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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, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, 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, ST, 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,



WO 2020/061431 A3

(54) **Title:** THIOL-CONTAINING COMPOSITION

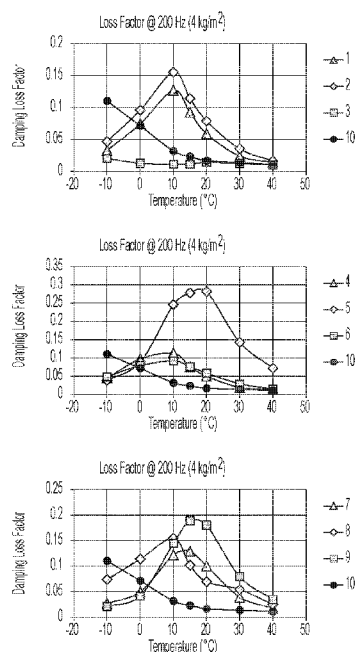


FIG. 2

(57) **Abstract:** The present invention is directed toward a composition comprising: an epoxy compound, a polythiol curing agent, and a second curing agent. Also disclosed are methods of treating a substrate with the composition and substrates formed by such methods.

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))*
- *of inventorship (Rule 4.17(iv))*

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:

23 April 2020 (23.04.2020)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2019/052111

A. CLASSIFICATION OF SUBJECT MATTER
INV. C08G59/06 C09J163/00
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)
C08L C08G C09J C09D
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	WO 2014/100245 A2 (DOW GLOBAL TECHNOLOGIES LLC [US]) 26 June 2014 (2014-06-26) examples 1-6 page 15, paragraph 3 page 7, line 16 - line 18 -----	1-10
X	WO 2016/176548 A1 (3M INNOVATIVE PROPERTIES CO [US]) 3 November 2016 (2016-11-03) table 2 page 18, line 15 - line 31 page 22, line 9 - line 12 page 19, line 31 - line 34 -----	1,3,4, 6-10
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Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"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</p> <p>"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</p> <p>"&" document member of the same patent family</p>
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Date of the actual completion of the international search 18 November 2019	Date of mailing of the international search report 26/03/2020
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer O'Sullivan, Timothy

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2019/052111

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013/023603 A1 (WALTER PABLO [DE] ET AL) 24 January 2013 (2013-01-24) table 2 paragraph [0139] paragraph [0147] paragraph [0002] -----	1,4,6-10
X	US 6 172 179 B1 (ZOOK JONATHAN DOHERTY [US] ET AL) 9 January 2001 (2001-01-09) figure 1 examples 9,15 -----	1,4,6-10
A	US 2017/166687 A1 (ORTELT MARTINA [DE] ET AL) 15 June 2017 (2017-06-15) paragraph [0070] paragraph [0107] -----	1-10
X,P	WO 2019/060559 A1 (PPG IND OHIO INC [US]) 28 March 2019 (2019-03-28) example 1 -----	1-10

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2019/052111

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.:

1-10

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: 1-10

A composition comprising: (i) an epoxy-containing compound, (ii) a polythiol curing agent and (iii) a second curing agent; wherein the epoxy-containing compound has an epoxide equivalent weight of more than 350 g/eq and the polythiol curing agent has a thiol equivalent weight of no more than 600 g/eq or the epoxy-containing compound has an epoxide equivalent weight of no more than 350 g/eq and the polythiol curing agent has a thiol equivalent weight of more than 600 g/eq.

2. claims: 11-21

A composition comprising: (i) an epoxy-containing compound (ii) a polythiol curing agent, (iii) a second curing agent and (iv) a filler package comprising at least one filler, the filler package having a pH of no more than 10.5 measured on a 10 weight percent slurry of the filler package in deionized water.

3. claims: 22-32

A composition comprising: (i) an epoxy-containing compound (ii) a polythiol curing agent and (iii) a second curing agent; wherein the composition has a theoretical maximum resin cross-link density of no more than 4 mol/kg.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2019/052111

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2014100245	A2	26-06-2014	BR 112015014765 A2
			CN 104955865 A
			EP 2935390 A2
			JP 2016501970 A
			JP 2019131813 A
			US 2015299379 A1
			WO 2014100245 A2

WO 2016176548	A1	03-11-2016	BR 112017023446 A2
			CA 2984145 A1
			CN 107531886 A
			EP 3288998 A1
			EP 3288999 A1
			US 2018094097 A1
			US 2018127538 A1
			WO 2016176537 A1
			WO 2016176548 A1

US 2013023603	A1	24-01-2013	NONE

US 6172179	B1	09-01-2001	KR 20000075457 A
			US 5912319 A
			US 6172179 B1
			US 6232401 B1
			ZA 9801373 B

US 2017166687	A1	15-06-2017	CA 2951249 A1
			CN 107011628 A
			EP 3178863 A1
			JP 2017122214 A
			KR 20170069947 A
			PL 3178863 T3
			US 2017166687 A1

WO 2019060559	A1	28-03-2019	TW 201920572 A
			WO 2019060559 A1
