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(88) Date of publication of the international search report:

19 April 2012

(54) Title: SUPERHYDROPHOBIC AND ANTI-ICING COATING AND METHOD FOR MAKING SAME

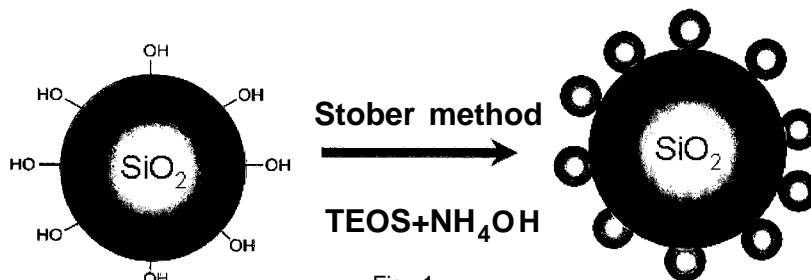


Fig. 1

(57) Abstract: Superhydrophobic and anti-icing coating composed of resin, clustered particles, a solvent, and/ or a surfactant. The clustered particles, ranging in diameter from 0.2 to 5 micrometers, are formed from small individual particles ranging in diameter from 2 to 200 nm that are aggregated into, agglomerated into, assembled into clusters or attached onto larger micrometer-sized particles. The surface of the clustered particles is hydrophobic. The surfactant diffuses to the surface of the resin during the curing of the resin when added to improve the water repellency of the original resin that binds the nanoparticles to a substrate. The coatings made through this method have superior water-repellency and anti-icing properties.



WO 2012/003004 A3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/001172**A. CLASSIFICATION OF SUBJECT MATTER*****C09D 5/00(2006.01)i, C09D 7/12(2006.01)I, C09D 201/00(2006.01)I, B05D 5/00(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)

C09D 5/00; C08F 290/06; B05D 7/24; C08F 2/44; B32B 3/00; B05D 1/36; B32B 5/30; C09D 153/00; B32B 5/16; C08F 2/48; B32B 1/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: superhydrophobic, coating, resin, hydrophobic silica, primary particle diameter, agglomeration particle diameter, two-tier roughness

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009-0298369 AI (KOENE BRYAN E. et al.) 03 December 2009 See figures 1A-7B and [0034] -[0078]	1-28
X A	JP 2004-359857 A (NIPPON PAINT CO., LTD.) 24 December 2004 See [0031H0045]	16-21 1-15, 22-28
A	US 2006-0286305 AI (JENS CHRISTOPH THIES et al.) 21 December 2006 See [0027H0061]	1-28
A	JP 08-208773 A (SEKISUI CHEM. CO., LTD.) 13 August 1996 See [0005H0035]	1-28
A	US 2009-0304996 AI (KISHIKAWA NORIKO et al.) 10 December 2009 See claim 1	1-28
A	US 06068911 A (SHOUJI ; MITSUYOSHI et al.) 30 May 2000 See abstract and figure 1	1-28

☐ 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

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/001172

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:

Claims 1-15 are directed to a superhydrophobic and anti-icing coating comprising: a resin; and a plurality of individual particles ranging in diametrial size from 2 to 200 nm clustered together to form a plurality of clustered particles ranging in diametrial size from 0.2 to 5 micrometers, wherein a surface of the coating has a two-tier roughness.

Claims 16-21 are directed to a superhydrophobic and anti-icing coating comprising: a resin from about 5 to about 95 weight percentage; and clustered particles ranging from about 1 to about 20 weight percentage.

Claims 22-28 are directed to a method of manufacturing a superhydrophobic and anti-icing coating comprising the steps of: mixing a resin and clustered particles; applying the mixture onto a substrate by brush, spray, roller, or dip coating; and curing the coating.

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/US201 1/001 172

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009-0298369 A1	03 . 12 , 2009	None	
JP 2004-359857 A	24 . 12 , 2004	None	
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