

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
7 January 2010 (07.01.2010)

PCT

(10) International Publication Number
WO 2010/000557 A3

(51) International Patent Classification:
C08F 10/00 (2006.01) *F16L 9/12* (2006.01)
C08F 210/02 (2006.01)

(21) International Application Number:
PCT/EP2009/056882

(22) International Filing Date:
4 June 2009 (04.06.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
08157848.6 9 June 2008 (09.06.2008) EP

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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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, 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, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, 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(ii))
- of inventorship (Rule 4.17(iv))

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))

(88) Date of publication of the international search report:
4 March 2010

(54) Title: NOVEL COPOLYMERS

(57) Abstract: Novel copolymers are described comprising ethylene and alpha-olefins having (a) a density (D) in the range 930 - 960 kg/m³ (b) a melt index (MI₂) in the range 0.1 - 3.5 g/10 min (c) a melt elastic modulus G' (G''= 500 Pa) in the range 40 to 150 Pa, and (d) a ratio of complex dynamic shear viscosities $\eta^*(0.1)/\eta^*(100)$ in the range 1.5 to 5.5. The novel copolymers are particularly suitable for use as Polyethylenes of Raised Temperature Resistance (PE-RT) for use in hot water piping systems. The novel copolymers may be prepared by use of metallocene catalyst systems. Pipes having a time to failure of ≥ 500 hrs measured according to ISO 1167 at 110°C and 2.6 MPa prepared in a single reactor are also disclosed.



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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
INV. C08F10/00 C08F210/02 F16L9/12

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 F16L

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2005/228139 A1 (LEE KI S [KR] ET AL LEE KI SOO [KR] ET AL) 13 October 2005 (2005-10-13) page 7, paragraph 114 - paragraph 115; claims 1,3,5,7,8 paragraphs [0003], [0017], [0068], [0069], [0114], [0115] examples 1,2; table 1	1-14, 17-29
A	WO 03/020821 A (DOW GLOBAL TECHNOLOGIES INC [US]; SCHRAMM DETLEF [CH]; QUACK WOLFGANG) 13 March 2003 (2003-03-13) claims 1,9,10 page 1, line 3 - line 6 page 2, line 13 - line 28 page 3, line 24 - line 29	1-10, 17-29
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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 January 2010	Date of mailing of the international search report 20/01/2010
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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 Lippert, Sigrid
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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2009/056882

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 1 760 096 A (INEOS MFG BELGIUM NV [BE]) 7 March 2007 (2007-03-07) the whole document	1-10, 17-29
A	WO 2005/049665 A (SOLVAY [BE]; GROSJEAN ABEL [US]; SANDSTRUM STEVEN DON [US]; ZIMMERMAN) 2 June 2005 (2005-06-02) the whole document	1-10, 17-29
A	WO 2006/085051 A (INEOS EUROPE LTD [GB]; CHAI CHOON KOOI [BE]) 17 August 2006 (2006-08-17) the whole document	1-10, 17-29
A	WO 2006/053709 A (INNOVENE MFG BELGIUM NV [BE]; LAMBERT YVES-JULIEN [BE]; FREDERICH ANDR) 26 May 2006 (2006-05-26) the whole document	1-10, 17-29
A	WO 2007/022908 A2 (BASELL POLYOLEFINE GMBH [DE]; BERTHOLD JOACHIM [DE]; VOGT HEINZ [DE];) 1 March 2007 (2007-03-01) the whole document	11-14, 17-29
A	US 2004/198911 A1 (VAN DUN JOZEF J [US] ET AL) 7 October 2004 (2004-10-07) the whole document	11-14, 17-29
A	EP 1 764 389 A1 (BOREALIS TECH OY [FI]) 21 March 2007 (2007-03-21) the whole document	11-14, 17-29

INTERNATIONAL SEARCH REPORT

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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.:
1-14, 17-29
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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-10, 17-29

Invention I is based on a copolymer of ethylene and an alpha olefin said copolymer characterized in having (a) a density (D) in the range 930-960 kg/cm³, (b) a melt index (MI₂) in the range 0.1-3.5 g/10min, (c) a melt elastic modulus G' (G''=500Pa) in the range 40-150 Pa and (d) a ratio of complex dynamic shear viscosities $\eta^*(0.1)/\eta^*(100)$ in the range 1.5-5.5.

2. claims: 11-14, 17-29

Invention II is based on a copolymer of ethylene and an alpha olefin said copolymer characterized in having (a) a density (D) in the range 930-960 kg/cm³, (b) a melt index (MI₂) in the range 0.1-3.5 g/10min and (c) a particular balance of high temperature creep resistance and products flexibility performance characterized by the equation as defined in claims 11-14.

3. claims: 15-29

Invention III is based on a copolymer of ethylene and an alpha olefin said copolymer characterized in having (a) a density (D) in the range 930-960 kg/cm³, (b) a melt index (MI₂) in the range 0.1-3.5 g/10min and (c) a particular critical frequency (in Hz) of activation of high temperature performances characterized by the equation as defined in claims 15 and 16.

4. claim: 30

Invention IV is based on a pipe having a particular time to failure (ISO 1167) and comprising a copolymer of ethylene and an alpha olefin produced in a single reactor.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2009/056882

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