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- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,

HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

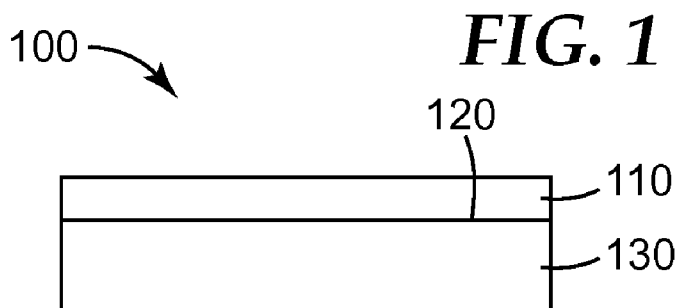
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

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))

- (88) **Date of publication of the international search report:**
27 November 2014

(54) **Title:** COATABLE COMPOSITION, PHOTOCATALYTIC ARTICLES, AND METHODS OF MAKING THE SAME



(57) **Abstract:** A method of making a coatable composition includes: providing a first composition comprising silica nanoparticles dispersed in an aqueous liquid vehicle, wherein the silica nanoparticles have an average particle size of less than or equal to 100 nanometers, wherein the first composition has a pH greater than 6; acidifying the first composition to a pH of less than or equal to 4 using inorganic acid to provide a second composition; and dissolving at least one metal compound in the second composition to form the coatable composition, wherein said at least one metal compound comprises a titanium compound. Coatable compositions and photocatalytic compositions, preparable by the method, are also disclosed. Photocatalytic articles including the photocatalytic compositions are also disclosed.



INTERNATIONAL SEARCH REPORT

International application No

PCT/US2013/059941

A. CLASSIFICATION OF SUBJECT MATTER

INV. C23C18/12

ADD.

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)

C23C

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/092765 A1 (HAGER PATRICK J [US] ET AL) 15 April 2010 (2010-04-15) the whole document	1-36
X	WO 2010/114700 A1 (3M INNOVATIVE PROPERTIES CO [US]; JING NAIYONG [US]; ZHANG YIFAN [US];) 7 October 2010 (2010-10-07) the whole document	27-36
Y	the whole document	1-26
E	WO 2014/008383 A1 (3M INNOVATIVE PROPERTIES CO [US]; BROWN KATHERINE A [US]; NARUM TIMOTH) 9 January 2014 (2014-01-09) the whole document	1-36
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☒ 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

22 September 2014

Date of mailing of the international search report

01/10/2014

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2013/059941

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2010/124403 A1 (EMPA [CH]; VERALIT AG [CH]; GRAULE THOMAS [CH]; DE HAZAN YORAM [CH]; F) 4 November 2010 (2010-11-04)	27-36
Y	the whole document -----	1-26

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/059941

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 additional 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 an 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.:

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-26

relate to a method for preparing a coatable composition having a pH of less than 4 by using a silica nanoparticles sol having a pH of greater than 6 and a Ti 4+ compound, and articles made therefrom.

2. claims: 27-36

relate to an article comprising a layer containing silica nanoparticles and Ti.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2013/059941

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2010092765	A1	15-04-2010	CA 2740066 A1	15-04-2010
			CN 102239222 A	09-11-2011
			EP 2344597 A1	20-07-2011
			JP 2012505295 A	01-03-2012
			KR 20110069842 A	23-06-2011
			RU 2011113237 A	20-11-2012
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			EP 2414455 A1	08-02-2012
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			JP 2012522110 A	20-09-2012
			KR 20120004476 A	12-01-2012
			US 2012010327 A1	12-01-2012
			WO 2010114700 A1	07-10-2010

WO 2014008383	A1	09-01-2014	NONE	

WO 2010124403	A1	04-11-2010	NONE	
