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COMPOSITION FOR AND METHOD OF PRODUCING CORROSION RESISTANT METAL COATING

John C. Kosmos, Springfield, Mass., assignor to The Chemical Corporation, Springfield, Mass., a corporation of Massachusetts

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This invention relates to an aqueous dipping solution and a process for depositing a visible corrosion resistant film on copper and its alloys and may also be used for similar treatment of magnesium and magnesium alloys. By the term "copper," as used in the specification and claims hereinafter, any copper or alloy of copper such as brass, bronze, and the like is intended to be included. Likewise in using the term "magnesium" any magnesium or alloy of magnesium is intended.

The primary object of the invention is to provide the surface of the metal with an improved corrosion resistant coating by means of an aqueous acidic dipping solution containing more particularly a water soluble chromium bearing compound, nitric acid, acetic acid, and a water soluble chloride bearing compound such as potassium chloride, sodium chloride, magnesium chloride or calcium chloride.

Another object of the invention is to produce an inexpensive quick acting bath and an aqueous dipping solution stable in character which can be utilized at room temperature. I am aware that acid dipping baths containing chromium have heretofore been used to impart a bright finish on copper surfaces but these do not form a satisfactory protective film for many purposes. Some of the prior baths, moreover, are objectionable among other reasons because of noxious gas fumes arising therefrom. While a bright finish may be obtained, prior baths, insofar as I am aware, are not effective to any appreciable degree in protecting copper or magnesium surfaces against adverse atmospheric conditions tending to oxidize and corrode the metal and especially under conditions of high humidity. The present invention provides a dipping solution for metal articles which does not give off objectionable gases and will impart a superior corrosion resistant film on copper-surfaces and magnesium articles as well as a color of pleasing character having a semi-bright finish ranging from a golden to a brown hue. The film is durable and will not stain.

A further object is to impart to the surface of the metal, over and above a corrosion resistant protective coating, a base for paint or lacquer which requires no further preparation or finishing for application of paints or lacquers.

In using the new composition the metal articles are subjected to any of the usual suitable cleaning procedures and rinsed clean. Such cleaning steps may be dispensed with if the articles are known to be initially clean. A pickling bath is recommended, however, not only to insure that heavy metallic oxides are removed but more specifically for the reason that etching of the metal is certain to result in the solution attacking the entire surface of an article uniformly and satisfactorily.

In carrying out this invention I have found that a superior corrosion resistant film for copper and magnesium articles may be obtained by immersion of the articles as by dipping the same in a bath containing an aqueous solution of sodium bichromate, nitric acid, glacial acetic acid, and sodium chloride in approximately the following respective amounts per liter of solution: 300 grams, 132 grams, 180 grams and 52.4 grams, the bath in its preferred form being made up by the addition to said solution of from 4 to 8 times an equal volume of water. The volume of water added to the solution may vary greatly and it has been found that a satisfactory bath can be operated with the addition of as small an amount as an equal volume of water or with an amount of water as much as 100 times the volume of the solution. The addition of 4 to 8 times an equal volume of water is preferred with optimum conditions being obtained at approximately 5 times the volume. A good operating range for the bath may be had, however, with anywhere from 2 to 12 times an equal volume of water.

In operating the bath copper-surfaced articles are dipped in the bath for a period of from 6 to 30 seconds, an optimum result being obtained by immersion for approximately 10 seconds. Longer periods of immersion may be utilized without harmful results but appear to serve no useful purpose.

After the dip the articles are then rinsed in overflowing cold water followed by a rinsing in warm water, preferably not exceeding a temperature of 120° F. The period of final warm water rinsing should not exceed 5 seconds for best results and the articles are then dried as by a cold or warm air blast.

Copper-surfaced metal articles treated according to the invention have been subjected to salt spray tests for periods in excess of 100 hours without corrosion. Untreated articles tested under identical conditions were adversely affected after four hours.

In treating magnesium articles the above procedure is followed with the sole exception that the period of immersion in the solution is from 30 to 60 seconds. It has been found that the resultant film on magnesium and magnesium alloys is considerably harder than that on the copper-surfaced articles. Otherwise the characteristics of the film are generally the same. The presence of aluminum in magnesium die castings appears to have no effect upon the resultant finish.

A uniform protective coating of a golden to brown color highly resistant to corrosion is deposited on the articles. The film is durable, is highly resistant to stain, and has a generally lustrous character. In baths wherein the solutions are in a more dilute range or a more concentrated range the degree of corrosion resistance or brightness of articles treated may vary from that obtained at the preferred range above stated for the bath of 4 to 8 times an equal volume of water. A pleasing and attractive surface coating on copper and magnesium surfaces, however, may be obtained as desired for particular articles according to the uses for which they are intended.

The solution is stable, and after use may be replenished by small additions of nitric acid or the addition of a concentrated solution of the dip in order to maintain the initial acidity of a bath.

The concentrations and relative proportions of the ingredients of the solution are important without being critical. Baths in which the solution has been diluted by from 1 to 100 times an equal volume of water have been found satisfactory where the concentration of sodium bichromate has been varied in amounts of from 100 to 300 grams per liter, the nitric acid (specific gravity about 1.410) in amounts from 42 to 132 grams per liter, the glacial acetic acid in amounts from 52 to 180 grams per liter, and the sodium chloride in amounts from 40 to 52.4 grams per liter.

The temperature at which the bath may operate satisfactorily may also vary. Room temperature is preferred, i. e. a temperature of from 70° to 90° F. but the temperature may be anywhere from 60° F. to 150° F.

The uniform clean appearance of a coated article is suitable as a final finish or as a base for painting or lac-

quering. While the type of film deposited has not as yet been definitely ascertained a complex chromate film is deposited during the formation of which a chemical smoothing action appears to take place on the surface of the article being treated. An unequal attack appears to be made on minute surface-roughening protuberances of the metal in contrast to the valleys between such projections. The peaks are apparently cut down while the film forming action of the bath prevents an equivalent attack on the valleys. Thus a smoothing action takes place during the deposit of the protective and decorative film. In the treatment of magnesium castings this is of particular advantage in obtaining a smoother finish on a treated surface than previously existed on the untreated article.

What I claim is:

1. A bath for imparting a corrosion resistant film to copper and magnesium surfaces and consisting of an aqueous solution consisting essentially per liter of solution of substantially 300 grams sodium bichromate, 132 grams nitric acid, 180 grams glacial acetic acid, and 52.4 grams sodium chloride, and water added to said solution in an amount of from 1 to 100 times the volume of said solution.

2. A bath for imparting a corrosion resistant film to copper and magnesium surfaces and consisting of an aqueous solution consisting essentially per liter of solution of substantially 300 grams sodium bichromate, 132 grams nitric acid, 180 grams glacial acetic acid, and 52.4 grams sodium chloride, and water added to said solution in an amount of from 2 to 12 times the volume of said solution.

3. A bath for imparting a corrosion resistant film to copper and magnesium surfaces and consisting of an aqueous solution consisting essentially per liter of solution of substantially 300 grams sodium bichromate, 132 grams nitric acid, 180 grams glacial acetic acid, and 52.4 grams sodium chloride, and water added to said solution in an amount of from 4 to 8 times the volume of said solution.

4. A bath for imparting a corrosion resistant film to copper and magnesium surfaces and consisting of an aqueous solution consisting essentially per liter of solution of a water soluble chromium bearing compound equivalent to 300 grams sodium bichromate, 132 grams nitric acid (specific gravity 1.410), 180 grams acetic acid, and a water soluble chloride bearing compound having chloride in an amount equivalent to 52.4 grams sodium chloride, and water added to said solution in an amount of from 1 to 100 times an equal volume of said solution.

5. A method of brightening copper and magnesium surfaced articles which consists in immersing the articles and forming a corrosion resistant film thereon in a bath containing an aqueous solution composed of sodium bichromate, nitric acid, glacial acetic acid, and sodium chloride in approximately the respective amounts of 300 grams, 132 grams, 180 grams, and 52.4 grams per liter of solution diluted in from 1 to 100 times an equal volume of water, thereafter rinsing said dipped articles in overflowing cold water followed by a warm water rinsing at a temperature not exceeding 120° F.

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