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ADDITION AGENT FOR CADMIUM PLATING SOLUTION

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The present invention relates to brightening agents for cadmium plating solutions.

It is an object of the present invention to prepare a novel brightening agent suitable for incorporation in a cadmium plating bath.

An additional object is to prepare a cadmium plating bath including a novel brightening agent.

A further object is to develop a brightening agent for cadmium plating solutions which will give bright, adherent deposits over a wide current density range while increasing the throwing power of the plating solutions.

Still further objects and the entire scope of applicability of the present invention will become apparent from the detailed description given hereinafter; it should be understood, however, that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

It has now been found that the objects of the present invention can be attained by employing a mixture of an alkali metal salt of an alkyl naphthalene sulfonic acid and a hydroxyalkyl cellulose as the brightening agent. Preferably, there is employed a mixture of a naphthalene sulfonic acid derivative such as used as a leveling agent for acid dye baths and available from the Antara Chemicals Division of General Dyestuff Corporation, and distributed under the registered trademark "Leonil SA," which product is believed to be specifically dibutyl naphthalene sodium sulfonate, and that the mixture consists of it and hydroxyethyl cellulose.

The weight ratio of the Leonil SA to hydroxyethyl cellulose can vary from the ratio 1.0 to 2.0 to the ratio 3.75 to 1, with a preferred ratio of 1 to 1.

The Leonil SA and hydroxyethyl cellulose are mixed dry, the requisite amount of water added, the mixture heated to 150° F., to dissolve the mixture quickly, and then the aqueous solution is allowed to stand overnight.

Typical formulations are given in the examples.

Example 1

	Grams
Leonil SA	0.152
Hydroxyethyl cellulose	0.076

The dry mixture was dissolved in water and added to a liter of plating solution.

Example 2

	Grams
Leonil SA	0.557
Hydroxyethyl cellulose	0.279

The dry mixture was dissolved in water as above.

Example 3

	Grams
Leonil SA	0.356
Hydroxyethyl cellulose	0.178

The dry mixture was dissolved in water.

Example 4

	Grams
Leonil SA	0.152
Hydroxyethyl cellulose	0.049

The dry mixture was dissolved in water.

Example 5

	Grams
Leonil SA	0.557
Hydroxyethyl cellulose	0.181

The dry mixture was dissolved in water.

Example 6

	Grams
Leonil SA	0.356
Hydroxyethyl cellulose	0.116

The dry mixture was dissolved in water and added to a liter of plating solution.

Examples 6 and 7 represent preferred examples of the invention.

Example 7

Leonil SA —pounds—	2.0
Hydroxyethyl cellulose, grade WPO9 —ounces—	10.8

The dry mixture was dissolved in 72.3 pounds of water with stirring. To hasten solution the aqueous mixture was quickly heated to 150° F. and then allowed to stand overnight at room temperature. One gallon of this mixture weighed about 8.5 pounds.

The cadmium plating brightener of any of Examples 1 to 7 is suitable as a brightening agent for cadmium plating solutions. The use of these brighteners results in the production of a bright, lustrous deposit with increased throwing power. At the same time, the brighteners of the present invention are economical to use.

The brighteners of the present invention are compatible with almost all organic addition agents and can be used in barrel, automatic and still plating.

The brighteners of the present invention can be added to standard cadmium plating formulations. Typical solutions of this type are as follows:

Constituent	Barrel Solution	Still and Automatic Solutions
Cadmium Metal, oz./gal	2.5 to 4.0	2.5 to 4.0
Sodium Cyanide, oz./gal	10.0 to 20.0	10.0 to 20.0
Caustic Soda, oz./gal	1.5 to 3.0	2.0 to 3.5
Ratio, NaCN/Cd	4 to 5:1	4 to 5:1
Temperature, °F	75 to 100	75 to 100

Example 8

The preferred formulation is cadmium metal 3.0 oz./gallon, sodium cyanide 13.5 oz./gallon, caustic soda 2.0 oz./gallon and an operating temperature of 80° F.

Typical examples of plating solutions according to the present invention are as follows:

Example 9

The aqueous brightening agent mixture of Example 7 was added to the plating formulation of Example 8 in an amount of ¾ fluid oz./gallon.

Example 10

The aqueous brightening agent mixture of Example 6 was added in total at a temperature of 80° F. to a liter of the plating formulation of Example 8 to give a plating solution.

In order to get the maximum efficiency from the brightener, it is necessary to have present in the plating solution a small amount of nickel or cobalt sulfate. This

not only acts as a catalyst for the brightener, but also contributes to the quality of the cadmium plate and particularly to the adhesion. For new solutions it has been found that 3 ounces of nickel sulfate should be added per 100 gallons of plating. Further additions of nickel or cobalt sulfate are made only when the plating solution becomes extremely pale in color.

Example 11

To 1 gallon of the plating solution prepared in Example 9 there was added 0.03 ounce of nickel sulfate.

In making up new plating solutions the aqueous mixture of dibutyl naphthalene sodium sulfonate and hydroxyethyl cellulose brightening agent, such as the formulations shown in Examples 1 to 7, is generally added to the plating formulation in an amount of ⅓ to 1¼ fluid oz./gallon and preferably ¾ fluid oz./gallon. When the brightener is added to old solutions it has been found advantageous to use 1.5 to 3.0 fluid ounces of the brightener solution per 100 gallons of the plating solution in order to raise the level of brightness commensurate with the quality standard obtained with new solutions. Old plating solutions become more efficient as the influence of the formerly used brightener becomes depleted and is replaced by the Leonil SA-hydroxyethyl cellulose mixture. Maximum efficiency can be obtained most quickly on old solutions by purifying the plating solution and filtering before adding the brightener.

In order to maintain the brightener concentration at the desired level there should be added 1 pound of brightener solution, e.g., the brightener solution of Example 6, for each 20 to 25 pounds of sodium cyanide consumed in plating.

Referring to Examples 10 and 11, while I have referred to the use of nickel sulfate, these examples have been repeated in each instance using cobalt sulfate, and in other examples using mixtures of nickel sulfate and cobalt sulfate, in the same amounts as recited.

Cadmium plated surfaces normally do not resist tarnishing for any appreciable length of time. The use of the brighteners of the present invention considerably extend the time of resistance to tarnishing. It is desirable in this connection to neutralize the retained cadmium plate solution with a standard acidulated dip to eliminate the tarnishing effects caused by retained solution.

Example 12

	Pounds
Leonil SA	1.5
Hydroxyethyl cellulose	1.5
Water	84

Example 13

Leonil SA	pounds	2
Hydroxyethyl cellulose	ounces	10.8
Water	pounds	72.3

The hydroxyethyl cellulose is available from Carbide & Carbon Chemical Company and is sold under its trademarke "Cellosize."

This application is a continuation-in-part of my copending application Serial No. 610,380, filed September 17, 1956, and now abandoned.

I claim:

1. A cadmium cyanide plating bath containing a mixture of dibutyl naphthalene sodium sulfonate and hydroxyethyl cellulose in an amount sufficient to act as a brightening agent, wherein the bath contains ¾ fluid ounce per gallon of bath of the brightener mixture, wherein said brightener mixture contains from 0.152 to 0.557 gram per liter of the dibutyl naphthalene sodium sulfonate and from 0.049 to 0.279 gram per liter of hydroxyethyl cellulose and the ratio of dibutyl naphthalene sodium sulfonate to hydroxyethyl cellulose is in the range from the ratio 1.0 to 2.0 to the ratio 3.75 to 1.

2. A cadmium cyanide plating bath according to claim 1 wherein the ratio of dibutyl naphthalene sodium sulfonate to hydroxyethyl cellulose is from 2.7 to 3.75 to 1.

3. A cadmium cyanide plating bath according to claim 2 wherein the ratio of dibutyl naphthalene sodium sulfonate to hydroxyethyl cellulose is about 3 to 1.

4. A composition consisting essentially of 1.8 to 3.75 parts by weight of dibutyl naphthalene sodium sulfonate and 1 part of hydroxyethyl cellulose.

5. A composition according to claim 4 wherein there is contained 2.7 to 3.75 parts by weight of the dibutyl naphthalene sodium sulfonate for each part by weight of hydroxyethyl cellulose.

6. A composition according to claim 5 wherein the ratio of dibutyl naphthalene sodium sulfonate to hydroxyethyl cellulose is about 3 to 1.

7. A composition consisting essentially of an alkali metal salt of an alkyl naphthalene sulfonic acid and a hydroxyalkyl cellulose wherein the ratio of the alkali metal salt to the hydroxyalkyl cellulose is in the range from the ratio 1.0 to 2.0 to the ratio 3.75 to 1.

8. A composition according to claim 7 dissolved in water.

9. A composition according to claim 7 in anhydrous form.

10. A cadmium cyanide plating bath according to claim 7 in which the ratio of sulfonic acid salt to the hydroxyethyl cellulose is 1 to 1.

11. A cadmium cyanide plating bath according to claim 7 in which the ratio of sulfonic acid salt to the hydroxyethyl cellulose is 3 to 1.

12. A composition comprising an alkali metal salt of an alkyl naphthalene sulfonic acid and a hydroxyalkyl cellulose, the ratio between the salt and the cellulose being about 1 to 1.

13. A composition comprising an akali metal salt of an alkyl naphthalene sulfonic acid and a hydroxyalkyl cellulose, the ratio between the salt and the cellulose being about 3 to 1.

14. The composition according to claim 12 wherein said salt is dibutyl naphthalene sodium sulfate and the cellulose is hydroxyethyl cellulose.

15. The composition according to claim 13 wherein said salt is dibutyl naphthalene sodium sulfate and the cellulose is hydroxyethyl cellulose.

16. A cadmium cyanide plating bath containing a brightener mixture wherein said brightener mixture contains from 0.152 to 0.557 gram per liter of dibutyl naphthalene sodium sulfonate and from 0.049 to 0.279 gram per liter of hydroxyethyl cellulose and the ratio of dibutyl naphthalene sodium sulfonate to hydroxyethyl cellulose is in the range from the ratio 1.0 to 2.0 to the ratio 3.75 to 1.

17. A cadmium cyanide plating bath according to claim 1 wherein the bath contains ¾ fluid ounce per gallon of bath of the brightener mixture, wherein said brightener mixture contains from 0.152 to 0.557 gram per liter of the dibutyl naphthalene sodium sulfonate and from 0.049 to 0.279 gram per liter of hydroxyethyl cellulose and the ratio of dibutyl naphthalene sodium sulfonate to hydroxyethyl cellulose is about 1 to 1.

18. A cadmium cyanide plating bath containing a brightener mixture, said brightener mixture containing from 0.152 to 0.557 gram per liter of an alkali metal salt of an alkyl naphthalene sulfonic acid and from 0.049 to 0.279 gram per liter of hydroxyalkyl cellulose and wherein the ratio of said alkali metal salt to said hydroxyalkyl cellulose is in the range from the ratio 1.0 to 2.0 to the ratio 3.75 to 1.

References Cited in the file of this patent

UNITED STATES PATENTS

1,818,229	Lutz et al.	Aug. 11, 1931
2,526,999	Diggin et al.	Oct. 24, 1950