PROCESS FOR THE AFTER-TREATMENT OF PHOSPHATE COATINGS

Willy Herbst, Hofheim, Taunus, Fritz Rochitz, Bad Soden, Taunus, and Herbert Vilseshof, Hofheim, Taunus, Germany, assignors to Farbwirke Hoechst Aktiengesellschaft, vormals Meister Luethy & Bräuning, Frankfurt am Main, Germany, a corporation of Germany.

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The present invention relates to a process for the after-treatment of phosphatized metal surfaces with solutions of alkene phosphonic acids. The phosphate coatings produced on metal surfaces, especially on iron and steel surfaces, for the purpose of corrosion protection, are porous and only offer sufficient protection for industrial requirements when followed by an appropriate after-treatment. This after-treatment is generally carried out with solutions containing compounds of hexavalent chromium, especially chronic acid. Proposals for improving such after-treatment solutions have already been made. Thus it has been proposed, for example, to add soluble, complex fluorides or certain metal salts, such as cerium nitrate, to chronic acid solutions.

The known after-treatment processes, however, have the disadvantage that they necessitate a special treatment of the waste water. Owing to the toxicity of hexavalent and trivalent chromium, compounds of these ions must be removed in subsequent water purification. Now we have found a process for the after-treatment of phosphatized metal surfaces in which the disadvantages of the processes described above, in particular the formation of toxic waste waters, are avoided. The process is characterized in that the phosphatized metal parts are treated with solutions of an alkene phosphonic acid having two or three carbon atoms per molecule, preferably vinyl phosphonic acid, and subsequently dried. Solutions containing about 0.008 to about 2 percent by weight, preferably 0.02 to 0.5 percent by weight, of alkene phosphonic acid, have proved to be particularly suitable.

As solvents for the alkene phosphonic acids there may be used, in addition to water, aliphatic alcohols having 1 to 4 carbon atoms per molecule, preferably isopropanol, or the mixtures thereof with water. The phosphatized metal parts can be treated with the solutions according to the invention in the usual manner, for example, by immersion, spraying or flooding.

The period during which the alkene phosphonic acid solutions may act upon the phosphatized metal parts to be treated is, in most cases, not limited. It is only necessary that the metal parts be satisfactorily wetted with the solutions. It is advisable, however, not to exceed a period of five minutes in the case of concentrations of the solutions, especially when the solutions contain more than 1 percent by weight of alkene phosphonic acid.

When drying the metal parts treated with the aforesaid solutions, care has only to be taken that a temperature of 200° C. is not exceeded. The drying temperature depends especially on the solvent used.

The following example serves to illustrate the invention, but it is not intended to limit it thereto:

Example

Steel plates (of class St VIII), as characterized by Deutsche Industrie Norm DIN 1623 were coated in a commercially available phosphatizing bath with a well adhering, light-gray layer of zinc-phosphate. Some of these phosphatized plates was immersed at room temperature for 15 seconds into an aqueous solution of 0.5 g. of vinyl phosphonic acid per liter and then dried in the drying closet at 140° C. for five minutes. Other of the plates were dried at once after the phosphatizing process without being subjected to an after-treatment. All these test plates were then varnished and subjected to the various usual corrosion and varnish adhesion tests.

It was found that the test samples after-treated according to the invention have excellent test values. Plates that have at once been varnished after the phosphatizing process without being subjected to an after-treatment, however, only possess an inferior protection against corrosion; their test values are poor.

Good results were also obtained when the plates were subjected to an after-treatment with the following solutions:

(a) 4.5 g. of vinyl phosphonic acid dissolved in 1 l. of water (treatment time 5 seconds; bath temperature 11° C.; drying temperature 150° C.; drying period 10 minutes);

(b) 0.15 g. of vinyl phosphonic acid dissolved in 1 l. of water (treatment time 1 minute; bath temperature 40° C.; drying temperature 110° C.; drying period 6 minutes);

(c) 0.4 g. of allyl phosphonic acid (propene-2,3-phosphonic-1-acid, CH₂CH₂PO(OH)₃) dissolved in 1 l. of water (treatment time 10 seconds; bath temperature about 20° C.; drying temperature 150° C.; drying period 5 minutes);

(d) 3.1 g. of propene phosphonic acid (propene-1,2-phosphonic-1-acid, CH₂CH²CH₂PO(OH)₃) dissolved in 1 l. of water (treatment time 6 seconds; bath temperature about 20° C.; drying temperature 150° C.; drying period 5 minutes);

(e) 1.1 g. of vinyl phosphonic acid dissolved in a mixture of 500 parts of water and 500 parts of isopropanol (treatment time 30 seconds; bath temperature about 20° C.; drying temperature 110° C.; drying period 5 minutes);

(f) 0.4 g. of vinyl phosphonic acid dissolved in a mixture of 700 parts of water and 300 parts of methanol (treatment time 30 seconds; bath temperature about 20° C.; drying temperature 150° C.; drying time 5 minutes);

(g) 18 g. of vinyl phosphonic acid dissolved in a mixture of 700 parts of water, 100 parts of butanol and 200 parts of isopropanol (treatment time 3 seconds; bath temperature 4° C.; drying temperature 150° C.; drying time 5 minutes);

(h) 0.08 g. of vinyl phosphonic acid dissolved in 1 l. of water (treatment time 2 minutes; bath temperature 40° C.; drying temperature 110° C.; drying time 6 minutes).

We claim:

1. A process for improving the corrosion protection of phosphatized metal surfaces, which process comprises after-treating said phosphatized metal surfaces with a solution containing from about 0.008 percent to about 2 percent by weight of an alkene phosphonic acid having 2 to 3 carbon atoms in at least one solvent selected from the group consisting of water and aliphatic alcohols having 1 to 4 carbon atoms, and then drying the treated surface.

2. A process as in claim 1 wherein said solution contains from 0.02 percent to 0.5 percent by weight of said alkene phosphonic acid.

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RICHARD D. NEVIUS, Primary Examiner.

WILLIAM D. MARTIN, Examiner.