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(54) Title: COALESCENTS FOR AQUEOUS BASED COATING COMPOSITIONS

(57) Abstract: Provided are aqueous coating compositions including an aqueous polymeric dispersion and a coalescent, wherein the coalescent is an alkoxyate. Also provided are methods for forming coatings from the aqueous coating compositions.

COALESCENTS FOR AQUEOUS BASED COATING COMPOSITIONS

Field

This invention relates generally to coalescing agents and their use in aqueous based coatings. More specifically, the coalescing agents are alkoxyate compounds derived from propylene oxide.

Background

Coalescents are typically added to coating compositions, for example waterborne paints or coatings, to facilitate the formation of a continuous polymeric, or binder, film as water evaporates from the composition. Without the addition of coalescents, polymer dispersions may not act as effective binders for pigments in the paint and adhesion to a substrate may be compromised. For many years, these coalescing aids have been relatively volatile solvents such as 2,2,4-trimethyl-1,3-pentanediol monoisobutyrate.

Volatile organic compound (VOC) emissions contribute to the creation of ozone, a main constituent of smog. In the US, VOC regulations established by the US Environmental Protection Agency (EPA) and enforced at the state level dictate the maximum concentration of volatile solvents in paints, clean up solvents, and other products. In Europe, VOC limits are defined by the 2004/42/EC Solvents Directive for Decorative Paints. VOC regulations have become more and more stringent and have affected the use of available coalescents.

The problem addressed by this invention is the provision of low or zero VOC coalescents for use in aqueous based coating compositions, for example, decorative and protective coatings for various substrates.

Statement of Invention

We have now found that alkoxyate compounds of formula I as described herein function as excellent coalescents for polymer dispersions, facilitating the formation of a continuous polymer, or binder, film from the dispersion as water evaporates. Advantageously, the alkoxyates exhibit very low volatility and are therefore suitable for use in zero or low VOC coating compositions.

In one aspect, there is provided an aqueous coating composition comprising: an aqueous polymeric dispersion; and a coalescent that is an alkoxyate of formula I:



wherein R is linear or branched C₈-C₁₀ alkyl, PO is propyleneoxy, and n is a number from 3 to 7.

In another aspect, there is provided an aqueous coating composition comprising: (a) a grind phase; and (b) a letdown phase including an aqueous polymeric dispersion and a
5 coalescent, wherein the coalescent is an alkoxyate of formula I as described herein.

In a further aspect, there is provided a method for forming a coating comprising: (a) forming the aqueous coating composition as described herein; (b) applying said aqueous coating composition to a substrate; and (c) drying, or allowing to dry, said applied aqueous coating composition.

10 Detailed Description

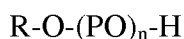
Unless otherwise indicated, numeric ranges, for instance as in "from 2 to 10," are inclusive of the numbers defining the range (e.g., 2 and 10).

Unless otherwise indicated, ratios, percentages, parts, and the like are by weight.

"Propyleneoxy" refers to -CH₂-CH(CH₃)-O- or -CH(CH₃)-CH₂-O-.

15 By "coalescent" is meant a material that facilitates the film formation of an aqueous polymeric dispersion, particularly an aqueous coating composition that includes a dispersion of polymer in an aqueous medium such as, for example, a polymer prepared by emulsion polymerization techniques. An indication of facilitation of film formation is that the minimum film formation temperature ("MFFT") of the composition including the aqueous
20 polymeric dispersion is measurably lowered by the addition of the coalescent.

As noted above, the invention provides aqueous coating compositions containing an aqueous polymeric dispersion and an alkoxyate as a coalescent. The alkoxyate is a compound of formula I:



25 wherein R is linear or branched C₈-C₁₀ alkyl, PO is propyleneoxy, and n is a number from 3 to 7.

Formula I includes the variable "n." This variable represent an average degrees of propoxylation in an oligomer distribution and is determined from the relative mole amounts of the alcohol and propylene oxide starting materials used in the synthesis of the alkoxyate.

30 In some embodiments, n is from 4 to 6, alternatively n is 5.

In some embodiments of the invention, R in the alkoxyate of formula I is branched C₈-C₁₀ alkyl.

In some embodiments, R is 2-ethylhexyl ($\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}(\text{CH}_2\text{CH}_3)\text{CH}_2-$). In some embodiments, R is 2-propylheptyl ($\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}(\text{CH}_2\text{CH}_2\text{CH}_3)\text{CH}_2-$).

A preferred alkoxyate of formula I is 2EH-O-(PO)₅-OH, wherein 2EH is 2-ethylhexyl. Another preferred alkoxyate of formula I is 2PH-O-(PO)₅-OH, wherein 2PH is
5 2-propylheptyl.

In some embodiments of the invention, the alkoxyate of formula I (the coalescent) exhibits a maximum volatility loss, when heated at 110 °C for 1 hour, of 20 weight percent or less, alternatively 17 weight percent or less.

The alkoxyates of formula I of the invention may be prepared by synthetic methods
10 known to those skilled in the art. For example, in a typical procedure, a suitable alcohol or fatty acid alcohol is alkoxyated with propylene oxide. Alkoxylation processes may, for instance, be carried out in the presence of acidic or alkaline catalysts, or by using metal cyanide catalysts. Alkaline catalysts may include, for instance, hydroxides or alcoholates of sodium or potassium, including NaOH, KOH, sodium methoxide, potassium methoxide,
15 sodium ethoxide and potassium ethoxide. Base catalysts are normally used in a concentration of from 0.05 percent to about 5 percent by weight, preferably about 0.1 percent to about 1 percent by weight based on starting material.

The addition of propylene oxide may, for instance, be carried out in an autoclave under pressures from about 10 psig to about 200 psig, preferably from about 60 to about 100
20 psig. The temperature of alkoxylation may range from about 30 °C to about 200 °C, preferably from about 100 °C to about 160 °C. After completion of oxide feed, the product is typically allowed to react until the residual oxide is less than about 10 ppm. After cooling the reactor to an appropriate temperature ranging from about 20 °C to 130 °C, the residual catalyst may be left unneutralized, or neutralized with organic acids, such as acetic,
25 propionic, or citric acid. Alternatively, the product may be neutralized with inorganic acids, such as phosphoric acid or carbon dioxide. Residual catalyst may also be removed using ion exchange or an adsorption media, such as diatomaceous earth.

In some embodiments, the aqueous coating composition of the present invention includes an aqueous polymeric dispersion and from 0.1% to 40% by weight, based on the
30 weight of aqueous polymeric dispersion solids, of the coalescent of formula I. In one embodiment when the MFFT of the aqueous polymeric dispersion is from -5°C to 100°C, from 0.1% to 30% coalescent, by weight based on the weight of aqueous polymeric dispersion solids, may be used. Alternatively, when the MFFT of the aqueous polymeric

dispersion is from -20°C to 30°C, from 0.1% to 10 % coalescent, by weight based on the weight of aqueous polymeric dispersion solids, may be used. MFFT's of the aqueous polymeric dispersions herein are those measured using ASTM D 2354 and films drawdown with a 5 mil drawdown bar. MFFT values are indicative of how efficient a coalescent is for a given aqueous polymeric dispersion; it is desirable to achieve the lowest possible MFFT with the smallest amount of coalescent.

The aqueous polymeric dispersion may be a dispersion of a polymer, oligomer, or prepolymer in an aqueous medium. In some embodiments the aqueous polymeric dispersion may be reactive before, during, or subsequent to film formation. By "aqueous medium" is meant herein a medium including at least 50%, by weight based on the weight of the medium, water. Typical aqueous polymeric dispersions are aqueous dispersions of epoxies, urethanes, acrylic polyols, polyesters, and hybrids of these and other chemistries; and emulsion polymers.

The emulsion polymer, an aqueous dispersion of polymer formed by emulsion polymerization techniques, includes at least one addition copolymerized ethylenically unsaturated monomer such as, for example, styrene or substituted styrenes; vinyl toluene; butadiene; (meth)acrylonitrile; a (meth)acrylic ester monomer such as, for example, methyl (meth)acrylate, ethyl (meth)acrylate, butyl (meth)acrylate, hydroxyethyl (meth)acrylate, hydroxypropyl (meth)acrylate, and ureido-functional (meth)acrylates; vinyl acetate or other vinyl esters; vinyl monomers such as vinyl chloride, vinylidene chloride, and N-vinyl pyrrolidone. The use of the term "(meth)" followed by another term such as (meth)acrylate, as used throughout the disclosure, refers to both acrylates and methacrylates.

In certain embodiments the emulsion polymer includes from 0% to 6%, or in the alternative, from 0% to 3 wt% or from 0% to 1%, by weight based on the weight of the polymer, of a copolymerized multi-ethylenically unsaturated monomer. The level of multi-ethylenically unsaturated monomer should be selected so as to not materially interfere with film formation and integrity. Multi-ethylenically unsaturated monomers include, for example, allyl (meth)acrylate, diallyl phthalate, 1,4-butylene glycol di(meth)acrylate, 1,2-ethylene glycol di(meth)acrylate, 1,6-hexanediol di(meth)acrylate, and divinyl benzene.

The emulsion polymer includes from 0% to 15%, preferably from 0.5% to 5%, of a copolymerized monoethylenically-unsaturated acid monomer, based on the weight of the polymer. Acid monomers include carboxylic acid monomers such as, for example, (meth)acrylic acid, crotonic acid, itaconic acid, fumaric acid, maleic acid, monomethyl

itaconate, monomethyl fumarate, monobutyl fumarate, maleic anhydride, 2-acrylamido-2-methylpropane sulfonic acid, vinyl sulfonic acid, styrene sulfonic acid, 1-allyloxy-2-hydroxypropane sulfonic acid, alkyl allyl sulfosuccinic acid, sulfoethyl (meth)acrylate, phosphoalkyl (meth)acrylates such as phosphoethyl (meth)acrylate, phosphopropyl (meth)acrylate, and phosphobutyl (meth)acrylate, phosphoalkyl crotonates, phosphoalkyl maleates, phosphoalkyl fumarates, phosphodialkyl (meth)acrylates, phosphodialkyl crotonates, and allyl phosphate.

The aqueous emulsion polymer is typically formed by an addition polymerization emulsion polymerization process as is known in the art. Conventional surfactants and blends may be used including, for example, anionic and/or nonionic emulsifiers such as, for example, alkali metal or ammonium alkyl sulfates, alkyl sulfonic acids, fatty acids, and oxyethylated alkyl phenols, and mixtures thereof. Polymerizable surfactants that include at least one ethylenically unsaturated carbon-carbon bond which can undergo free radical addition polymerization may be used. The amount of surfactant used is usually 0.1% to 6% by weight, based on the weight of total monomer. Either thermal or redox initiation processes may be used. Conventional free radical initiators may be used such as, for example, hydrogen peroxide, t-butyl hydroperoxide, t-amyl hydroperoxide, ammonium and/or alkali persulfates, typically at a level of 0.01% to 3.0% by weight, based on the weight of total monomer. Redox systems using the same initiators coupled with a suitable reductant such as, for example, sodium sulfoxylate formaldehyde, sodium hydrosulfite, isoascorbic acid, hydroxylamine sulfate and sodium bisulfite may be used at similar levels, optionally in combination with metal ions such as, for example iron and copper, optionally further including complexing agents for the metal. Chain transfer agents such as mercaptans may be used to lower the molecular weight of the polymer. The monomer mixture may be added neat or as an emulsion in water. The monomer mixture may be added in a single addition or more additions or continuously over the reaction period using a uniform or varying composition. Additional ingredients such as, for example, free radical initiators, oxidants, reducing agents, chain transfer agents, neutralizers, surfactants, and dispersants may be added prior to, during, or subsequent to the monomer addition. Processes yielding polymodal particle size distributions such as those disclosed in US Patent Nos. 4,384,056 and 4,539,361, for example, may be employed. The emulsion polymer may be formed in a multi-stage emulsion polymerization process as are well known in the art. The emulsion polymer is also contemplated to be formed in two or more

stages, the stages differing in molecular weight. Blending two different emulsion polymers is also contemplated.

The average particle diameter of the emulsion polymer particles is typically from 40 nm to 1000 nm, preferably from 40 nm to 300 nm. Particle diameters herein are those
5 measured by dynamic light scattering on a Brookhaven BI-90 Plus particle size analyzer.

The aqueous coating composition of the invention is prepared by techniques which are well known in the coatings art. First, pigment(s), if any, are well dispersed in an aqueous medium under high shear such as is afforded by a Cowles mixer or predispersed colorant(s), or mixtures thereof are used. Then the emulsion polymer is added under low
10 shear stirring along with the coalescent composition and other coatings adjuvants as desired. The aqueous coating composition may include, in addition to the aqueous polymeric dispersion and optional pigment(s), conventional coatings adjuvants such as, for example, extenders, emulsifiers, coalescing agents other than the coalescent composition of the present invention, plasticizers, freeze-thaw stabilizers, curing agents, buffers, neutralizers,
15 thickeners, rheology modifiers, humectants, wetting agents, biocides, antifoaming agents, UV absorbers, fluorescent brighteners, light or heat stabilizers, chelating agents, dispersants, colorants, waxes, and water-repellants. The coating composition may also contain surfactants, including for instance materials of the formula $R^1-(PO)_x-(EO)_y-H$, where R^1 is linear or branched C_6-C_{12} alkyl, preferably branched C_8-C_{10} alkyl, and more preferably 2-ethylhexyl, PO is propyleneoxy, EO is ethyleneoxy, x is from 1 to 11, preferably from 4 to
20 6, and y is from 1 to 20, preferably from 3 to 11.

Examples of suitable pigments and extenders include titanium dioxide such as anatase and rutile titanium dioxides; zinc oxide; antimony oxide; iron oxide; magnesium silicate; calcium carbonate; organic and inorganic colored pigments; aluminosilicates; silica;
25 various clays such as kaolin and delaminated clay; and lead oxide. It is also contemplated that the aqueous coating composition may also contain opaque polymer particles, such as, for example, ROPAQUE™ Opaque Polymers (Ropaque is a trademark of Rohm and Haas Company). Also contemplated are encapsulated or partially encapsulated opacifying pigment particles; and polymers or polymer emulsions adsorbing or bonding to the surface
30 of pigments such as titanium dioxide; and hollow pigments, including pigments having one or more voids.

Titanium dioxide is the main pigment used to achieve hiding in architectural paints. This pigment is expensive and in short supply. One way to achieve hiding while decreasing

the amount of TiO₂ is to include multistage emulsion polymers that add opacity to the paint film, commonly known as "opaque polymers." These polymers are water-filled emulsion polymer particles (mostly styrene) with a high Tg. These particles fill with air during film formation and scatter light creating opacity. Typically an aqueous coating composition including an opaque polymer will also include an aqueous polymeric dispersion; desirably a coalescent will facilitate film formation of the aqueous polymeric dispersion, but not cause the opaque polymer to collapse. However, some coalescents attack the opaque polymer causing the particles to collapse which results in less light scattering and decreased opacity. TEXANOL™ (TEXANOL is a trademark of Eastman Chemical Company), for example, attacks the opaque polymers when used at 15% by weight on resin solids while the low VOC plasticizer OPTIFILM™ 400 (OPTIFILM is a trademark of Eastman Chemical Company) attacks the polymer at much lower levels (about 6% by weight on resin solids). Coalescents of the invention may be useful in their ability to preserve the opacity provided by certain commercial ROPAQUE™ opaque polymers.

The amounts of pigment and extender in the aqueous coating composition vary from a pigment volume concentration (PVC) of 0 to 85 and thereby encompass coatings otherwise described in the art, for example, as clear coatings, stains, flat coatings, satin coatings, semi-gloss coatings, gloss coatings, primers, textured coatings, and the like. The aqueous coating composition herein expressly includes architectural, maintenance, and industrial coatings, caulks, sealants, and adhesives. The pigment volume concentration is calculated by the following formula:

$$\text{PVC (\%)} = \frac{\text{volume of pigment(s)} + \text{volume extender(s)}}{\text{total dry volume of paint}} \times 100.$$

The solids content of the aqueous coating composition may be from 10% to 70% by volume. The viscosity of the aqueous coating composition may be from 50 centipoises to 50,000 centipoises, as measured using a Brookfield viscometer; viscosities appropriate for different application methods vary considerably.

In the method for forming a coating of the invention the aqueous coating composition is typically applied to a substrate such as, for example, wood, metal, plastics, marine and civil engineering substrates, cementitious substrates such as, for example, concrete, stucco, and mortar, previously painted or primed surfaces, and weathered surfaces. The aqueous coating composition may be applied to a substrate using conventional coatings application methods such as, for example, brush, roller, caulking applicator, roll coating,

gravure roll, curtain coater and spraying methods such as, for example, air-atomized spray, air-assisted spray, airless spray, high volume low pressure spray, and air-assisted airless spray.

Drying of the aqueous coating composition to provide a coating may be allowed to proceed under ambient conditions such as, for example, at 5 °C to 35 °C. or the coating may be dried at elevated temperatures such as, for example, from 35 °C to 150 °C.

Some embodiments of the invention will now be described in detail in the following Examples.

EXAMPLES

10 EXAMPLE 1. Synthesis of 2EH-O-PO₅-OH

Propoxylation of 2-ethylhexanol is performed in a jacketed, autoclave reactor. Solid double metal cyanide catalyst (DMC, 0.48 g) is charged with 2-ethylhexanol (1850.90 g). The mixture is heated to 130 °C. Propylene oxide (PO, 4171.90 g) is added to the 2-ethylhexanol-DMC mixture over 8 hours 16 minutes, during which the temperature is kept at 130 °C. The mixture is kept at 130 °C for 14 h before being cooled back to room temperature. Analysis of the reaction mixture determined that the product has a molecular weight of 426 based on a percent hydroxyl analysis, which is consistent with the average molecular weight for 2EH-O-PO₅-OH. The 2EH-O-PO₅-OH material may also be prepared by KOH catalysis using the procedures described above.

20 EXAMPLE 2. VOC Testing

The VOC content of 2EH-O-PO₅-OH is determined by using the test conditions under EPA Method 24 for establishing volatility. The test involves measuring the sample mass loss after heating. General procedure: the sample being tested is placed in three pre-weighed aluminum pans at room temperature. Sample mass in each pan is recorded. The samples are heated in a force flow oven at 110 °C for 1 hour. Samples are cooled back to room temperature. The pans are weighed again to determine the mass change after heating.

The VOC and percent VOC content is defined as follow:

$$VOC = \text{Original sample mass} - \text{sample mass after heating}$$

$$\text{Percent VOC} = \frac{VOC}{\text{Original sample mass}} \times 100\%$$

#	Original sample mass	VOC	Percent VOC	
5	1	0.5171 g	0.0765 g	14.8
	2	0.5117 g	0.0840 g	16.4
	3	0.5104 g	0.0741 g	14.5

The data shows an average VOC content for 2EH-O-PO₅-OH of 15.2%. In contrast, the comparative material TEXANOL™ is 100 % VOC under the same EPA Method 24 test conditions.

EXAMPLE 3. Coalescent for Latex Binder

The coalescing performance of 2EH-O-PO₅-OH for latex binder is evaluated by determining the minimum film formation temperature (MFFT).

15 Materials:

RHOPLEX™ SG10M – Binder (an acrylic emulsion polymer). RHOPLEX is a trademark of Rohm and Haas Company.

RHOPLEX™ SG30 – Binder (an acrylic emulsion polymer).

20 TEXANOL™ (2,2,4-trimethyl-1,3-pentanediol monoisobutyrate) – a comparative coalescing agent.

Sample A - 2EH-O-PO₅-OH -prepared using the procedure described in example 1, catalyzed by DMC.

Sample B - 2EH-O-PO₅-OH prepared using the procedure described in example 1, catalyzed by KOH.

25 General Procedure:

Coalescent agent is mixed with a latex binder at the proportion specified in Table 1 below. The mixture is coated on a six pieces of Scotch Magic™ tape (1 inch x 24 inch) that are warmed with a uniform temperature gradient of 30-53 °F. One end of the tape is 30 °F, the other end of the tape is 53 °F. After four hours, the temperature at which the first sign of cracking could be observed on the tape is recorded. This temperature is the minimum film formation temperature (MFFT). The average MFFT value is reported based on the readings

for the six replicates. A compound that provides a lower MFFT value to a binder indicates a better coalescing aid.

Table 1

Latex tested	Plasticizer tested	Coalescent Level (%)	MFFT (°F) Visual
RHOPLEX™ SG10M	none	n/a	>56
RHOPLEX™ SG10M	TEXANOL™	8	38
RHOPLEX™ SG10M	Sample A	8	44
RHOPLEX™ SG10M	Sample B	8	42
RHOPLEX™ SG 30	none	n/a	>50
RHOPLEX™ SG 30	TEXANOL™	8	36
RHOPLEX™ SG 30	Sample A	8	38
RHOPLEX™ SG 30	Sample B	8	38

- 5 As shown in the Table 1, inventive coalescents, Sample A and Sample B, performed similarly to the comparative material, TEXANOL™. Advantageously, the inventive coalescents are low VOC.

CLAIMS:

1. An aqueous coating composition comprising:
an aqueous polymeric dispersion; and
a coalescent that is an alkoxyate of formula I:



wherein R is linear or branched C₈-C₁₀ alkyl, PO is propyleneoxy, and n is a number from 3 to 7.

2. The aqueous coating composition of claim 1 wherein R is branched C₈-C₁₀ alkyl.
3. The aqueous coating composition of any one of claims 1-2 wherein R is 2-ethylhexyl or 2-propylheptyl.
- 10 4. The aqueous coating composition of any one of claims 1-3 wherein n is 5.
5. The aqueous coating composition of any one of claims 1-4 wherein the aqueous polymeric dispersion is an epoxy emulsion or an emulsion polymer.
6. The aqueous coating composition of any one of claims 1-5 further comprising one or more pigments, extenders, emulsifiers, co-coalescing agents, plasticizers, freeze-thaw stabilizers, curing agents, buffers, neutralizers, thickeners, rheology modifiers, humectants, wetting agents, biocides, antifoaming agents, UV absorbers, fluorescent brighteners, light or heat stabilizers, chelating agents, dispersants, colorants, waxes, or water-repellants.
- 15 7. The aqueous coating composition of any one of claims 1-6 wherein the coalescent has a volatility content when heated at 110 °C for 1 hour of 20 weight percent or less.
8. The aqueous coating composition of any one of claims 1-7 wherein the coalescent comprises from 0.1% to 30% by weight, based on the weight of solids of the aqueous polymeric dispersion, and wherein the aqueous polymeric dispersion has a MFFT of from -5 °C to 100 °C.
- 25 9. A method for forming a coating, the method comprising:
(a) forming the aqueous coating composition of any one of claims 1-8;
(b) applying said aqueous coating composition to a substrate; and
(c) drying, or allowing to dry, said applied aqueous coating composition.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/019182

A. CLASSIFICATION OF SUBJECT MATTER
INV. C09D5/00 C09D7/00 C08K5/00
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)
C09D C08K

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 2008/063829 A1 (BASF SE [US]; ANCHOR MICHAEL J [US]; DREWNO GREGORY W [US]) 29 May 2008 (2008-05-29) claim 8; examples -----	1-9
X	EP 2 186 863 A1 (COGNIS IP MAN GMBH [DE]) 19 May 2010 (2010-05-19) claim 5; [0014,0015,0016,0027] -----	1-9
A	WO 2006/115550 A1 (BASF AG [DE]; PORZIO ROBERT SHANE [US]; ZHAO CHENG-LE [US]; ANCHOR MIC) 2 November 2006 (2006-11-02) claims; examples -----	1-9
A	WO 2012/054317 A1 (EASTMAN CHEM CO [US]) 26 April 2012 (2012-04-26) claims; examples -----	1-9
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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
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- "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

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Date of the actual completion of the international search 23 July 2014	Date of mailing of the international search report 29/07/2014
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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 Kositza, Matthias
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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/019182

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2 399 960 A2 (DOW GLOBAL TECHNOLOGIES LLC [US]) 28 December 2011 (2011-12-28) claims; examples -----	1-9
A,P	WO 2013/165618 A1 (DOW GLOBAL TECHNOLOGIES LLC [US]) 7 November 2013 (2013-11-07) claims; examples; page 3 lines 13-29 -----	1-9

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2014/019182

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