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ELECTROLYTE FOR THE PRODUCTION OF SELF-COLORED ANODIC OXIDE LAYERS ON ALUMINUM AND ALUMINUM ALLOYS

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ABSTRACT OF THE DISCLOSURE

Electrotype containing sulfonic acid with tartaric acid and sulfuric acid and/or metal sulfate for use in the production of self-colored anodic oxide layers by the anodic oxidation of aluminum or aluminum alloys.

Prior art

A number of processes are known for the anodic oxidation of aluminum and aluminum alloys to produce hard oxide layers having fast-to-light colors of their own, that is to say without addition of special coloring agents. The electrolytes employed for these processes are generally mixtures of acids containing in an aqueous solution one or more organic acids and sulfuric acid and/or metal sulfates. Such electrolytes are often very expensive. Furthermore these processes require, for the production of dark-colored oxide layers, voltages up to 100 volts and even more.

The present invention

The present invention relates to an electrolyte for the production of self-colored anodic oxide layers on aluminum and aluminum alloys which is relatively cheap and which requires, even for the production of dark-colored layers, only voltages being far below 100 volts. The electrolyte according to the present invention contains in an aqueous solution from 10 to 200 g./l. (grams per liter) of tartaric acid, from 1 to 10 g./l. of sulfuric acid or an equivalent amount of metal sulfate, and from 10 to 150 g./l. of sulfonic acid. For the anodization with this electrolyte, direct current or direct current superposed by alternating current may be employed having a current density of 0.5 to 5, preferably 1.5 to 3 a./dm.^{2} A metal sulfate replacing the sulfuric acid may be, e.g. sodium bisulfate. The preferred concentrations of tartaric acid and sulfuric acid are from 50 to 100 g./l. and from 2 to 5 g./l. respectively.

Advantages

The differences between the electrolyte according to the present invention and the electrolytes known in the art are the tartaric acid content and the ability to produce and reproduce really dark colored oxide layers. When anodized in a pure aqueous solution of tartaric acid, only very thin barrier layers are formed on aluminum; increase of voltage causes corrosion. When anodizing in tartaric acid solutions containing small amounts, e.g. from 1 to 10 g./l. of sulfuric acid or metal sulfates, there appear on the aluminum surface irregularly scattered dark colored "oxide islands." With a high tartaric acid concentration there is a very narrow range, being below 0.1% in the sulfuric acid content, wherein oxide layers with a dark color of their own are produced. Below this range in the sulfuric acid content, which practically cannot be carried out, corrosion appears, and above this range "oxide islands" are formed. Pursuant to the present invention, the range in the sulfuric acid or sulfate content favorable to the production of a homogenous colored oxide layer may be extended by the addition of a sulfonic acid.

Description

The sulfonic acid may be aromatic sulfonic acid, e.g. sulfosalicylic acid or sulfophthalic acid in amounts of 10 to 15 g./l. as well as the inorganic sulfamic acid in amounts of 50 to 150 g./l. The darker shades obtained by the electrolyte according to the present invention compared with those produced by electrolytes known in the art depend upon the tartaric acid content.

Increasing tartaric acid content yields darker shades. On the other hand the intensity of the color depends as well upon the sulfuric acid content. Electrolytes with more than 10 g./l. sulfuric acid yield lightly colored or colorless layers.

The temperature of the electrolyte during the anodizing process may be kept between 20 and 40° C. Intense cooling to 0° C. and below, as is necessary in the production of hard anodized layers is thus avoided.

Example 1

An extruded section made from AlMgSi 0.5-type alloy was anodized in an electrolyte containing in an aqueous solution of 50 g./l. tartaric acid, 45 g./l. sulfosalicylic acid, and 3 g./l. sulfuric acid, at a temperature of 25° C., during 30 minutes, with direct current of a density of 2 a./dm.^{2}, the current density being increased to its nominal value within the first three minutes. The final voltage was of 65 volts. The oxide layer produced had a thickness of 20 μm. and a dark bronze color.

Example 2

A similar section as in Example 1 was anodized in an aqueous electrolyte containing 50 g./l. tartaric acid, 25 g./l. sulfophthalic acid and 4 g./l. sulfuric acid, at a temperature of 25° C. during 40 minutes with a direct current density of 1.5 a./dm.^{2}, the current density being increased to its nominal value within the first three minutes. The final voltage was of 55 volts. The oxide layer had a thickness of 20 μm. and a medium bronze color.

Example 3

A similar sample of a section as in Example 1 was anodized in an aqueous electrolyte containing 40 g./l. tartaric acid, 100 g./l. sulfamic acid, and 6 g./l. sodium bisulfate, at a temperature of 25 to 30° C, during 40 minutes, with a direct current density of 1.5 a./dm.^{2}. The current density was increased to its nominal value within the first two minutes. The final voltage was of 45 volts. The oxide layer had a thickness of 20 μm. and a light bronze color of its own.

Example 4

A piece of sheet rolled from an AlMgSi 1-type alloy containing 1% Si, 0.8% Mg, 0.3% Mn and 0.3% Fe was anodized in an electrolyte containing in an aqueous solution of 80 g./l. tartaric acid, 100 g./l. sulfamic acid, and 3 g./l. sulfuric acid, at 25° C. during 30 minutes, with a current density of 2 a./dm.^{2}. The final voltage was of 68 volts. The produced oxide layer had a thickness of 20 μm and a dark brown-grey color of its own.

What we claim is:

1. Electrolyte for the production of self-colored anodic oxide layers which consists essentially of an aqueous solution containing tartaric acid in an amount from 10 to 200 g./l. and a member of the group consisting of sulfuric acid, and metal sulfate in an amount

equivalent to 1 to 10 g./l. of sulfuric acid, and which also contains from 10 to 150 g./l. of sulfonic acid.

2. Electrolyte according to claim 1 in which said sulfonic acid content is from 50 to 150 g./l. of sulfamic acid.

3. Electrolyte according to claim 1 in which said sulfonic acid content is from 10 to 50 g./l. of sulfosalicylic acid.

4. Electrolyte according to claim 1 in which said sulfonic acid content is from 10 to 50 g./l. of sulfophthalic acid.

5. Electrolyte according to claim 1 containing from 50 to 100 g./l. of tartaric acid and from 2 to 5 g./l. of sulfuric acid.

6. Electrolyte according to claim 5 wherein the sulfonic acid is a member of the group consisting of sulfamic, sulfosalicylic, and sulphophthalic acids.

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