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ELECTRODEPOSITION OF ZINC

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This invention relates to the electrodeposition of zinc and has for its principal object the provision of an improved electroplating bath or composition and an improved electroplating method.

According to our improved method, we are able to produce bright deposits of zinc without any tendency to coarseness of crystalline structure or to the production of trees. The deposits thus produced, even when built up to substantial thickness, are tenacious and ductile and do not check or crack when the base metal is bent.

Our improved bath is of the acid zinc type but is characterized by addition agents which when present even to a slight extent have the effects of decreasing the crystal size of the deposited zinc, insuring the production of a continuous coating, reducing any tendency to roughness or treeing, and increasing the throwing power of the solution or bath. Our zinc deposits have a remarkable resistance to corrosion, which we attribute to the great purity and smoothness of the zinc deposited.

The addition agents we employ comprise the class of unsubstituted alkylamines. We may use mono-, di- and tri-alkylamines. It must be understood that we do not intend to include in the term "unsubstituted alkylamine" any amine which includes a cyclic or aromatic radical since the presence of such a radical has a very objectionable roughening effect on the deposit. For example, aniline, if used as an addition agent, invariably results in the production of rough deposits. Furthermore, the present invention does not contemplate the employment of alkylamines in which one or more of the hydrogens of the alkyl groups is substituted by an inorganic element or radical.

Among the unsubstituted alkylamines which may be employed are monomethylamine, dimethylamine, trimethylamine, the corresponding ethyl, propyl, butyl, amyl, and other alkyl homologues, and also mixed unsubstituted alkylamines such as monomethylmonoethylamine, monomethyldiethylamine, methylpropylbutylamine and so forth. Many of these are prohibitive because of cost or difficulty of obtaining them. In actual practice, we prefer to employ trimethylamine on account of its low cost and its high efficiency.

The bath employed preferably contains zinc sulphate and a small amount of free acid. The alkylamine may be present in very slight amount, its action being apparently of a catalytic nature. We give the following examples of baths embodying our invention:

Example I:

Zinc	100 grams per liter
Excess sulphuric acid	0.01–2.0%
Trimethylamine (25% by weight $(CH_3)_3N$) aqueous solution	0.0002–0.005 cc. per liter

Example II:

Zinc	200 grams per liter
Excess sulphuric acid	0.1–2.0%
Trimethylamine (25% by weight $(CH_3)_3N$) aqueous solution	0.000025–0.005 cc. per liter

The composition of our electrolyte may be varied within wide limits. Thus the specific gravity may suitably be between 1.23 and 1.46 corresponding to between 1.7 and 3.5 pounds of zinc ions per gallon.

Care must be taken to prevent mechanical loss of trimethylamine owing to so-called "drag," that is owing to bath liquid being carried away with the plated metal. Thus in plating wire we prefer to add about one ounce of pure trimethylamine for each ton of cathode zinc deposited.

In electroplating with zinc according to our invention, we may employ various current densities, for example, between 350 and 2,000 amperes per square foot and obtain extremely pure zinc deposits of highly desirable mechanical properties.

We claim:

1. A bath for the electrodeposition of zinc comprising an acid solution of zinc sulphate and an addition agent adapted to act as a catalyst and consisting of an unsubstituted alkylamine of the character described in an amount substantially equivalent to that supplied within the range of 0.000025–0.005 cc. per liter (25% by weight $(CH_3)_3N$) aqueous solution.

2. A bath for the electrodeposition of zinc comprising an acid solution of zinc sulphate and an

addition agent adapted to act as a catalyst and consisting of an unsubstituted trimethylamine in an amount substantially equivalent to that supplied within the range of 0.000025–0.005 cc. per liter (25% by weight $(CH_3)_3N$) aqueous solution.

3. A bath for the electrodeposition of zinc comprising the following constituents within substantially the ranges indicated:

Zinc	100–200 grams per liter
Excess sulphuric acid	0.01–2.0%
Trimethylamine (25% by weight $(CH_3)_3N$) aqueous solution	0.000025–0.005 cc. per liter

4. The method of electroplating zinc which comprises the passing of an electric current ranging in density substantially between 350–2000 amperes per square foot through a bath comprising an acid solution of zinc sulphate and an addition agent adapted to act as a catalyst and consisting of an unsubstituted alkylamine of the character described in an amount substantially equivalent to that supplied within the range of 0.000025–0.005 cc. per liter (25% by weight $(CH_3)_3N$) aqueous solution.

5. The method of electroplating zinc which comprises the passing of an electric current ranging in density substantially between 350–2000 amperes per square foot through a bath comprising an acid solution of zinc sulphate and an addition agent adapted to act as a catalyst and consisting of an unsubstituted trimethylamine in an amount substantially equivalent to that supplied within the range of 0.000025–0.005 cc. per liter (25% by weight $(CH_3)_3N$) aqueous solution.

6. The method of electroplating zinc which comprises the passing of an electric current ranging in density substantially between 350–2000 amperes per square foot through a bath comprising constituents within substantially the ranges indicated: zinc 100–200 grams per liter, excess sulphuric acid 0.01–2.0%, trimethylamine (25% by weight $(CH_3)_3N$) aqueous solution 0.000025–0.005 cc. per liter.

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