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SURFACE TREATMENT OF ALUMINUM AND ALUMINUM ALLOYS

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2 Claims. (Cl. 204—35)

The invention relates to the surface treatment of aluminum and aluminum alloys. Although more particularly directed to treatment for maintaining the specular reflectivity of such surfaces, and the description below will be mainly applied to the maintenance of brightened surfaces, it is not limited thereto.

When a surface of aluminum or aluminum alloys is treated by an electrolytic brightening process for the purpose of producing a bright highly reflective surface, one effect of the first part of the process, i. e., the actual brightening treatment, is to produce on the surface of the metal a film which has certain undesirable characteristics, the main one being its softness giving rise to a white persistent smudge when fingered or rubbed. This film is more or less independent of the type of electrolyte employed. Its removal becomes essential if a surface free from a liability to smudge or finger-mark is to be produced.

It has been proposed to effect this removal by chemical solvents such as sodium carbonate solution containing chromates, silicates or other inhibitors applied either to an intermediate stage, i. e., between the brightening treatment and the subsequent reinforcing anodic treatment, or as a final treatment. Where the solvent is used at the aforesaid intermediate stage, an extension of the smudge film seems to be produced by the final washing in hot water, and when used at the final stage such strong alkaline solvents may attack the reinforcing film if carelessly applied.

It is known that when aluminum is subjected to electrical treatment in a suitable electrolyte such as sulphuric, oxalic or chromic acid, the aluminum being the anode, a film is formed on the surface of the metal which is not homogeneous, but consists of at least two and probably three layers, of which the outer layer is the softest and liable to become powdery. It is also known that, where a piece of aluminum is subjected to more than one anodic treatment, the film from the first treatment apparently remains on the outside, subsequent films forming under it next to the actual metal surface.

In the case of the brightening process therefore, the smudge film formed in the first treatment will remain as the outer surface layer through any subsequent anodic treatment until deliberately removed.

The main object of the present invention is to provide a process for the removal of smudge film, that is of the outer soft powdery or otherwise undesirable film, which method avoids the use of strong alkalies or solvents as aforesaid, and also avoids the use of a frictional or dry rubbing method.

The invention consists in a method having the object of the preceding paragraph, in which the undesired film formed on an aluminum or aluminum alloy surface is in effect split off from the desired surface by means of the formation of a cleavage plane or by separation of the smudge film at a cleavage plane incidentally formed, for instance, by aqueous treatment such as by immersion of the coated surface in aqueous solution, subject to the reservations regarding strong alkalies and solvents made above.

The invention also consists in a process according to the preceding paragraph, in which the aluminum or aluminum alloy is treated for the removal of undesired film by a solution containing the following ingredients substantially in the proportions stated, namely, sulphuric acid 5–10%, aluminum sulphate 0.01–0.5%, sodium fluoride 0.01–0.05%, gelatine 0.00–0.5%.

The invention also consists in processes for the surface treatment of aluminum and aluminum alloys substantially as hereinafter described, and in aluminum or aluminum alloy articles, the surfaces of which have been treated substantially as hereinafter described.

In carrying the invention into effect in one form by way of example, an aluminum article is given a brightening treatment, that is to say, it is first treated in a hot alkaline brightening bath, then given a second or acid treatment in which a reinforcing film is produced. It is then washed, the final traces of electrolyte being removed by immersion in distilled water, and heated to about 80° C. for about ten minutes.

According to this example, as soon as the article has regained a temperature of about 20° C., it is immersed in a solution at about that temperature containing about 7% sulphuric acid, 0.1% aluminum sulphate, 0.02% sodium fluoride and 0.2% gelatine. After about one minute from the time of immersion the surface film will be seen to crack and start to peel off in small flakes, removal usually being complete in about five minutes or less. The film thus removed appears to consist of the whole of the soft smudge-forming film together with what appears to be the soft outer layer of the reinforcing film. On removal from this solution washing in cold water and drying, it will be found that the surface is free or substantially free from the liability to smudge or finger-mark, and does not necessarily require any further treatment.

The operation can be examined visually, and the flakes are seen to remain suspended in the solution for a considerable time after the article has been removed. The removal of the film thus appears to be effected by physical splitting off, and not by chemical solution.

In the sulphuric acid—fluoride mixture referred to above, the surface film, after immersion, apparently first cracks, then curls at the edges and peels off, again suggesting that the effect is mainly physical, and may be regarded as splitting along the cleavage plane, that is to say, a place of weakness along which splitting can occur under suitable conditions.

One of the effects of the hot water treatment appears to be the production of a cleavage plane somewhere near the surface of the reinforcing film at which splitting can readily occur, the optimum effect apparently being produced by distilled water at a temperature of 83° C., since both above and below this temperature splitting occurs less readily and seems to disappear if the water temperature is below 65° C. The speed and ease of stripping appear to be influenced by the temperature of the distilled water.

General

Although the process referred to above was arrived at during investigation of brightening surfaces of aluminum and aluminum alloys, it is not limited to use with brightened surfaces, for it is also found that a normal anodic film may be treated on similar lines for the removal of a surface layer by what may be termed a splitting process, this being useful because this layer appears to be that which causes most trouble in connection with finger-marking, adsorption of staining material and the like.

The sulphuric acid-fluoride mixture given above works well, but the ingredients may be replaced by others of like kind, for instance, the sulphuric acid by another strong mineral acid such as hydrochloric or nitric, or some organic acid such as oxalic acid, the aluminum sulphate by any other soluble aluminum salt, and the sodium fluoride by other soluble fluorides, fluoride complexes of hydrofluoric acid, such as ammonium fluoride, silico fluoride or fluoborates; the gelatine may also be replaced by dextrine, pyridine, quinoline or other inhibitors of a similar nature, in which case some adjustment of the ranges may be required, according to the particular substance chosen. The time of immersion in the aforesaid mixture may vary from about two to about twenty minutes, depending on temperature.

The function of the gelatine seems to be to slow down the action of the mixture, and thereby enable control to be more easily effected.

I claim:

1. The process of producing a highly reflective surface on aluminum and aluminum alloy articles which comprises brightening and oxidizing said surface by anodic treatment in a hot alkaline brightening electrolyte, subjecting said brightened surface to further anodic treatment in an acid electrolyte adapted to produce an aluminum oxide film on the brightened surface, heating the article in water maintained at a temperature not substantially below 65° C., and thereafter immersing the article in an aqueous bath containing about 5–10 per cent of an acid selected from the group consisting of sulfuric acid, hydrochloric acid, and nitric acid, together with a soluble aluminum salt and a soluble fluoride, for a period of about 2 to 20 minutes, in order to selectively remove the oxide film produced in the brightening treatment.

2. The process of producing a highly reflective surface on aluminum and aluminum alloy articles which comprises brightening and oxidizing said surface by anodic treatment in a hot alkaline brightening electrolyte, subjecting said brightened surface to further anodic treatment in an acid electrolyte adapted to produce an aluminum oxide film on the brightened surface, heating the article in water maintained at a temperature not substantially below 65° C., and thereafter immersing the article in an aqueous bath containing about 5–10 per cent of an acid selected from the group consisting of sulfuric acid, hydrochloric acid, and nitric acid, together with about 0.01–0.5 per cent of a soluble aluminum salt, about 0.01–0.05 per cent of a soluble fluorine-containing salt, and up to about 0.5 per cent of an inhibitor selected from the group consisting of gelatin, dextrine, pyridine, and quinoline for a period of about 2 to 20 minutes, in order to selectively remove the oxide film produced in the brightening treatment.

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