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PHOSPHATE COATING OF METALS

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9 Claims. (Cl. 148—6)

This invention relates to the treatment of metals, especially iron or steel, for instance to the treatment of metals with phosphate coating solutions in order to improve the resistance of the metals to corrosion or to provide a corrosion-resisting base for paints. This application is a continuation in part of application, Serial No. 254,238, filed February 2, 1939, issued as Patent No. 2,295,545, September 15, 1942. This application covers the disclosed coating chemicals as a composition of matter, the coating of zinciferous surfaces not disclosed in said prior application, and the use of nitro-guanidine which is alternative to the three species specifically claimed in said prior application.

It is an object of the invention to accelerate the action of reagents which attack a metal surface.

It is a further object of the invention to accelerate the action of phosphate coating solutions, such as zinc, manganese and the like, i. e., to reduce the time taken by the coating solution to form a complete coating, or to reduce the temperature, or to obtain a better coating in a given time under given conditions than if the compound were not present.

Where phosphate and similar coatings are being employed, they may be applied to the metal in any suitable manner, for instance by spraying, brushing, flowing or immersion methods.

It has now been found that the action of reagents which attack metal surfaces, and especially phosphate coating solutions, are improved by incorporating therein a nitro group.

As illustrative of the compounds which may be employed to provide the nitro group we have nitromethane, nitrobenzene, o-, m- and p-nitrophenols, nitrobenzoic acids, picric acid, nitrourea, nitroguanidine, nitrourethane, o-, m-, and p-nitraniline, o- and p-nitrobenzoic acid and m-dinitrobenzene.

The optimum concentration of the compound to provide the accelerating group in the reagent attacking the metal surface differs with different compounds but in the case of phosphate coating solutions is in general from about .01% to .4% by weight of the solution. The proper amount of accelerator for best results may be easily determined in any case by starting the solution off with a small amount of the accelerator and increasing the amount added to the phosphate coating solution until the desired acceleration is obtained.

The optimum concentrations, under the conditions used, of various compounds which may be employed according to the invention are given in the following table, the results being arrived at by adding the compound to a solution of zinc dihydrogen phosphate having a normality of N/20 free acid (determined by titrating with the aid of methyl orange indicator) and N/5 total acid (determined by titrating with the aid of phenolphthalein indicator) and treating a cleaned steel sheet for two minutes at 80° C. The cleaned steel sheet referred to here and in the examples given below is a steel sheet in its original bright rolled condition rendered substantially free from grease by wiping with clean white spirit.

Substance	Optimum concentration
	Percent
Picric acid	0.1
Nitroguanidine	0.2
Nitrobenzene	0.1
Nitromethane	0.1
Nitrourethane	0.2
m- or p-Nitrophenol	0.04
Nitrourea	0.4
m-Nitrobenzoic acid	0.1
o-Nitrophenol	0.1

While the compounds of the invention may be the only accelerators present in the coating bath, they may also be employed in conjunction with other accelerators and with other acid phosphate coating solutions, for instance metallic accelerators such as copper compounds, or oxidizing agents such as nitrates or nitrites. The presence of copper ions appears to promote heavier and darker coatings and the presence of a nitrate, such as zinc nitrate, appears to give a slight further acceleration.

Certain of the accelerating compounds of the invention are so effective that coatings can be produced from phosphate solutions containing them in the cold as is the case with nitroguanidine.

The invention is illustrated by the following examples:

Example 1

This is an example of the use of nitroguanidine to provide the nitro group to accelerate a coating operation to so great an extent that it can be effected in the cold.

A cold solution of manganese phosphate having a normality of about N/100 free acid (determined by titrating with the aid of methyl orange indicator) and N/5 total acid (determined by

titrating with the aid of phenolphthalein indicator) will not produce a coating on a cleaned steel sheet in an hour. The addition of 0.3% of nitroguanidine to such a solution enables a coating to be obtained in 10 minutes.

Example 2

This is an example of the use of nitroguanidine in a hot solution.

A zinc dihydrogen phosphate solution with normality of about N/20 free acid (determined by titrating with the aid of methyl orange indicator) and N/5 total acid (determined by titrating with the aid of phenolphthalein indicator), to which 0.2% of nitroguanidine has been added, will at 80° C. produce an adherent coating on a cleaned steel sheet in two minutes. In the absence of the nitroguanidine only a soft non-adherent coating is produced in 10 minutes.

Example 3

A cleaned steel sheet can be successfully coated with a phosphate coating by treating it at a temperature from 15 to 80° C. with a solution of zinc or manganese dihydrogen phosphate, of concentration N/5 when determined using phenolphthalein as indicator, containing 0.05% of nitroguanidine.

If in any of the above examples 0.001% of copper (calculated as the metal) is added to the solution, for instance in the form of the nitrate or carbonate, a darker and slightly heavier coating is obtained, and the addition of zinc nitrate results in a slight further acceleration.

While the invention has been illustrated by the treatment of steel, it is also useful in the coating of other metallic surfaces, such as surfaces containing zinc and alloys thereof.

What we claim is:

1. A composition consisting essentially of acid phosphate coating chemicals and an organic compound which contains the nitro group in sufficient quantity to act as an accelerator.

2. A composition in accordance with claim 1 and in which the acid phosphate is zinc dihydrogen phosphate.

3. A composition in accordance with claim 1 and in which the acid phosphate is manganese dihydrogen phosphate.

4. The process which comprises treating zinciferous surfaces with an acid phosphate coating solution containing an organic compound which itself contains the nitro group in sufficient quantity to act as an accelerator until there is obtained upon the metallic surface a phosphate coating bonded to the metallic surface by chemical reaction therewith.

5. A process which comprises treating zinciferous surfaces with an acid phosphate coating solution containing zinc and an organic compound having the nitro group in sufficient quantity to act as an accelerator until there is obtained upon the metallic surface a phosphate coating bonded thereto by chemical reaction.

6. A process which comprises treating zinciferous surfaces with an acid phosphate coating solution containing manganese and an organic compound having the nitro group in sufficient quantity to acts as an accelerator until there is obtained upon the metallic surface a phosphate coating bonded thereto by chemical reaction.

7. A process which comprises treating a zinciferous surface with an acid phosphate coating solution containing a nitrobenzene in an amount sufficient to have an accelerating effect upon the coating action until a visible protective phosphate coating is obtained upon the metallic surface.

8. A process which comprises treating a zinciferous surface with an acid phosphate coating solution containing a nitrophenol in an amount sufficient to have an accelerating effect upon the coating action until a visible protective phosphate coating is obtained upon the metallic surface.

9. A process which comprises treating a surface of one of the group consisting of ferrous and zinciferous surfaces with an acid phosphate coating solution containing nitroguanidine in an amount sufficient to have an accelerating effect upon the coating action until a visible protective phosphate coating is obtained upon the metallic surface.

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