

1

2,846,343

PRODUCT AND METHOD FOR EFFECTING A COLD CHEMICAL OXIDATION OF ALUMINUM AND ITS ALLOYS

Walter A. Mason, Minneapolis, Minn.

No Drawing. Application September 21, 1955
Serial No. 535,740

13 Claims. (Cl. 148—6.24)

My invention relates to a product and method for effecting a cold chemical oxidation of a metallic surface. In particular, it relates to a product and method for effecting a cold chemical oxidation of aluminum and its alloys.

An object of my invention is to provide a method for effecting a cold chemical oxidation of a metallic surface to produce a surface with a blue-black or jet-black color.

Specifically, it is an object of my invention to provide a novel and improved method of cold treating aluminum and its alloys to produce a blue-black or jet-black color to the surface thereof.

Another object of my invention is to provide a novel solution which may be used to effect a cold chemical oxidation of a metallic surface.

A further object of my invention is to provide a novel solution which may be easily applied to aluminum and/or its alloys to produce a blue-black or jet-black color to the surface thereof.

In essence, my invention comprises a method for effecting a cold chemical oxidation of a metallic surface to produce a blue-black or jet-black color by effecting a plating on the metallic surface of blackened copper, which may be copper selenate or copper tellurate. Although the principals of my invention may be used with respect to other metals, I shall hereinafter specifically disclose my invention as it is used to effect a cold chemical oxidation of aluminum and its alloys.

Specifically, I form a solution consisting of cupric chloride, ferric chloride, selenium or tellurium, nitric acid, alkylaryl sulphate, known commercially as aerosol, an alcohol, and water.

With respect to the chemicals in the solution product, the selenium or tellurium acts as a blackening agent for the copper, which is put into solution as the copper salt, cupric chloride. The selenium or tellurium may be in solution as one of the oxygen acids thereof, that is, selenous or selenic acid, or tellurous or telluric acid, or in solution as a water soluble salt which may be thought of as derived from the aforementioned oxygen acids, for example, sodium or potassium tellurite.

The cupric chloride in solution with selenous or selenic acid, or with tellurous or telluric acid, or with any of the water soluble salts of these acids provides in solution either copper selenite, copper selenate, copper tellurite or copper tellurate, depending upon the extent of oxidation of the selenium or tellurium in solution. Copper selenite and copper tellurite are readily oxidized to the selenate and tellurate, respectively; and although this may occur to some extent in solution, it at least occurs upon oxidation of the coated aluminum surface. Therefore, it shall generally be considered that the solution comprises either copper selenate or copper tellurate even though, as aforementioned, the copper selenium or tellurium may be in solution as selenite or tellurite.

It is the purpose of my invention, in essence, to maintain the copper selenate or copper tellurate in solution

2

until brought in contact with the metallic surface to be coated, and then to controllably effect the precipitation or plating of the copper selenate or copper tellurate onto the metallic surface.

Copper selenate or copper tellurate is generally insoluble in water so that I maintain the solution acidic. This is effected by the nitric acid. The nitric acid further acts to dissolve the oxide on the surface to be plated, which specifically is aluminum oxide. Other acids might be used, such as fluoboric acid; and the only requirements are that the acid is capable of dissolving the oxide and that it is compatible with the other elements in solution as an electrolytic agent so that the solution product is acidic.

With respect to the alcohol in solution, I have found that either isopropyl alcohol or methanol is preferred for the specific solution herein disclosed; however, other alcohols might be better adapted to variations of my invention, and it is conceivable that other alcohols might be proved acceptable in the specific product specifically disclosed. The only requirements are that the alcohol be compatible with the other elements in solution to maintain the solution without any precipitation. The alcohol and the aerosol, alkylaryl sulphate, act as suppressors or retarders; in other words, they slow down the plating process to produce a finer grain of surface or a smoother finish. The type of finish desired may be variable depending upon the percentage of alcohol and aerosol in relation to the amount of water. Both the alcohol and aerosol serve other functions which will be brought out subsequently.

The ferric chloride acts as a catalyst for effecting the copper precipitation.

In forming the solution, first, a specific amount of water is taken for each 54 gallon batch to be made; and the amount of water may vary between 22 and 54 gallons depending upon the dilution of solution desired. In plating aluminum by immersion, a weaker solution is preferred because of the slower plating action. Next, the selenium or tellurium, and cupric and ferric chloride salts are put into the water. For every 54 gallon batch, the amount of cupric chloride may vary between 3 and 12 pounds, and the ferric chloride may vary between 2 and 6 pounds. Preferably, the selenium is put into solution as selenium dioxide in an amount between 3 to 12 pounds. Next, I add the nitric acid in an amount approximately equal to 110–170 fluid ounces. Next, I add from between 2 to 4 pounds of alkylaryl sulphate. Here, it might be noted that the alkylaryl sulphate or aerosol acts as a spreading agent for the solution and further acts as a detergent for penetrating any film of oil which might be retained on the aluminum surface to be plated. A larger amount of aerosol might be used in an immersion application to insure a more uniform spreading. Last, the alcohol is added to the solution in an amount to make 54 gallons; the amount is generally between 5 and 20 gallons. As previously mentioned, the amount of alcohol may be varied to determine the speed of the reaction.

It might be noted that with respect to the amount of copper in relation to the amount of selenium, or tellurium, one might use 15% more copper or 15% less copper than selenium, or tellurium, to vary the color from a blue-black to a jet-black, respectively. Generally, it is preferable to use more selenium or tellurium than copper because some aluminum selenate or tellurate is formed. There is actually an interchange between the aluminum, copper and copper blackening agent.

In using tellurium, the dioxide is not soluble in water, and this may be converted to a sodium or potassium tellurite. Preferably, I dissolve the metal itself in nitric acid beefed up with hydrogen peroxide to form telluric acid. In this respect, I use $\frac{3}{4}$ of a fluid ounce of nitric acid, one

ounce of hydrogen peroxide and one ounce of tellurium to form approximately 1½ ounces of telluric acid. In every 54 gallon batch of solution product, I use 3 to 12 pounds of telluric acid in place of the selenium dioxide. It might be noted that instead of using selenium dioxide, the metal itself might be dissolved in nitric acid to form the selenous or selenic acid.

In essence, the method of the cold chemical oxidation of any aluminum surface or its alloys comprises immersing, spraying or brushing the above disclosed solution product on a cleaned aluminum surface which, in effect, precipitates or plates the blackened copper, copper selenate or tellurate onto the aluminum surface to produce a blue-black or jet-black finish. There is actually a chemical reaction or interaction between the aluminum surface and the solution so that the blackened copper precipitate is absorbed in and becomes a part of the aluminum surface; therefore, it is more than a mere coating. After coating, within 24 hours, the surface is oxidized and hardened which improves it from an abrasion standpoint; in other words, my novel and improved plating process forms not only a particularly desirable color but also a protective coating. When the solution is applied to the aluminum surface it produces aluminum chloride, a white salt, which would be incompatible with the surface desired. The alcohol dissolves this salt and it is carried away in the solution. It might be noted that before plating, the aluminum surface is degreased by a solvent such as any petroleum solvent, carbon tetrachloride or any of the chloride solvents, or any alkyd cleaner. Although the petroleum solvents leave an oil film, this is penetrated by the aerosol.

My invention has been practiced as hereinbefore disclosed, and has been found to accomplish all of the aforementioned objectives and advantages. It will be obvious to those skilled in the art that my invention may be modified in many respects without departing from the essence of my invention; and therefore, I intend to be limited solely by the scope of the appended claims.

What I claim is:

1. A solution comprising a water solvent, a cupric salt, a copper blackening agent selected from the group consisting of selenium and tellurium, a catalyst, and an acid compatible with the other elements of the solution as an electrolytic agent and capable of dissolving the surface oxide of the surface to be coated with the solution.

2. A solution comprising a water solvent, a cupric salt, a ferric salt, a copper blackening agent selected from the group consisting of selenium and tellurium, an alcohol, alkylaryl sulphate, and nitric acid.

3. A solution comprising a water solvent, cupric chloride, ferric chloride, a copper blackening agent selected from the group consisting of selenium and tellurium, and an acid compatible with the other elements of the solution as an electrolytic agent and capable of dissolving the surface oxide of the surface to be coated.

4. A solution comprising a water solvent, cupric chloride, ferric chloride, a copper blackening agent selected from the group consisting of selenium and tellurium, an alcohol, and an acid capable of dissolving aluminum oxide and compatible with the other elements of the solution as an electrolytic agent.

5. A solution comprising a water solvent, cupric chloride, ferric chloride, a copper blackening agent selected from the group consisting of selenium and tellurium, an alcohol selected from the group consisting of isopropyl alcohol and methanol, and nitric acid.

6. A solution comprising a water solvent, cupric chloride, ferric chloride, a copper blackening agent selected

from the group consisting of selenium and tellurium, an alcohol selected from the group consisting of isopropyl alcohol and methanol, alkylaryl sulphate, and nitric acid.

7. A solution comprising in every 54 gallons of solution approximately 3 to 12 pounds of a copper blackening agent selected from the group consisting of selenium and tellurium, cupric chloride in an amount by weight approximately equal plus or minus 15% to the weight of copper blackening agent, approximately 2 to 6 pounds of ferric chloride, approximately 110 to 170 fluid ounces of nitric acid, approximately 2 to 4 pounds of alkylaryl sulphate, approximately 5 to 20 gallons of an alcohol selected from the group consisting of isopropyl alcohol and methanol, and sufficient water to make the 54 gallon solution.

8. A method for effecting a cold chemical oxidation of aluminum and its alloys comprising coating the metallic surface with cupric chloride, ferric chloride, and a copper blackening agent selected from the group consisting of selenium and tellurium in an acidic solution comprising water and an alcohol selected from the group consisting of isopropyl alcohol and methanol to effect a union between the aluminum surface and blackened copper for producing aluminum having a surface with a black color.

9. A method for effecting a cold chemical oxidation of aluminum and its alloys comprising degreasing the aluminum surface, and effecting a suppressed plating of the degreased surface with a blackened copper selected from the group consisting of copper selenide and copper telluride by coating the degreased surface with cupric chloride, ferric chloride, alkylaryl sulphate, and a copper blackening agent selected from the group consisting of selenium dioxide and tellurium dioxide in an acidic solution comprising water, nitric acid, and an alcohol selected from the group consisting of isopropyl alcohol and methanol.

10. A solution comprising water as a solvent, a cupric salt, ferric chloride, selenium dioxide, and an acid compatible with the other elements of the solution as an electrolytic agent and capable of dissolving the surface oxide of the surface to be coated with the solution.

11. A solution comprising water as solvent, a cupric salt, ferric chloride, selenium dioxide, and nitric acid.

12. A solution consisting in every 54 gallons of solution of approximately 3 to 12 pounds of selenium dioxide, cupric chloride in an amount by weight approximately equal plus or minus 15% to the weight of selenium dioxide, approximately 2 to 6 pounds of ferric chloride, approximately 110 to 170 fluid ounces of nitric acid, approximately 2 to 4 pounds of alkylaryl sulphate, approximately 5 to 20 gallons of an alcohol selected from the group consisting of isopropyl alcohol and methanol, and sufficient water to make the 54 gallon solution.

13. A method for effecting a cold chemical oxidation of aluminum and its alloys comprising degreasing the aluminum surface, and effecting a suppressed plating of the degreased surface with a blackened copper by coating the degreased surface with cupric chloride, ferric chloride, alkylaryl sulphate, and selenium dioxide in an acidic solution comprising water, nitric acid, and an alcohol selected from the group consisting of isopropyl alcohol and methanol.

References Cited in the file of this patent

UNITED STATES PATENTS

2,273,234	Tanner	Feb. 17, 1942
2,285,468	Slunder	June 9, 1942
2,303,350	Fuller	Dec. 1, 1942
2,527,232	Scroxtton	Oct. 24, 1950