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C08J 9/22 (2006.01) *C08J 5/00* (2006.01)
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C08L 33/06 (2006.01)

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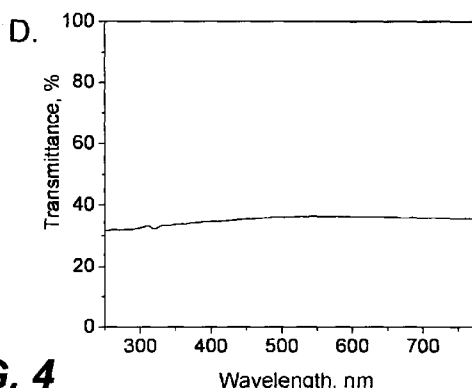
Published:

- with international search report (Art. 21(3))
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(88) Date of publication of the international search report:

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(54) **Title:** SUPERHYDROPHOBIC AND SUPERHYDROPHILIC MATERIALS, SURFACES AND METHODS

**FIG. 4**

(57) **Abstract:** A broadly applicable method requiring no more than a single step facilitates the preparation of large area super hydrophobic or super hydrophilic surfaces on a variety of substrates such as glass, metal, plastic, paper, wood, concrete and masonry. The technique involves the free radical polymerization of common acrylic or styrenic monomers in the presence of porogenic solvents in a mold or on a free surface. The material can be semi- or fully- transparent and either super hydrophobic or super hydrophilic depending on the choice of the monomers. Because porosity and dual scale roughness are intrinsic bulk properties of the monolithic materials and not only a surface characteristic, the polymers can be powdered to produce a super hydrophobic powder or otherwise fragmented and attached to the surface of any object to render it super hydrophobic or super hydrophilic. The surface properties of the porous material may also be altered locally by photografting with selected monomers.

A. CLASSIFICATION OF SUBJECT MATTER

C08J 9/224(2006.01)i, C08J 9/22(2006.01)i, C08L 33/14(2006.01)i, C08L 33/06(2006.01)i, C08L 25/08(2006.01)i, C08J 5/00(2006.01)i, C08K 7/00(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)

IPC C08J, A61M

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)

eKOMPASS(KIPO internal)& Keywords : superhydrophobic, superhydrophilic, porous

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	YING, M. et al. Fabrication of super-hydrophobic film from PMMA. October 2007 See page 7455 paragraph 1st, page 7456 paragraph 2nd lines 11-20, page 7457 paragraph 3th lines 1-5, page 7459 lines 3-19.	1,11,15-16,18,27-28,3 2,34-39,41-46,52-53
X	PAUL ROACH. et al. Progress in superhydrophobic surface development. October 2007 See page 225 paragraph 3th lines 11-17, page 228 paragraph 3th,page 237 paragraph 2nd.	1,11,15-16,18,27-28,3 2,34-39,41-46,52-53
A	US 2007-0005024 A1(JAN WEBER. et al), 04 January 2007 See the whole document.	1-8,11-16.18-28,32-57
A	H,J LEE, Preparation of superhydrophobic rough surface, February 2007 See page 255 paragraph 5th-page 256.	1-8,11-16.18-28,32-57
A	STEFAN SCHELER, A Novel approach to interpretation and prediction of solvent effects. May 2007, See the whole document.	2-8



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 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

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Date of mailing of the international search report

11 JANUARY 2010 (11.01.2010)

Name and mailing address of the ISA/KR



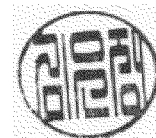
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2009/041277**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.: 9-10,17,29-31
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/US2009/041277Patent document
cited in search reportPublication
datePatent family
member(s)Publication
date

US 2007-0005024 A1

04. 01. 2007

CA 2624980-A1

21. 12. 2006

EP 1890738 A2

27. 02. 2008

JP 2008-545511 A

18. 12. 2008

WO 2006-135755 A2

21. 12. 2006