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KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
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(54) Title: STABLE ETHYLSILICATE POLYMERS AND METHOD OF MAKING THE SAME

(57) Abstract: Ethylsilicate polymers and a method of making, specifically ethylsilicate polymer binders with reduced levels of reg-
ulated volatile organic compounds (VOCs) for use in the coatings industry and casting industry, and more specifically to stable, fast
cure ethylsilicate polymer binders with low levels of regulated VOCs.



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2015/060977

A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - C09D 183/02 (2016.01) CPC - C09D 183/02 (2016.02) 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) IPC(8) - C09D 5/10, 183/02; C09F 7/04 (2016.01) CPC - C09D 5/106, 183/02 (2016.02) Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched USPC - 106/38.35, 287.16; IPC(8) - C09D 5/10, 183/02; C09F 7/04; CPC - C09D 5/106, 183/02 (keyword delimited) Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) Orbit, Google Patents, Google Scholar. Search terms used: polyethylsilicate, alcohol, ethanol, silica, silicon dioxide, propylene carbonate, tert-butylacetate, parachlorobenzotrifluoride.		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,186,743 A (FLASCH) 16 February 1993 (16.02.1993) entire document	1-46
Y	US 2014/0221567 A1 (AIR PRODUCTS AND CHEMICAL INC) 07 August 2014 (07.08.2014) entire document	1-46
Y	US 4,480,072 A (MALLON) 30 October 1984 (30.10.1984) entire document	36
A	US 2006/0093786 A1 (OHASHI et al) 04 May 2006 (04.05.2006) entire document	1-46
☐ 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 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 10 February 2016		Date of mailing of the international search report 26 FEB 2016
Name and mailing address of the ISA/ Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300		Authorized officer Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2015/060977

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 Extra 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 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.:
1-46

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

International application No.

PCT/US2015/060977

Continued from Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees need to be paid.

Group I: claims 1-46 are drawn to compositions.

Group II: claims 47-60 are drawn to methods thereof.

The inventions listed in Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1, because under PCT Rule 13.2 they lack the same or corresponding special technical features for the following reasons:

The special technical features of Group I, compositions, are not present in Group II; and the special technical features of Group II, methods, are not present in Group I.

The Groups I and II share the technical features of a polyethylsilicate composition comprising: silica; ethanol; propylene carbonate; and an acid. However, these shared technical features do not represent a contribution over the prior art.

Specifically, US 4,480,072 A to Mallon teaches a polyethylsilicate composition comprising: silica; an alcohol; and an acid (See Col. 5, Lns. 14-27, Examples 9-11; Col. 6, Table 3, Example 11; Example 11 has an alcohol comprised of Phenoxy PKHH, a source of silica comprised of ES-40 (20% SiO₂), and sulfuric acid).

Additionally, US 2006/0093786 A1 to Ohashi et al. teach a polyethylsilicate composition comprising: silica; ethanol; propylene carbonate; and an acid (See Para. [0159], "...primary silica particles...was mixed with 36 g of ethanol...aqueous nitric acid solution was further dropwise added thereto while stirring at room temperature; Para. [0120], Specific examples of dispersion mediums include...propylene carbonate...).

The inventions listed in Groups I and II therefore lack unity under Rule 13 because they do not share a same or corresponding special technical feature.