

PROCESS FOR COATING AND CLEANING METAL SURFACES

Field of the Invention

This invention relates to process for coating a metal surface, wherein said process comprises contacting the metal surface with a barrier coating comprising (a) an amine salt of a fatty acid or an amine salt of a derivative of a fatty acid, (b) a salt of a non polymeric aromatic acid, (c) optionally, a nonionic or anionic surfactant, and (d) water. The invention further comprises a process for cleaning a metal surface containing residues, which comprises contacting the metal surface, exposed to the barrier coating, with water to remove residues that have deposited after applying the barrier coating to the metal surface.

Background of the Invention

Residues such as cement, iron ore, sulfur, coal and petroleum coke often develop on metal surfaces and have to be removed. This is particular a problem in the container and cargo industry.

It is known that such residues can be removed from metal surfaces by the application of corrosive solvents, e.g. mineral acids. It also known to apply barrier agents to the metal surface once it has been cleaned in order to keep from residues from being deposited again. Some of the well-known barrier aids are a soya-based barrier aid sold by RoBo Products/RBM, Stomme and a silicone-based barrier aid sold by Dow Corning. One of the problems with using these barrier aids is that they require supplemental products to remove them after they are applied.

U.S. Patent 6,458,320 relates to a corrosion inhibitor for galvanized steel comprising (a) an amine salt of a fatty acid or an amine salt of a derivative of a fatty acid, (b) preferably a salt of a non polymeric aromatic acid, and (c) preferably a nonionic or anionic surfactant, and water, but not as a barrier coating composition, or as part of a barrier coating process. The patent does not teach or suggest that the composition can be used as a coating that enables one to remove residues such as cement, which has deposited on a metal surface.

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2 All citations to prior art are incorporated by reference.

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4 **Summary of the Invention**

5 This invention relates to process for coating a metal surface, wherein said process
6 comprises contacting a metal surface with a barrier coating comprising:

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8 (a) an amine salt of a fatty acid or an amine salt of a derivative of a fatty
9 acid;

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11 (b) a salt of a non polymeric aromatic acid;

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13 (c) optionally, a nonionic or anionic surfactant having an HLB of 1 to 20;
14 and

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16 (d) water.

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18 The barrier coating can be applied to any metal surface, but is particularly useful for
19 steel surfaces, most particularly for carbon steel. Preferably the metal surface should be
20 clean or substantially clean of residues such as cement, iron ore, sulfur, coal, and
21 petroleum coke when the barrier coating is applied. It is believed that the barrier
22 coating will be effective when applied to metal surfaces that are painted or otherwise
23 coated.

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25 One of the advantages of the process is that residue that forms after the barrier coating
26 is applied can removed by washing with water. Thus, another aspect of the invention
27 relates to washing residues from the metal surface with water after the barrier coating is
28 applied to the metal surface. The barrier coating is allowed to become tacky or dry
29 before loading the cargo. Typically, a waiting period of at least two hours is required
30 before loading the cargo. Residues of the cargo then loaded can be removed by water
31 after the cargo is unloaded. The thickness of the barrier coating ranges from 0.5 mils to
32 5.0 mils., typically 0.8 mils to 3.0 mils.

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2 The barrier coating can be applied in such a manner to obtain a reproducible thickness.
3 It can be applied by brushing, spraying, or other means.

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5 A particularly useful application of the process relates to the removal of residues from
6 larger bulk cargoes. Residues that accumulate on these containers and vessels include
7 powders and dusts, e.g. dusts from larger bulk cargoes, such as dust from iron ore
8 pellets. The thickness of the residue can be several inches, but the residue can still be
9 removed with washing if the barrier coating has been applied to the metal surface
10 containing the bulk cargo. When the residue is thicker, i.e. an inch or more, it may be
11 necessary to use a high-pressure water jet to create sufficient force to remove the
12 residue from the surface.

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14 **Detailed Description of the Invention**

15 The amine salts of fatty acids or the amine salts of derivatives of fatty acids used in the
16 barrier coating are formed by neutralizing a carboxylic acid with an amine. The
17 carboxylic acid used may be a saturated or unsaturated, mono-, di-, or polycarboxylic
18 acid having a least six carbon atoms per functional group. Specific examples include,
19 but are not limited to, capric acid, lauric acid, and palmitic acid. Most preferably used
20 as the carboxylic acid are higher fatty acids such as rosin acids, tall oil, and their
21 derivatives, most preferably a C₂₁ dicarboxylic acid, DIACID 1550 sold by Westvaco.
22 Other useful derivatives include partial esters of maleated tall oil fatty acid.

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24 The amine used to form the amine salt of a fatty acid or derivative thereof can be any
25 primary, secondary, or tertiary aliphatic amine. Examples include alkylamines, for
26 instance methylamine, ethylamine, propylamine, and butylamine; alkanolamines, for
27 instance as monoethanolamine, diethanolamine, and triethanolamine; morpholine; and
28 cyclohexylamine. Preferably, the amine is triethanolamine, or N, N-
29 diethylethanolamine, dimethylamine, 1,2-diaminoethane, diaminopropane,
30 ethanolamine, 2-methyl-2-amino-1-propanol, 5-aminopentanol, methoxypropylamine.

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1 The amount of carboxylic acid and amine used to form the amine carboxylates can vary
2 over wide ratios, but the amount typically used is such that the ratio of carboxyl groups
3 of the carboxylic acid to amino groups of the amine is from 4:1 to 1:4, preferably about
4 2:1 to 1:2, most preferably about 1:1.

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6 Preferably used as the salt of the non-polymeric aromatic acid are the alkali metal salts
7 of benzoic acid. The amount of salt of the non polymeric aromatic acid used is from 1:5
8 to 5:1, parts by weight, 0.5:1 to 3:1 parts by weight based upon the total weight of the
9 amine salt used, most preferably from 1:1 to 2:1.

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11 An optional component of the barrier coating is a nonionic or anionic surfactant having
12 hydrophilic-lipophilic balance (HLB) of 1-20. Preferably the surfactant is a
13 polyoxyethylene- polyoxypropylene nonionic surfactant, having an average molecular
14 weight of about 1000 to 10,000, preferably from 3000 to 5000, and a hydrophobe to
15 hydrophile ratio of about 1:1 to 10:1, preferably from 3:1 to 10:1. The amount of
16 nonionic surfactant use is from 1:30 to 2:1, preferably from 1:6 to 1:8, based upon the
17 total weight of the amine salt used. Other useful surfactants include linear alcohol
18 ethoxylates, for example, one with 12 to 15 carbon atoms and 9 moles of ethoxylation;
19 and alkali metal salts of fatty acids, for example, oleic acid.

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21 The amount of the various components in the barrier coating are within the following
22 ranges: component (a) is typically used in an amount of from 5 to 30 parts by weight
23 based upon the amount of barrier coating, preferably 10 to 20 parts by weight, and most
24 preferably 15 to 20 parts by weight; component (b) is typically used in an amount of
25 from 10 to 40 parts by weight based upon the amount of barrier coating, preferably 20
26 to 40 parts by weight, and most preferably 20 to 30 parts by weight; component (c) is
27 typically used in an amount of from 1 to 10 parts by weight based upon the amount of
28 barrier coating, preferably 1 to 5 parts by weight, and most preferably 2 to 3 parts by
29 weight; and the amount of water typically used in the barrier coating is from 40 to 85
30 parts by weight based upon the amount of barrier coating, preferably 40 to 60 parts by
31 weight, and most preferably 50 to 60 parts by weight

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The barrier coating is most conveniently formulated as an aqueous solution of about 30 to 50 percent solids with a pH of about 7.0 to 8.0, preferably about 7.5.

DEFINITIONS AND ABBREVIATIONS

TEA = triethanolamine.

DIACID = a C₂₁ diacid sold by WESTVACO as DIACID 1550.

PP = PLURONIC® Polyol L101, a polyoxypropylene-polyoxyethylene copolymer nonionic surfactant sold by BASF Corporation having an HLB value of 1, and an average molecular weight of about 3800, and hydrophobic and hydrophilic segments where the weight ration of hydrophobe to hydrophile is about 9 to 1.

SALT = salt of DIACID and TEA.

SBEN = sodium benzoate

EXAMPLES

Example 1

A barrier coating was formulated by mixing the components set forth in Table I. The components were added by continuous mixing in the following order: water, TEA, DIACID, SBEN, and PP. The pH of the barrier coating was about 7.5.

TABLE I
BARRIER COATING FORMULATION

Deionized water	56.6 parts
TEA salt of DIACID	15.2 parts
Sodium benzoate (SBEN)	26.2 parts
PLURONIC Polyol L101 (PP)	2.0 parts
Total	100.0 parts

1 Mild carbon steel panels were coated with the barrier coating of Example 1 to a
2 thickness of 0.81 mils and 2.88 mils using a RDS Coating Rod. The panels were dried
3 for two hours. Then one part of Portland cement mixed with 0.5 parts of water and
4 applied to the treated steel panel and an untreated panel.

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6 The cement was left to dry overnight. Then the panels were then sprayed with water
7 from an aspirator bottle. The cement was easily removed from the treated panel, down
8 to bare metal. On the other hand, the cement remained adhered to the untreated panel.

9 Essentially none of the cement was removed from the treated panel after washing with
10 water.

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CLAIMS

1. A process for removing deposits from a coated metal surface comprising:
 - A. contacting a metal surface with a barrier coating to form a coated metal surface comprising:
 - (1) an amine salt of a fatty acid or an amine salt of a derivative of a fatty acid,
 - (2) a salt of a non polymeric aromatic acid, and
 - (3) water; and
 - B. allowing the coated metal surface to dry;
 - C. allowing residue to form on said coated metal surface; and
 - D. washing the residue formed on the coated metal surface to remove some or all of the residue.
2. The process of claim 1 wherein the metal surface is substantially free of residues before it is coated.
3. The process of claim 2 wherein component (2) is an alkali metal benzoate.
4. The process of claim 3 wherein component (1) is the triethanolamine salt of a C₂₁ diacid.
5. The process claim 4 wherein the metal is carbon steel.
6. The process of claim 6 wherein the metal surface is the surface of a container or a cargo vessel.

7. The process of claims 1, 2, 3, 4, 5 or 6 wherein the barrier coating also comprises a surfactant.
8. The process of claim 7 wherein the barrier coating contains from 5 to 30 parts by weight of an amine salt of a fatty acid, (b) 10 to 40 parts by weight of a salt of a non polymeric aromatic acid, (c) from 1 to 10 parts by weight of a surfactant, and from 40 to 85 parts by weight of water, where said parts by weight are based upon 100 parts by weight of barrier coating.
9. The process of claim 8 wherein water is sprayed onto the deposit-containing metal surface in an amount sufficient to remove all or substantially all of the deposits from the metal surface.