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METHOD OF COATING METAL SURFACES COMPRISING ALUMINUM

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This invention relates to the production of chemically formed coatings on aluminum and other metals, the coatings consisting essentially of phosphates and fluorides.

An object of the invention is to improve the prior processes, such as disclosed in the patent to Thompson, 2,312,855, March 2nd, 1943, where fluoborate is employed in the solution. In said patent, fluosilicate is specified in each of the formulas given, but it is stated that other double fluorides, including fluoborate, may be used. It has been found that fluoborate is more stable than fluosilicate, and less fluorine compounds are lost from the solution when fluoborate is used than when fluosilicate is used. This is especially true, and especially important, when the solution is applied to the metal surface by spraying. The coating solution to which this invention relates comprises as its essential ingredients dihydrogen phosphate, an oxidizing agent, and a double fluoride.

A solution made up in accordance with said patent, using fluoborate instead of fluosilicate, coats well when first made up, but it was found that continued use, with usual replenishment by the phosphates, oxidizing agent, and fluoborate, resulted in a solution which produced a much thinner coating than in the start, so that the initial coating action could not be continued without dumping the solution and making up a new one.

By the present invention, it is possible by varying the make up of the solution to produce a coating of the desired thickness throughout quite a wide range, and to replenish the solution so as to continue to obtain the desired coating indefinitely.

By this invention, a phosphate solution is made up in any of the ways described in said former patent, but instead of adding fluosilicate there is added boric acid and fluoborate, or boric acid and a single fluoride, such as sodium fluoride or bifluoride, the proportion of boric acid to fluoride being greater than the amount necessary to form fluoborate with all of the fluoride present in the solution. This excess of boric acid aids in stabilizing the fluoride, and also results in a somewhat thinner and harder coating than results where the only fluoborate is employed in making up the solution.

The amount of excess boric acid is varied in accordance with the kind of coating desired, the more boric acid there is present—the thinner the resulting coating. Usually from 50% to 200% more boric acid is employed in making up the solution than is required to form fluoborate with the fluoride used, but in any particular case the excess boric acid is adjusted to obtain the desired results.

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In use, the fluorine is depleted much more rapidly than the boric acid, both because the boric acid does not enter into the chemically formed coating and does not escape into the air as readily as some of the fluorine compounds formed in the solution. Accordingly, an excess of boric acid can be maintained without the addition of as much boric acid as would be required theoretically to form fluoborate with the fluoride added. While other dihydrogen phosphates may be employed as described in said patent, zinc dihydrogen phosphate is preferred, and nitrate is preferred as the oxidizing agent, though nitrite, iodate, periodate, peroxide, bromate, quinone, chlorate, perchlorate, sulphite and permanganate may be used, with proper control of acidity where iron is amongst the metals coated, as taught in the prior art.

A quick approximation to the quantity of boric acid in the solution may be made by titration with phenolphthalein as an indicator first without and then with mannitol in the solution, the difference between the two titrations giving the amount of boric acid present as accurately as is usually necessary for proper control of the bath. The amount of fluorine present may be ascertained by known distillation methods not necessary to describe in detail.

The free acid in the solution should be kept in proper proportion to the salts in the solution, as is well known. If the free acid tends to run too high, more of the fluorine can be added as sodium fluoride, while any tendency for the free acid to be low can be counteracted by addition of more of the fluorine as sodium bifluoride.

While the fluoride in the solution is especially useful for producing a coating on aluminum or alloys containing aluminum, it does not interfere with the production of phosphate coatings on iron, zinc or other metals which can be coated with phospates. Therefore it is a valuable addition to any solution which is to be used in whole or in part upon any surfaces rendered hard to coat by the presence of aluminum, even though most of the coating takes place upon readily coated surfaces.

When fluoride-containing solutions, as described, are employed upon surfaces of iron or steel, there seems to be more etching of the surface than where the fluoride is not present, and therefore the use of fluoride may be desirable

where the surface is coated for wear-resisting or oil-retaining purposes as well as where some surfaces containing aluminum are to be coated.

What I claim is:

1. A method of coating metal surfaces which can be coated by phosphate and fluoride solutions and some of which contain aluminum, which comprises subjecting the surfaces to the action of a hot aqueous solution containing as its essential ingredients dihydrogen phosphate, an oxidizing agent, fluoborate, and excess boric acid, and replenishing the fluoborate and boric acid content of the solution by the addition of a single fluoride and only the amount of boric acid to keep the excess boric acid in the solution within the desired working range.

2. A method of coating metal surfaces containing iron and aluminum and which can be coated by phosphate and fluoride solutions, which comprises subjecting the surfaces to the action of a hot aqueous solution containing as its essential ingredients dihydrogen phosphate, an oxidizing agent, fluoborate, and excess boric acid, and replenishing the fluoborate and boric acid content of the solution by the addition of a single fluoride and only the amount of boric acid to keep the excess boric acid in the solution within the desired working range.

3. A method of coating metal wear-resisting surfaces of the group comprising iron and aluminum and which can be coated by phosphate and fluoride solutions, which comprises subjecting the surfaces to the action of a hot aqueous solution containing as its essential ingredients dihydrogen phosphate, an oxidizinng agent, fluoborate, and excess boric acid, and replenishing the fluoborate and boric acid content of the solution by the addition of a single fluoride and only the amount of boric acid to keep the excess boric acid in the solution within the desired working range.

4. A method of coating metal surfaces which can be coated by phosphate and fluoride solutions and some of which contain aluminum, which comprises subjecting the surfaces to the action of a hot aqueous solution containing as its essential ingredients dihydrogen phosphate, an oxidizing agent, fluoborate, and excess boric acid, and replenishing the fluoborate and boric acid content of the solution by the addition of a single fluoride and only the amount of boric acid to keep the excess boric acid in the solution within the desired working range, the single fluoride being of the group consisting of sodium fluoride and sodium bifluoride, and the method comprising proportioning said two fluorides to maintain the desired free acidity of the solution.

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REFERENCES CITED

The following references are of record in the file of this patent:

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