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METHOD FOR FORMING A COLORED OXIDE COATING ON THE SURFACES OF ALUMINUM OR ALUMINUM ALLOY MATERIALS

Masashi Ikegaya and Fumio Shigeta, Shizuoka, Japan, assignors to Riken Light Metal Industries Co., Ltd., Shizuoka City, Japan

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5 Claims

ABSTRACT OF THE DISCLOSURE

A colored oxide coating of reddish yellow or reddish orange on the surfaces of aluminum or aluminum alloy materials is produced by electrolytically anodizing said materials in an aqueous solution of sulfuric acid or phosphoric acid and a selenium compound.

The present invention relates to a method for forming a colored oxide coating on the surfaces of aluminum or aluminum alloy materials and particularly a method for forming a colored oxide coating having a reddish color tone of reddish yellow or reddish orange on aluminum or aluminum alloy materials by an anodic oxidation.

In the specification, aluminum or aluminum alloys are referred to as merely "aluminous material(s)."

Recently, aluminous building materials have been utilized broadly, because aluminous materials have excellent abrasion resistance and weather resistance and fulfill the desired requirements as the building materials and have a beautiful appearance and a broader coloration range than the other metal materials.

However, it can be said that, while the coloration range of aluminous materials is broader than that of the other metal materials, it is not always possible to color such aluminous materials in various color tones to the maximum desired extent. Thus, various investigations have been made to widen the color tone but the method which can color the aluminous materials to the color tones desired by the user and particularly to reddish yellow or reddish orange, has never heretofore been developed. Conventional processes for coloring aluminous materials yellow are as follows.

- (1) Oxalic acid is used as an electrolytic bath.
- (2) Anodic oxidation is effected in an electrolytic bath containing an aromatic sulfonic acid and sulfuric acid or a metal sulfate.
- (3) An aluminous material is previously subjected to an anodic oxidation and then applied with an alternate current in an electrolytic bath containing a metal salt.

In any of the above conventional processes, the obtained range of the color tones is narrow, and reddish yellow or reddish orange colored oxide coatings have never been obtained. For example, in the above described first process which is the most practical process among the above processes, the color tone of the obtained oxide coating is a very narrow range and even if the thickness of oxide coating or the quality of aluminous materials is varied, the remarkable variation cannot be obtained. Accordingly, colored oxide coatings having a broad yellowish color tone, which is required by the user, have not been heretofore obtained.

The above described second and third processes can provide oxide coatings having a relatively broad color tone but the second process uses an electrolytic bath consisting mainly of an aromatic sulfonic acid which is a specific chemical and therefore the electrolytic bath is expensive. In the third process, after the usual anodic oxidation, an

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alternate current must be applied and consequently there are problems in view of productivity and cost.

The present invention aims to solve the above described deficiencies and provides a method for producing reddish yellow or reddish orange colored oxide coatings of aluminous materials by an anodic oxidation using an electrolytic bath having a sample composition.

For the practice of the method of the present invention, firstly, an aluminous material to be treated is degreased with an aqueous solution of sodium hydroxide and then washed with water and successively neutralized in an aqueous solution of nitric acid and then washed with water. Then, the thus treated aluminous material is subjected to an anodic oxidation as an anode by using the following electrolytic bath.

For the production of the reddish yellow colored oxide coating, an aqueous solution containing 5.0–20.0% by weight of sulfuric acid and 0.01–1.0% by weight of a selenium compound is used as an electrolytic bath.

On the other hand, for the production of the reddish orange colored oxide coating, an aqueous solution containing 5.0–15.0% by weight of phosphoric acid and 0.01–1.0% by weight of a selenium compound.

In the above electrolytic baths, sulfuric acid or phosphoric acid is the main component of the bath and improves the electric conductivity of the electrolytic bath and is an essential component for forming an oxide coating on aluminous material. Furthermore, these acids contribute to develop color of the oxide coating together with a selenium compound.

On the other hand, a selenium compound contributes to develop the color tone.

At the concentration lower than the above described lower limit of the acids, the electric conductivity of the bath is poor and an oxide coating having a satisfactory intensity can not be obtained.

On the other hand, a concentration over the upper limit does not improve the effect for developing color and the quality of the resulting oxide coating is degraded.

A concentration lower than the lower limit of the selenium compound can not provide the desired coloration, while a concentration over the upper limit can not improve the effect for coloration.

The electrolytic conditions, when the anodic oxidation is effected by using the above described electrolytic bath, are preferred to satisfy the following conditions.

- (1) Electrolytic bath temperature: 15–50° C.
- (2) Current density: up to 2 A./dm.²
- (3) Voltage: up to 50 v.

At a temperature higher than the upper limit, a precipitate is formed and such a temperature is not preferred.

The upper limit of the voltage is determined in view of corrosion.

The upper limit of current density is determined in relation to the electric conductivity, and when the current density exceeds the upper limit, the desired color tone can not be obtained.

The selenium compounds to be used in the present invention are those which can dissociate in the electrolytic bath and separate selenium, for example aluminum selenide, sodium selenide, ammonium selenide, sodium selenite and the like.

The following examples are given for the purpose of illustration of this invention and are not intended as limitations thereof.

Example 1

An aluminous material 1100 was immersed in 7% by weight of an aqueous solution of sodium hydroxide at 80° C. for 15 seconds to be degreased and washed with water. Then, the thus treated aluminous material was im-

mersed in 16% by weight of an aqueous solution of nitric acid to effect neutralization at room temperature for 30 seconds and washed with water.

The thus pretreated aluminous material was anodized as an anode in an electrolytic bath of an aqueous solution containing 5, 10 or 15% by weight of sulfuric acid and 0.05% by weight of sodium selenite as shown in the following Table 1 at a temperature of 29–46° C., with an alternating current of a current density of up to 1.5 a./dm.² and a voltage of up to 25 v. for 60 minutes to obtain colored oxide coatings showing reddish yellow as shown in Table 1.

TABLE 1

Composition of electrolytic bath (percent by weight)			
Sulfuric acid	Sodium selenite	Voltage (v.)	Color tone*
5.0-----	0.05	Up to 25-----	5.0 Y 5.3/2.5
10.0-----	0.05	Up to 20-----	1.1 Y 6.3/2.9
15.0-----	0.05	-----do-----	3.2 Y 5.7/2.3

*Munsell notation.

Example 2

The same aluminous material as used in Example 1 was pretreated in the same manner as described in Example 1. The pretreated aluminous material was anodized as an anode in an electrolytic bath of an aqueous solution containing 5, 10 or 15% by weight of phosphoric acid and 0.05% by weight of sodium selenite as shown in the following Table 2 at a temperature of 19–21° C., with an alternating current of a current density of up to 0.4 a./dm.² and a voltage of up to 30 v. for 30 minutes to obtain colored oxide coatings showing reddish orange as shown in Table 2.

TABLE 2

Composition of electrolytic bath (percent by weight)			
Phosphoric acid	Sodium selenite	Voltage (v.)	Color tone
5.0-----	0.05	Up to 30-----	5.4 YR 4.5/6.1
10.0-----	0.05	-----do-----	3.3 YR 4.5/7.6
15.0-----	0.05	-----do-----	1.8 YR 4.2/8.0

What is claimed is:

1. A method of producing a colored oxide coating having reddish color tone on aluminum or aluminum alloy, consisting essentially of electrolytically anodizing, with an alternating current, a suitable aluminum material selected from the group consisting of aluminum and alloys thereof in an aqueous acid solution containing selenium selected from the group consisting of an aqueous solution of 5.0–20.0% by weight of sulfuric acid and 0.01–1.0% by weight of a selenium compound and an aqueous solution of 5.0–15.0% by weight of phosphoric acid and 0.01–1.0% by weight of a selenium compound.

2. A method as claimed in claim 1, wherein said selenium compound is selected from the group consisting of sodium selenite, aluminum selenide, sodium selenide and ammonium selenide.

3. A method as claimed in claim 1, wherein a reddish yellow colored oxide coating is produced by using said aqueous solution of sulfuric acid and a selenium compound.

4. A method as claimed in claim 1, wherein a reddish orange colored oxide coating is produced by using said aqueous solution of phosphoric acid and a selenium compound.

5. A method as claimed in claim 1, wherein said electrolytic oxidation is effected at a temperature of 15–50° C., a current density of up to 2 a./dm.² and a voltage of up to 50 v.

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RICHARD L. ANDREWS, Primary Examiner