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## METHOD OF MAKING A DRY LUBRICANT COATING

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4 Claims

### ABSTRACT OF THE DISCLOSURE

A metal such as tin, aluminum or magnesium is electrolytically anodized and simultaneously therewith there is electrophoretically deposited particles of a solid lubricant on the metal. All types of solid lubricant particles which normally have or can be made to have a negative charge may be used, including molybdenum disulphide, alumina-tungsten disulphide, polyethylene, and fluorocarbon polymers.

This application is a division of our copending application Ser. No. 520,360, filed Jan. 13, 1966, now abandoned.

The invention relates to a dry lubricant coating and method of making such a coating and coated article. More particularly the invention relates to a method of incorporating particles of a solid lubricant into the anodized surface of a metal to form a dry lubricant coating.

An object of the invention is to provide a strongly adherent dry lubricant coating.

A further object is to provide a method of quickly and economically producing an anodized metal surface having superior lubricating qualities to that of an ordinary anodized surface.

Another object is to provide a method of producing a dry lubricant comprising an anodized metal surface containing particles of a fluorocarbon polymer.

Other objects and advantages of the invention will become apparent as the following detailed description progresses.

In accordance with this invention a metal such as tin, aluminum or magnesium is electrolytically anodized as is well known to the art and while the anodization is taking place there is electrophoretically deposited on the metal particles of a solid lubricant. This simultaneous electrolytic growth of oxide and electrophoretic deposition of a lubricating media is accomplished by incorporating in the electrolyte being used for the anodization a negatively charged particle of a solid lubricant. Thus, when the metal is made the anode and oxidation is taking place by electrolysis at the anode, the negatively charged particles of solid lubricant will migrate by means of the electric current induced in the bath to the anode and will be comingled with the oxide coating during its formation. This gives an extremely adherent low coefficient of friction coating useful as a bearing surface and for other uses of dry lubricants. This thickness of the coating is a function of the treatment time. Suitable coatings have been made with .001 inch thickness and as thick as .005 inch, but lesser and greater thicknesses can be attained.

The preferred metals used for simultaneous anodization

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and electrophoretic deposition of solid particles are aluminum, magnesium and the alloys containing a major proportion of such metals. The oxide coating produced is better suited for the comingling with solid lubricants such as fluorocarbon polymers, and gives a superior lubricating coat than produced by anodizing tin.

All types of solid lubricant particles which normally have or which can be made to have a negative charge may be used. Thus particles of molybdenum disulphide, alumina-tungsten disulphide, polyethylene, and fluorocarbon polymers can be used. For lubricating purposes the fluorocarbon polymers are preferred, particularly the completely fluorinated fluorocarbon polymers, of which the best appears to be tetrafluoroethylene. The suitable fluorocarbon polymers include polytetrafluoroethylene, polyhexafluoropropylene, polychlorotrifluoroethylene, polyvinylidene fluoride, polyvinyl fluoride, tetrafluoroethylene-hexafluoropropylene copolymer, vinylidene fluoride-hexafluoropropylene copolymer, poly 1,1,1-trifluoropropylmethylchlorosilane polymer, fluorosilicone elastomers, polyfluoroaniline, and copolymers of tetrafluoroethylene and trifluoronitrosomethane. The preferred completely fluorinated fluorocarbon from the point of view of coefficient of friction and all around value, is polytetrafluoroethylene. This material under the trademark Teflon is commercially available as negatively charged colloidal particles dispersed in an aqueous liquid.

The following example illustrates the invention.

### EXAMPLE I

An aluminum sheet is made the anode. The cathode is lead or stainless steel. The electrolyte consists of sulfuric acid (10 fluid ounces per gallon), oxalic acid (2 ounces per gallon), an aqueous suspension of negative charge colloidal particles of polytetrafluoroethylene containing 0.5 percent by weight TFE (Teflon suspension No. 3170) acidulated with 5 percent sulfuric acid, the ingredients being merged in water to a volume of two gallons. The electrolyte was contained in a glass tank and maintained at a temperature of 25°–95° F. during the operation. The current density used was 10–36 amperes per square foot. The voltage was 10–75 volts. Vigorous agitation of the electrolyte was maintained. The time of operation was 15 to 60 minutes.

The coated plate produced by the above example had a coating of mixed aluminum oxide and particles of polytetrafluoroethylene of 0.0002–0.0025 inch thickness.

Substantially the same results as with the above example were obtained with the other fluorocarbon polymers above mentioned using the same procedure and conditions as in Example I. With particles of molybdenum disulphide and other metal sulfides a suitable comingled coating was also obtained by substituting a molybdenum disulphide aqueous dispersion for the Teflon dispersion and otherwise keeping the conditions the same, although modification of the procedure to obtain better anodic deposition of the molybdenum disulphide could be carried out in accordance with procedures known to the art without interfering with the simultaneous anodization. Polyethylene does not give as satisfactory lubricating properties as the fluorocarbon polymers but can also be electrophoretically deposited during electro anodization using the procedure and condition of Example I.

We claim:

1. The method of making a dry lubricant coating which

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comprises electrolytically anodizing an anodizable metal surface while simultaneously electrophoretically depositing particles of a solid lubricant on said surface.

2. The method of claim 1 wherein the metal is aluminum and the particles of solid lubricant are particles of a fluorocarbon polymer.

3. The method of claim 1 wherein the metal is aluminum and the particles of solid lubricant are particles of molybdenum disulphide.

4. The method of making a dry lubricant coating which comprises making an aluminum surfaced object the anode in an electroplating system comprising an anode, cathode and electrolyte containing particles of negatively charged polytetrafluoroethylene and passing electric current through the electrolyte at a current density such as to

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anodize the surface of the aluminum anode and simultaneously deposit the said polytetrafluoroethylene particles on said anode.

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