT RESEARCH [NL]; DE BOER ERIC JOHANNES MARIA [NL]; VAN DER HEI) 3 July 2008 (2008-07-03) pages 46-47; compound D" pages 48-49; compound F pages 62-64; examples 15, 17-20; table 1; compounds D', F -----	1, 11, 12

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/IB2014/063485

## 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.:
  
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.:

1-15(partially)

### 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: 1-15(partially)

insofar as relating to a catalyst composition comprising ligand of general structure (A); any reaction products arising therefrom; a process for tri- and/or tetramerization of ethylene using it.

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2. claims: 1-15(partially)

insofar as relating to a catalyst composition comprising ligand of general structure (B), 1st alternative; any reaction products arising therefrom; a process for tri- and/or tetramerization of ethylene using it.

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3. claims: 1-5, 7-15(all partially)

insofar as relating to a catalyst composition comprising ligand of general structure (B), 2nd alternative; any reaction products arising therefrom; a process for tri- and/or tetramerization of ethylene using it.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2014/063485

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