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PROCESS OF COATING METALLIC ALUMINUM OR ALUMINUM ALLOYS WITH ALUMINUM OXIDE SKIN

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This invention relates to a process of coating metallic aluminum or aluminum alloy with aluminum oxide skin of desired thickness and consists in carrying out electrolysis by direct or alternating current with the metal or its alloy as electrode or electrodes, and using electrolyte of an aqueous solution of special organic acids such as oxalic and malonic acid or their salts, so that the skin produced on the surface of the metal or its alloy will not check the current flowing therethrough. The object of the invention is to cover the metal or its alloy with aluminum oxide skin which is of desired thickness and has an excellent property of electric insulation and anticorrosion, together with great mechanical strength and hardness, in an easy and effective manner. An aqueous solution of special organic oxidizing agents such as oxalic acid, malonic acid or their sodium, potassium or calcium salts may also be used for the electrolyte of the invention. Moreover, either direct or alternating current may be used for electrolysis. When direct current is used, the positive electrode is made of metallic aluminum or its alloy, while the negative electrode may be any other conductor inactive to the electrolyte. When alternating current is used, both electrodes can be made of the metal or its alloy. Concentration of electrolytes, current voltage and density, and the time of electrolysis may vary according to kinds of electrolyte and thickness of the skin.

The following examples will fully explain the invention.

Example I.—Aqueous solution of 1.0 to 3.0 per cent of oxalic acid or its salts is used as the electrolyte. When alternating current is used for electrolysis both electrodes are made of metallic aluminum or aluminum alloys, such as duralumin. When direct current is used, the positive electrode is made of metallic aluminum or aluminum alloy, while the negative electrode may be metallic aluminum or any other conductor inactive to the electrolyte.

In both cases the electrolysis should preferably be performed under the working voltage of 60 to 100 volts and the current density of 0.05 to 0.03 amperes per square centimeter. After electrolysis of about one hour, the surface of aluminum or its alloy is covered with the skin having yellow or gray enamel like luster, which has electrically insulating and anticorrosive properties.

The thickness of this skin increases nearly proportional to the quantity of electricity used for electrolysis.

Example II.—Aqueous solution of 1.0 to 3.0 per cent of malonic acid or its salts is used as the electrolyte under the similar condition and process of electrolysis as explained in the Example I, the surface of aluminum or its alloy is covered with the skin having gray enamel like luster with insulating and anti-corrosive properties.

In all cases, the temperature of the electrolyte is preferably to remain under 30° C. by cooling and continuous agitation is recommended.

It is a well known fact that the metallic aluminum has a special property of checking the flow of electric current when it is used as the anode on electrolysis. For example, when it is used as the electrode in the solution of silicates, boric acid, borates, phosphates, chromic acid, manganic acid or their salts, or of organic acids such as, succinic and citric acids; the flow of current is immediately checked by the formation of thin film or skin on the surface of the metallic aluminum.

Many attempts have been carried out to make electric insulating and anticorrosive skin on the surface of metallic aluminum by the electrolytic process in the solution above mentioned, but these have failed to get a sufficiently thick film to withstand several hundred volts, owing to the properties of checking the current by the thin film thus produced.

According to the present invention, however, either by adding a small quantity of inorganic acids or their salts, in the solution of inorganic oxidizing agents, or by choosing solutions of special kinds of organic acids, the current flows for sufficient duration, so that a film of any desired thickness is produced on the surface of the aluminum or its alloy.

In the claims the expression "aluminum material" is intended to cover either substantially pure aluminum or an aluminum alloy.

Claims:

1. In the process of electrolytically forming an insulating and anti-corrosive oxide coating on aluminum material, acting as an electrode, the step which comprises electrolyzing a solution of a dibasic organic acid compound in contact with said material.

2. In the process of electrolytically forming an insulating and anti-corrosive oxide coating on aluminum material, acting as an electrode, the step which comprises electrolyzing a solution of an oxalic acid compound in contact with said material.

3. The process of electrolytically forming an insulating and anti-corrosive oxide coating on aluminum acting as an electrode which comprises electrolyzing a solution of an oxalic acid compound in contact with said aluminum with a voltage of 60 to 100 volts and a current density of .05 to .03 amperes per square centimeter.

4. The process as in claim 3 wherein the solution contains from 1 to 3 per cent of the oxalic acid compound.

In testimony whereof they affix their signatures.

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