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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :		(11) International Publication Number:
C08F 10/00, 4/655, C08L 23/16 C08J 5/18	**A3**	**WO 93/19105**
		(43) International Publication Date: 30 September 1993 (30.09.93)

(21) International Application Number: PCT/US93/02751

(22) International Filing Date: 17 March 1993 (17.03.93)

(30) Priority data:
07/854,175 20 March 1992 (20.03.92) US

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(81) Designated States: AT, AU, BB, BG, BR, CA, CH, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, LK, LU, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(88) Date of publication of the international search report:
11 November 1993 (11.11.93)

(54) Title: SILICA SUPPORTED TRANSITION METAL CATALYST

(57) Abstract

A transition metal containing catalyst useful for the polymerization of α-olefins is prepared by (A) forming in an inert atmosphere which excludes oxygen and moisture a slurry of (1) a porous inorganic oxide support material selected from the group consisting of silica, alumina, or a combination of silica and alumina, said support material containing not greater than about 5 millimoles of hydroxyl groups per gram of support material and a particle size not greater than about 10 microns and a surface area of from about 50 to about 800 m^2/g in an inert organic liquid medium; (B) mixing said slurry with (2) an alkoxide and stirring the resultant mixture at a temperature of from about -20 °C to about 120 °C for a time sufficient to saturate the surface of the support material; (C) mixing the product form (B) with (3) a titanium compound or a combination of a titanium compound and (4) a vanadium compound and stirring the resultant mixture at a temperature of from about -20 °C to about 120 °C for a time sufficient to allow complete reaction of the titanium compound and the vanadium compound with the organomagnesium moieties remaining on the solid support; (D) mixing the product from (C) with an inert organic solution of (5) a Group IIIA metal alkyl halide at a temperature of from about -20 °C to about 120 °C for a time sufficient to complete the reduction of the titanium and vanadium, if present, compounds to their final oxidation state. Ethylene/alpha-olefin copolymers which have greater than 17 percent high density fraction and an M_w/M_n ratio of less than about 3.6 are shown to be useful in making cast films which have good stretchability and good puncture resistance. Copolymers of the present invention having the specified properties are especially useful in making the films.

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INTERNATIONAL SEARCH REPORT

International Application No PCT/US 93/02751

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 C08F10/00; C08F4/655; C08L23/16; C08J5/18

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	C08F ; C08L ; C08J

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
P,X	WO,A,9 213 009 (THE DOW CHEMICAL COMPANY) 6 August 1992 see the whole document	9-13
A	EP,A,0 435 627 (MOBIL OIL CORPORATION) 3 July 1991 see abstract; claims 1,4,9 see page 2, line 1 - line 6 see page 3, line 53 - page 4, line 3	1
A	GB,A,2 189 252 (CHEMOPETROL KONCERNOVA UCELOVA ORGANIZACE) 21 October 1987 see claims 1-3; table 1	
A	US,A,4 558 024 (STEVEN A. BEST) 10 December 1985 see example 3	

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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

"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

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
08 SEPTEMBER 1993	12.10.93
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	FISCHER B.R.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	EP,A,0 324 588 (MOBIL OIL CORPORATION) 19 July 1989 see example 1	
A	US,A,4 243 619 (FRASER W. A.) 6 January 1981 see example 17	14-24
	JOURNAL OF PLASTIC FILM & SHEETING vol. 4, July 1988, DOHRER K.K. 'Short Chain Branching Distribution of ULDPE' cited in the application see the whole document	
A	EP,A,0 100 689 (SOCIETE CHIMIQUE DES CHARBONNAGES) 15 February 1984 see claims 1,3,5,10 see page 1, line 32 - page 2, line 4	14-24

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 93/ 02751

Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1:Claims 1-13,1-8,9-13
2:Claims 14-24

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 searches 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.

☒ No protest accompanied the payment of additional search fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

US 9302751
SA 72012

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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