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- Declarations under Rule 4.17:**
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- 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))

[Continued on next page]

(54) Title: SUPERHYDROPHOBIC AND SUPEROLEOPHOBIC NANOSURFACES

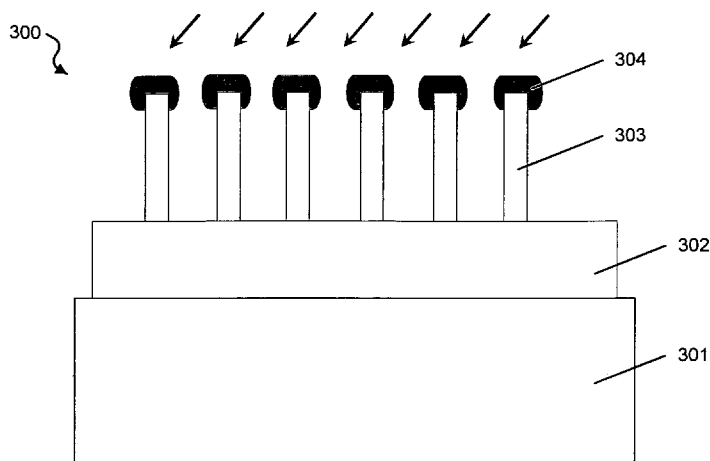


FIG. 3

(57) Abstract: Devices, systems and techniques are described for producing and implementing articles and materials having nano-scale and microscale structures that exhibit superhydrophobic, superoleophobic or omniphobic surface properties and other enhanced properties. In one aspect, a surface nanostructure can be formed by adding a silicon-containing buffer layer such as silicon, silicon oxide or silicon nitride layer, followed by metal film deposition and heating to convert the metal film into balled-up, discrete islands to form an etch mask. The buffer layer can be etched using the etch mask to create an array of pillar structures underneath the etch mask, in which the pillar structures have a shape that includes cylinders, negatively tapered rods, or cones and are vertically aligned. In another aspect, a method of fabricating microscale or nanoscale polymer or metal structures on a substrate is made by photolithography and/or nano imprinting lithography.



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A. CLASSIFICATION OF SUBJECT MATTER*B05D 5/00(2006.01)i, B05C 3/12(2006.01)i, B32B 3/26(2006.01)i, G03F 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)

B05D 5/00; H01L 21/20; H01L 51/05; B05D 1/36; H01L 51/40; B29C 39/00; H01L 31/00

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: "nano pillar", "superhydrophobic, superoleophobic, superomniphobic"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|---|-----------------------|
| X | WO 2010-022107 A2 (THE REGENTS OF THE UNIVERSITY OF CALIFORNIA et al.) 25 February 2010 See abstract, paragraphs [0009]-[0093], figs. 1-9 and claims 1-68. | 20-27,94-97,105-110 |
| A | US 2010-0206367 A1 (JEONG CHAEHWAN et al.) 19 August 2010 See the whole document. | 1-70,94-110 |
| A | WO 2007-128965 A1 (CAMBRIDGE DISPLAY TECHNOLOGY LIMITED et al.) 15 November 2007 See the whole document. | 1-70,94-110 |
| A | US 7531120 B2 (VAN RIJN CORNELIS JOHANNES MARIA et al.) 12 May 2009 See the whole document. | 1-70,94-110 |

 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

29 NOVEMBER 2012 (29.11.2012)

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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:

I.: Claims 1-70 and 94-110 relate to a nono-pillars or a noanowires structure on a substrate or its fabricating method.

II.: Claims 71-93 relate to a nanostructrue surface having pores or a trench in which a liquid having a superhydrophobic, superoleophobic or superhydrophilic property is impregnated and trapped , or its fabricating method.

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.: 1-70, 94-110

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/US2011/001995

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
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