(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 January 2002 (17.01.2002)

PCT

(10) International Publication Number
WO 02/04132 A2

(51) International Patent Classification⁷: B05D

(21) International Application Number: PCT/US01/11717

(22) International Filing Date: 11 April 2001 (11.04.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/612,024 7 July 2000 (07.07.2000) US

(71) Applicant (*for all designated States except US*): **BASF CORPORATION** [US/US]; Patent Department, 26701 Telegraph Road, Southfield, MI 48034-2442 (US).

(72) Inventors; and
(75) Inventors/Applicants (*for US only*): **STARR, Keith** [US/US]; 8322 County Road C, Delta, OH 43515 (US). **TYE, Anthony** [US/US]; 449 Canal Court, Waterville, OH 43566 (US). **RIHAN, Ali** [US/US]; 6070 Atwell, Toledo, OH 43566 (US).

(74) Agents: **GOLOTA, Mary** et al.; BASF Corporation, 26701 Telegraph Road, Southfield, MI 48034-2442 (US).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 02/04132 A2

(54) **Title:** METHOD OF IMPROVING A COATED SUBSTRATE HAVING VISUAL DEFECTS CAUSED BY SURFACE CONTAMINATION

(57) **Abstract:** The present invention relates to coatings and provides a method of improving visual defects in coated substrates believed to be caused by surface contamination. Such visual defects include "fisheyes" or "cratering" and "telegraphing". The method comprises providing a substantially uncured, coated substrate having one or more visual defects caused by surface contamination and applying to said coated substrate a solution comprising a volatile linear siloxane of a particular formula.

METHOD OF IMPROVING A COATED SUBSTRATE HAVING VISUAL DEFECTS CAUSED BY SURFACE CONTAMINATION

FIELD OF THE INVENTION

The present invention relates to methods of improving certain visual defects in coated substrates, especially those used in the automotive industry. More particularly, the invention relates to a method for improving coated substrates containing certain visual defects known as "fisheyes" and "telegraphing".

BACKGROUND OF THE INVENTION

Coatings applied to surfaces typically serve decorative and/or protective functions. This is particularly so for automotive finishes, which must provide an esthetically appealing appearance while simultaneously meeting and maintaining rigorous performance and durability requirements. As used herein, "automotive coating or finish" encompasses both original equipment (OEM) coatings and refinish coatings, but especially to refinish coatings, the later term referring to coatings which are applied after the car has left the manufacturer, usually for repair purposes. It will be appreciated that automotive coatings are typically required to possess optimum application and performance parameters.

For example, automotive coatings must generally exhibit exceptional gloss, depth of color, and distinctness of image (DOI). An extremely high degree of clarity is necessary to achieve these desired visual effects. High gloss coatings also require a low degree of visual aberrations at the surface in order to achieve a desired visual effect such as high DOI.

One way that the automotive industry has met these challenges, especially original equipment manufacturers (OEM), involves the use of color-plus-clear composite coatings for use in the manufacture of automotive body panels. As used herein, the term "composite color-plus-clear" relates to composite coating systems requiring the application of a first coating, typically a colored basecoat, followed by the application of a second coating, generally a clearcoat, over the noncured or "wet" first coating. The applied first and second coatings are then cured. Thus, such systems are often described as "wet on wet" or "two-coat/one bake". Drying processes, which fall short of complete cure, may be used between the application of the coatings.

Automotive refinishers must provide appearance and performance equal to those obtained by the OEMs but must provide such performance requirements without benefit of the controlled application environments and high temperature cure ovens used in the OEM facilities. Refinish operations may involve the repair of one or more outer coating layers, the repair or replacement of entire automotive body components, or a combination of both. The terms “refinish coating” or “repair coating” may be used interchangeably.

Automotive refinishers have often met these challenges with the use of two-component coating compositions. As used herein, the term “two-component” refers to the number of solutions and/or dispersions which are mixed together to provide a curable coating composition. Up until the point of mixing, neither of the individual components alone provides a curable coating composition.

Thus, both OEMs and automotive refinishers seek to provide coating compositions with high gloss and high DOI. However, these coating compositions are often susceptible to visual defects believed to be caused by surface contamination. Examples of such defects include “fisheyes” or “craters” and “telegraphing”. For the purposes of the instant application, the terms “fisheyes” and “cratering” may be used interchangeably. However, these terms as used herein refer solely to defects believed to result from surface contamination and not to defects resulting from solvent vapors and the like.

Fisheyes or craters are round concave depressions in the film which may or may not have raised edges. They vary in size from barely visible to more than 0.25 inches (6 mm) in diameter and may be deep enough to reveal the surface under the paint. While not wishing to be bound by a particular theory, it is believed that these defects result from the repulsion of the paint by contaminants on the surface of the substrate. They may occur singly in isolated events or in mass, with several hundred giving a mottled effect to the film.

Telegraphing refers to a visual defect wherein the pattern or location of a surface contaminate is visible in the cured film. For example, if an attempt is made to wipe away a contaminate, the wipe marks can ‘telegraph’ through the surface of the cured film, i.e., the wipe marks may be visible in the cured film.

Common contaminants believed to cause visual defects such as fisheyes and telegraphing include but are not limited to fats, oils, greases, silicones, and a variety of cosmetics and personal care products. Those skilled in the art appreciate that these defects are some of the most challenging paint defects to prevent or cure. They often appear suddenly and without warning, persist for a time and then disappear just as suddenly as they appeared. The presence of even one crater or fisheye may be an unacceptable defect which can result in the scrapping or repainting of an entire part or substrate.

Although products intended to eliminate these visual defects are known, they often result in paint films having significant recoatability problems. That is, subsequently applied coating layers fail to adhere to the previously applied coating layer containing the visual defect eliminating product. Both OEM and automotive refinish compositions must be capable of adhering to subsequently applied coating compositions.

Accordingly, fisheyes and/or telegraphing present an expensive and difficult problem for the automotive finishing industry. Coating compositions of all types having improved resistance to visual defects caused by surface contamination have long been sought.

It is thus an object of the invention to provide a method of improving the appearance of coated substrates containing visual defects such as fisheyes and/or telegraphing which is applicable for use with a wide variety of coating composition and which is suitable for use in both OEM and automotive refinish facilities.

It is a further object of the invention to provide a method of improving and preferably eliminating these visual defects which does not affect the subsequent recoatability of the coating layer from which the visual defect was eliminated.

SUMMARY OF THE INVENTION

These and other objects have been achieved with the method of the instant invention. The method comprises applying a coating composition to a substrate having one or more surface contaminates so as to produce a coated substrate having one or more visual defects caused by surface contamination, and then applying to said coated substrate a solution comprising a volatile linear siloxane of the formula:

$$(R)_3\text{-Si-O-}((R)_2\text{-Si-O})_y\text{-Si-}(R)_3$$

wherein R is H or an alkyl group of from 1 to 3 carbon atoms and y is a number from 0 to 6.

In another aspect of the invention, the method comprises providing a substantially uncured coated substrate having one or more visual defects caused by surface contamination and then applying to said coated substrate a solution comprising a volatile linear siloxane of the formula:

$$(R)_3\text{-Si-O-}((R)_2\text{-Si-O})_y\text{-Si-}(R)_3$$

wherein R is H or an alkyl group of from 1 to 3 carbon atoms and y is a number from 0 to 6.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS.

The method of the invention improves the appearance of coated substrates containing one or more visual defects caused by surface contamination. The method particularly relates to the improvement of such defects during a period which begins with the application of a coating composition to a substrate to produce a coated substrate and ends with the curing and/or crosslinking of the coated substrate so as to provide a finished film.

As indicated above, the visual defects improved by the method of the invention are those believed to be caused by surface contamination. Examples of such defects include “fisheyes” or “craters” and “telegraphing”. For the purposes of the instant application, the terms “fisheyes” and “cratering” may be used interchangeably. However, these terms as used herein refer solely to defects believed to result from surface contamination and not to defects resulting from solvent vapors and the like.

Fisheyes or craters are round concave depressions in the film, which may or may not have raised edges. They vary in size from barely visible to more than 0.25 inches (6 mm) in diameter and may be deep enough to reveal the surface under the paint. While not wishing to be bound by a particular theory, it is believed that these defects result from the repulsion of the paint by contaminants on the surface of the substrate. They may occur singly in isolated events or in mass, with several hundred giving a mottled effect to the film.

Telegraphing refers to a visual defect wherein the pattern or location of a surface contaminate is visible in the cured film. For example, if an attempt is made to wipe away a contaminate, the wipe marks can ‘telegraph’ through the surface of the cured film, i.e., the wipe marks may be visible in the cured film.

Common contaminants believed to cause visual defects such as fisheyes and telegraphing include but are not limited to fats, oils, greases, silicones, and a variety of cosmetics and personal care products.

It has unexpectedly been found that the application of a solution comprising a volatile linear siloxane of the formula:

$$(R)_3\text{-Si-O-}((R)_2\text{-Si-O})_y\text{-Si-}(R)_3$$

wherein R is H or an alkyl group of from 1 to 3 carbon atoms and y is a number from 0 to 6, to a coated substrate having one or more visual defects caused by surface contamination improves, preferably substantially reduces, and most preferably eliminates, said visual defects.

It will be appreciated that the identified visual defects as defined above can occur in a wide variety of coating compositions. Such coating compositions may be one component or two component coating compositions as are understood in the art and discussed above.

The method of the invention is suitable for use with a wide variety of coating compositions, including but not limited to, primers, electrodeposition coatings, sealers, basecoats, topcoats, clearcoats, color-plus-clear composite coatings, and the like. Such compositions may be pigmented or unpigmented and may be solvent borne or water borne.

Use with more than one coating layer of a multilayer coating film is also within the scope of the instantly claimed method.

Suitable coating compositions for use in the instant invention will typically comprise a film-forming component that forms a thermoplastic or thermosetting film via solvent evaporation or chemical crosslinking. Preferred are thermoset films produced by a crosslinking reaction between a principal resin having one or more functional groups and a crosslinking agent having one or more groups reactive with the functional groups of the principal resin.

Thermoplastic films formed by solvent evaporation are typically referred to as lacquers and may or may not contain oxidizing substances to hasten the film formation. Examples of resins used in suitable lacquers include but are not limited to nitrocellulose, cellulose acetate butyrate, acrylics, polyurethanes, and the like. Preferred are acrylics and polyurethanes.

Examples of functional groups of principal resins and/or crosslinking agents used in crosslinking coatings suitable for use in the instant invention include, but are not limited to, active-hydrogen, isocyanate, epoxide, carboxylic acid, hydroxyl including methylol or methylalkoxy, carboxylic acid, amide, amine, acetoacetoxy, mercaptan, anhydride groups, mixtures thereof, and the like. A most preferred functional group for use in a principal resin is hydroxyl. A most preferred functional group for use in a crosslinking agent is isocyanate.

Resins suitable for use as the principal resin in the instant invention will generally have an average functionality of at least 1, preferably from 1.5 to 8, most preferably from 2 to 4. Examples of illustrative principal resins include acrylic, modified acrylic, polyester, polyurethane, polyepoxides, polycarbonates, polyamides, polyimides, hybrids thereof, mixtures thereof, and the like.

In one preferred embodiment of the invention, the coating composition used in the claimed method has a principal resin, which is an acrylic polymer. Such polymers are well-known in the art, and can be prepared from monomers such as methyl acrylate, acrylic acid, methacrylic acid, methyl methacrylate, butyl methacrylate, cyclohexyl methacrylate, and the like. Nonfunctional monomers such acrylate esters and styrene can also be incorporated. Functional groups reactive with a crosslinking agent, i.e., hydroxyl, can be incorporated into the ester portion of the acrylic monomer. For example, hydroxy-functional acrylic monomers that can be used to form such polymers include hydroxyethyl acrylate, hydroxybutyl acrylate, hydroxybutyl methacrylate, hydroxypropyl acrylate, and the like. Aminofunctional acrylic monomers would include t-butylaminoethyl methacrylate and t-butylaminoethylacrylate. Other acrylic monomers having isocyanate-reactive functional groups in the ester portion of the monomer are also within the skill of the art.

In a particularly preferred embodiment, coating compositions useful in the method of the invention will comprise a principal resin which is at least one acrylic polymer prepared from monomers selected from the group consisting of acrylic acid, methacrylic acid, acrylate alkyl esters, hydroxyfunctional acrylate esters, ethylenically unsaturated nonfuntional monomers and mixtures thereof. Such a polymer will generally have a number average molecular weight in the range of from 1000 to 50,000, a hydroxyl number of from 200 to 3000 mg KOH/g, and an acid number in the range of from 0.1 to 25 mg KOH/g.

Modified acrylics can also be used in coating compositions suitable for use in the method of the invention. Such acrylics are typically polyester-modified acrylics or polyurethane-modified acrylics, as is well known in the art. An example of one preferred polyester-modified acrylic is an acrylic polymer modified with δ-caprolactone. Such a polyester-modified acrylic is described in U.S. Pat. No. 4,546,046 of Etzell et al, the disclosure of which is incorporated herein by reference. Polyurethane-modified acrylics are also well known in the art. They are described, for example, in U.S. Pat. No. 4,584,354, the disclosure of which is incorporated herein by reference.

Polyesters having hydroxyl groups, acid groups, or amino groups as isocyanate-reactive groups can also be used as the film-forming component of coatings suitable for use in the method of the invention. Such polyesters are well-known in the art, and may be prepared by the polyesterification of organic polycarboxylic acids (e.g., phthalic acid, hexahydrophthalic acid, adipic acid, maleic acid) or their anhydrides with organic polyols containing primary or secondary hydroxyl groups (e.g., ethylene glycol, butylene glycol, neopentyl glycol).

Other polymers suitable for use as the film-forming component of coatings suitable for use in the claimed method include polyurethanes and polyureas. Polyurethanes having active hydrogen functional groups are also well known in the art. They are prepared by a chain extension reaction of a polyisocyanate (e.g., hexamethylene diisocyanate, isophorone diisocyanate, MDI, etc.) and a polyol (e.g., 1,6-hexanediol, 1,4-butanediol, neopentyl glycol, trimethylol propane). Similarly, polyureas having active hydrogen functional groups are prepared by the reaction of an isocyanate functional compound, such as is discussed above for the preparation of polyurethanes, with amines such as primary and secondary amines. Both polyurethanes and polyureas can be provided with active hydrogen functional groups by capping the polymer chain with an excess of diol, polyamine, amino alcohol, or the like.

Although polymeric or oligomeric film-forming components are often preferred, lower molecular weight non-polymeric film-forming components may also be used in some applications, for example aliphatic polyols (e.g., 1,6-hexane diol), hydroxylamines (e.g., monobutanolamine), and the like.

The film-forming components of coating compositions suitable for use in the method of the invention may, and most preferably will, further comprise one or more crosslinking agents. Examples of suitable crosslinking agents include those compounds having one or more functional groups reactive with the functional groups of the film-forming polymer. Examples of suitable crosslinking agents include isocyanate functional compounds and aminoplast resins, epoxy functional compounds, acid functional compounds and the like. Most preferred crosslinkers for use in suitable coating compositions are epoxide resins, aminoplast resins and isocyanate functional compounds, with isocyanate functional compounds being most preferred.

Aminoplast resin refers to melamine or urea formaldehyde resins. Illustrative examples include but are not limited to monomeric or polymeric melamine resins, partially or fully alkylated melamine resins, methylol ureas such as urea formaldehyde and alkoxy ureas such as butylated urea formaldehyde.

Epoxy resins are typically those constructed through reaction of an oxirane functional group with a phenolic or carboxylic acid group. These resins are often a stoichiometric blend of ephichlorhydrin with phenolics such as bisphenol A or novalac resins, and derivatives thereof, or oxirane functional resins, such as acrylic resins prepared with glycidyl acrylate or methacrylate, and derivatives thereof.

In a most preferred embodiment, the method will utilize a coating having a film-forming component comprising an isocyanate functional crosslinking agent.

Suitable isocyanate functional crosslinking agents include polyisocyanates that are aliphatic, including cycloaliphatic polyisocyanates, or aromatic. Useful aliphatic polyisocyanates include aliphatic diisocyanates such as ethylene diisocyanate, 1,2-diisocyanatopropane, 1,3-diisocyanatopropane, 1,6-diisocyanatohexane, 1,4-butylene diisocyanate, lysine diisocyanate, hexamethylene diisocyanate (HDI), 1,4-methylene bis-(cyclohexylisocyanate) and isophorone diisocyanate. Useful aromatic diisocyanates include the various isomers of toluene diisocyanate, meta-xylenediioscyanate and para-xylenediisocyanate, also 4-chloro-1,3-phenylene diisocyanate, 1,5-tetrahydro-naphthalene diisocyanate, 4,4'-dibenzyl diisocyanate and 1,2,4-benzene triisocyanate can be used. In addition, the various isomers of .alpha.,.alpha.,.alpha.',.alpha.'-tetramethyl xylene diisocyanate can be used. Aliphatic polyisocyanates are preferred, particularly hexamethylene diisocyanate and isophorone diisocyanate.

Also suitable for use are the biurets, aliphonates and/or isocyanurates of such aliphatic or aromatic polyisocyanates. Preferred for use as crosslinking agents in the film-forming components of coatings suitable for use in the method of the invention are the biurets and isocyanurate of polyisocyanates, especially of the aliphatic polyisocyanates such as hexamethylene diisocyanate and isophorone diisocyanate. Most preferred for use as crosslinking agents are the biurets and isocyanurates of hexamethylene diisocyanate.

The composition of the present invention may also comprise any additional ingredient, which imparts any desired characteristic to the composition, or to the process, or to the curable or cured coating composition made therefrom. Such additional ingredients comprise pigments, solvents, rheology control agents, leveling agents, catalysts, cure inhibiting agents, anti-yellowing agents, free radical scavengers, anti-cratering agents, flow modifiers, and mixtures thereof. If the coating composition of the invention is a two-component composition, such additives may be present in component (I) or component (II).

The method of the invention encompasses the application of such coatings to a wide variety of substrates typically encountered in the automotive finishing industry. Illustrative examples include, but are not limited to, metal substrates, plastics, wood, and mixtures thereof. Examples of metal substrates include aluminum, galvanized steel, cold rolled steel, and the like. Plastic substrates may be rigid or flexible and include all plastics encountered in the automotive finishing industry such as bulk and sheet-molded compound (BMC/SMC), polyurethanes, ABS, nylon, and the like. Such substrates may be cleaned or uncleaned, pretreated or unpretreated, painted or unpainted or in a repair condition wherein a portion of a previously applied coating has been removed by sanding.

It will be appreciated that suitable substrates will generally have been cleaned to some degree. However, while not wishing to be bound by a particular theory, it is currently believed that the mechanism of formation of the visual defects addressed by the instant invention requires the presence of one or more contaminants on the surface of the substrate. As indicated above, these visual defects are thought to be caused by a variety of known and unknown contaminants. The methods in which such contaminants arrive on the surface of a substrate are not well understood or controlled. Accordingly, it is understand that even 'cleaned' substrates are within the scope of the instant invention.

The solution of the invention may be applied to the coated substrate during a period beginning with the appearance of a visual defect and closing with the substantial cure of the applied coating composition. The coated substrate may be allowed to air dry upon exposure to ambient air for a period of from 0 to 30 minutes, preferably 0 to 15 minutes, most preferably from 0 to 5 minutes. In a preferred embodiment of the method, the solution comprising the volatile linear siloxane will be applied as soon as one or more visual defects become apparent. More preferably, the solution will be applied to the coated, uncured substrate containing the visual defects before said substrate is exposed to conditions of elevated temperature. Most preferably, the solution of the invention will be applied before substantially all of the solvent contained in the applied coating composition has left the coated substrate and/or the applied coating has been crosslinked.

The solution of the invention may be applied in any essentially any manner in which the underlying coating composition has been applied. Most preferably, the solution of the invention will be applied to a coated substrate containing one or more visual defects caused by surface contamination via air atomized spray.

The solution of the invention comprises a volatile linear siloxane of the formula:

$$(R)_3\text{-Si-O-}((R)_2\text{-Si-O})_y\text{-Si-}(R)_3$$

wherein R is H or an alkyl group of from 1 to 3 carbon atoms and y is a number from 0 to 6. Preferably, R is an alkyl group of from 1 to 3 carbons and is most preferably a methyl group. y is preferably a number from 0 to 3, preferably a number from 1 to 2, and most preferably is 2. Examples of particularly preferred volatile linear siloxanes for use in the instant invention are hexamethyldisiloxane, octamethyltrisiloxane, decamethyltetrasiloxane, and dodecamethylpentasiloxane. Octamethyltrisiloxane and dodecylmethylpentasiloxane are preferred, with dodecylmethylpentasiloxane being most preferred.

The solution of the invention may further comprise one or more solvents, one or more binders, and mixtures thereof. Binders as used herein refer to polymeric materials such as are discussed above with respect to the film-forming components of coating compositions suitable for use herein. Suitable solvents may be hydrocarbon or water-soluble. Examples of suitable solvents include ketones, esters, acetates, aprotic amides, aprotic sulfoxides, or aprotic amines, methyl ethyl ketone, methyl isobutyl ketone, m-amyl acetate, ethylene glycol butyl ether-acetate, propylene glycol monomethyl ether acetate, xylene, N-methylpyrrolidone, or blends of aromatic hydrocarbons. In another preferred embodiment, the solvent may be water or a mixture of water with small amounts of aqueous co-solvents.

It will be appreciated that a true solvent is a liquid that can dissolve the binder. A solvent is a thus a single liquid or blends of liquids, volatile under specified drying conditions, and in which the binder or film-forming component is completely soluble. <u>European Standards, XP-002066658, Paints and Varnishes - Terms and definitions for</u>

coating materials - Part 1: General Terms, European Committee for Standardization. Alternatively, a solvent may be defined as a pure or mixed liquid, which is used to make a coating flowable prior to its application. Understanding Paint and Painting Processes, 3rd Edition, Schneberger, Dr. Gerald L., Hitchcock Publishing Co. Wheaton, IL 60188.

It will be appreciated that the volatile linear siloxanes used in the instant invention are generally not, and most preferably will not be, solvents for the film-forming component of the instant invention. However, the volatile linear siloxanes may be and most preferably will be, soluble in any solvents used in the solution of the invention.

The solution of the invention may be comprised of 100% by weight of the volatile linear siloxane, based on the total weight of the solution. Preferably, the solution will comprise from 0.10 to 99.00 percent by weight, more preferably from 0.10 to 90.00 percent, and most preferably from 0.10 to 70.00 percent by weight of the volatile linear siloxane, based on the total weight of the solution.

The invention is further illustrated but is not limited by the following examples in which all parts and percentages are by weight unless otherwise specified.

Example I

An automotive refinish clear coating, DC-92 (BASF Corporation), was mixed in a 3:1:0.2 ratio, by volume, with DH-46 hardener (BASF Corporation) and UR-50 reducer (BASF Corporation), respectively, and applied in two coats via air atomized spray to a dry film thickness of 2.1-2.3 mils. to a clean, 12x18-inch pre-primed aluminum panel. The panel was allowed to dry for three minutes, after which a light coat of a solution of FreKote® TR-900 mold release agent (Dexter Corporation), representing an airborne contaminant, was applied via air atomization to the freshly coated panel which produced numerous “fisheye” defects on the coating surface. The panel was allowed to dry for another five minutes. A solution of 95 parts by weight UR-50 reducer and 5 parts by weight of decamethyltetrasiloxane was then applied by air atomized spray over the coated surface. The surface defects were either eliminated or attenuated, depending on the severity of the original defect.

CLAIMS

1. A method of improving a coated substrate having visual defects caused by surface contamination, comprising

applying a coating composition to a substrate having one or more surface contaminates so as to produce a coated substrate having one or more visual defects caused by surface contamination, and

applying to said coated substrate a solution comprising a volatile linear siloxane of the formula:

$$(R)_3\text{-Si-O-}((R)_2\text{-Si-O})_y\text{-Si-}(R)_3$$

wherein R is H or an alkyl group of from 1 to 3 carbon atoms and y is a number from 0 to 6.

2. The method of claim 1 wherein the step of applying the solution comprises spraying the solution onto the coated substrate.

3. The method of claim 1 wherein the solution further comprises a solvent.

4. The method of claim 1 wherein the solution further comprises a binder.

5. The method of claim 4 wherein the binder is selected from the group consisting of acrylic resins, urethane resins, epoxy functional resins, alkyd resins, polyester resins, and mixtures thereof.

6. The method of claim 1 wherein the solution comprises from 0.10 to 99.00 percent by weight of the volatile linear siloxane, based on the total weight of the solution.

7. The method of claim 6 wherein the solution comprises from 0.10 to 90.00 percent by weight of the volatile linear siloxane, based on the total weight of the solution.

8. The method of claim 7 wherein the solution comprises from 0.10 to 70.00 percent by weight of the volatile linear siloxane, based on the total weight of the solution.

9. The method of claim 1 comprising providing the volatile linear siloxane wherein y is a number from 0 to 3.

10 The method of claim 1 comprising providing the volatile linear siloxane wherein y is a number from 1 to 2.

11 The method of claim 1 comprising providing the volatile linear siloxane wherein y is 2.

12. The method of claim 1 wherein R is methyl.

13. The method of claim 1 wherein the coating composition comprises a film-forming component and the volatile linear siloxane is not a solvent for said film-forming component.

14. The method of claim 13 wherein the film-forming component has no more than 2.00 % by weight of Si-containing compounds, based on the total nonvolatile weight of the coating composition.

15. The method of claim 1 wherein the solution is applied to the coated substrate having one or more visual defects before the coated substrate is cured.

16. A method of improving visual defects caused by surface contamination from a coated substrate, comprising

providing an uncured coated substrate having one or more visual defects caused by surface contamination; and

applying to said coated substrate a solution comprising a volatile linear siloxane of the formula:

$$(R)_3\text{-Si-O-}((R)_2\text{-Si-O})_y\text{-Si-}(R)_3$$

wherein R is H or an alkyl group of from 1 to 3 carbon atoms and y is a number from 0 to 6.

17. The method of claim 16 wherein the uncured coated substrate is allowed to dry at ambient temperature for a period of from 1 to 15 minutes before the application of the solution.

18. The method of claim 16 wherein the uncured coated substrate is substantially uncured.

19. The method of claim 16 wherein the solution is applied to the uncured substrate before the uncured panel is exposed to conditions of elevated temperature.

20. The method of claim 16 wherein the solution is applied to the uncured coated substrate by air atomized spray.