PROCESS FOR INCREASING CORROSION RESISTANCE OF CONVERSION COATED METAL

The corrosion resistance of conversion coated metal is increased by a process which comprises the steps of applying a phosphate conversion coating, rinsing with water, applying a chromate rinse, drying the metal surface, rinsing with deionized water, and drying.

2 Claims, No Drawings
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PROCESS FOR INCREASING CORROSION RESISTANCE OF CONVERSION COATED METAL

This invention concerns improvements in metal coating and more particularly relates to a method of improving chemically formed coatings on metal surfaces as a base for the application of an organic finish such as paint, lacquer, varnish and the like, whereby the corrosion resistance of the metal surface is significantly increased.

This invention concerns an improvement in the commercial processing of metal parts for painting, being adaptable for use in applying chemical coatings on the surface of any metal which is susceptible to corrosion in the atmosphere or under corrosive conditions, e.g., iron, steel, zinc and aluminum. The first step in the conventional process of treating said metal surfaces is a conventional cleaning. This is followed by the application of a "phosphate conversion coating" from an aqueous bath, especially the zinc, iron, and calcium-zinc phosphate types. The phosphate conversion coating baths normally consist of an aqueous solution of metal phosphates dissolved in phosphoric acid solutions containing accelerators such as the chlorates, nitrates or nitrates, or other special additives well known to those in the art, such as fluorides. The conversion coatings are applied to the metal surfaces from said aqueous baths at elevated temperatures, generally in the range of 120°F to 180°F.

In the conventional processes, the conversion coating step is followed by a water rinse, normally at an ambient temperature of about 50°F to 120°F. The next essential step is a rinsing of the metal surface in a dilute chromic acid bath. This standard and well known chromate rinse operation is carried out with an aqueous solution containing hexavalent chromium ion in a concentration ranging from about 0.001 percent to about 0.1 percent by weight. The chromate rinse bath may contain other additives such as small amounts of trivalent chromium ion and calcium ions. The chromate rinse is applied to the metal surface at a temperature within the range of about 60°F to 170°F. It is followed by a deionized water rinse and the metal is then dried as the final step in the conventional process.

It has now been discovered that the corrosion resistance of the treated metal is unexpectedly improved by a simple revision of the foregoing process. More particularly, in accordance with this invention it has been discovered that drying the chromate rinse on the metal prior to the deionized water rinse, followed by deionized water rinsing and final drying, significantly increases corrosion resistance compared to the traditional steps of chromate rinsing, deionized water rinsing and drying. Any conventional means of drying may be used in the drying steps, e.g., forced air drying, hot air drying, infrared light banks and the like. Hot air drying in ovens is commonly used and is the preferred method.

The following examples are set forth to illustrate the results of the process of this invention but it is to be understood that they are not to be construed as limiting the invention in any way. For instance, in the examples a representative zinc phosphate conversion coating was used, however, any suitable phosphate coating may be employed with similar results since this variation is not critical to the claimed method.

EXAMPLE 1

The tests were carried out using panels of 1010 cold rolled steel which were first cleaned with a conventional alkaline cleaner and rinsed with cold water. A phosphate conversion coating bath as described in U.S. Pat. No. 3,203,835 was prepared comprised of 1.22 percent of 75 percent phosphoric acid, 0.25 percent zinc oxide, 0.32 percent sodium chloride, 0.27 percent nickel nitrate, 0.008 percent disodium arsenate and the balance water. A chromate rinse "concentrate" was prepared by mixing 16.6 parts of chromic acid, 16.6 parts of chromium nitrate and 66.8 parts water. The chromate rinse bath was prepared from the concentrate by diluting 10.5 volumes of the concentrate with 4,000 volumes of water. The pH was adjusted to 3.5 with 10 percent sodium hydroxide solution. The temperature of the chromate rinse was maintained at 160°F.

Two metal treatment sequences were used in the test. Process A, a method according to the present invention, consisted of the following steps:

No. 1 — Phosphate conversion coating treatment at 160°F.
No. 2 — Water rinse at ambient temperature
No. 3 — Chromate rinse at 160°F.
No. 4 — Drying step at 212°F.
No. 5 — Deionized water rinse at ambient temperature
No. 6 — Drying step at 212°F. Process B, carried out according to the prior art methods, consisted of the following steps:

No. 1 — Phosphate conversion coating treatment at 160°F.
No. 2 — Water rinse at ambient temperature
No. 3 — Chromate rinse at 160°F.
No. 4 — Deionized water rinse at ambient temperature
No. 5 — Drying step at 212°F.

Subsequent to the foregoing process steps, the panels were painted with a standard industrial alkyd paint and tested for corrosion resistance according to ASTM D 1654-61 in a salt spray apparatus for 240 hours. As a result of this accelerated corrosion test, the panels prepared according to process A of the invention had only a trace of creep whereas the panels from process B had 1/16-inch creep, clearly indicating the superiority of process A. "Creep" is defined as the distance the paint has peeled away from the score mark in the accelerated corrosion test.

EXAMPLE 2

The comparative tests of EXAMPLE 1 were repeated with these exceptions. The chromate rinse concentrate was prepared by mixing 35 parts of chromic acid with 16.6 parts of calcium carbonate and 48.4 parts water. The chromate rinse was prepared by diluting 4.5 volumes of this concentrate in 4,000 volumes of water. The chromate rinse was adjusted to pH 3.5 and maintained at 160°F. The panels were subjected to the two processes described in Example 1, then painted, and subjected at 240 hours in the salt spray cabinet. The process A panels showed no creep whereas those processed according to method B showed 1/16-inch creep.

EXAMPLE 3

The tests of EXAMPLE 1 were repeated with these exceptions. The chromate rinse concentrate was prepared by reacting 35 parts of chromic acid with 16.6 parts of calcium carbonate and 48.4 parts water. The chromate rinse bath was prepared by diluting 3.5 volumes of the concentrate with 4000 volumes of water. No pH adjustment was made. The treatment processes were carried out as described above. The process A panels had only 1/32-inch creep while the process B panels showed 1/4-inch creep, 5 times as great.

I claim:

1. A method of increasing the corrosion resistance of conversion coated metal which comprises the steps of treating the metal surface with a phosphate conversion coating bath, rinsing with water, applying a chromate rinse, drying, rinsing with deionized water, and drying the metal surface.

2. The method of claim 1 wherein the metal is selected from the group consisting of iron, steel, zinc and aluminum.

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