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PROCESS FOR THE ELECTRO-PLATING OF ZINC-TITANIUM-ZIRCONIUM ALLOY

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This invention relates to a process for the electroplating of zinc-titanium-zirconium alloy, wherein a titanium compound and a zirconium compound are dissolved in a zinc cyanide plating bath and the solution is subjected to electrolysis, using conventional zinc as an anode, in order to obtain an anti-corrosive coating consisting of an alloy of zinc containing titanium and zirconium.

The main object of the present invention is to provide a novel electro-plating process to produce more efficient and superior anti-corrosive coatings and to make plating time shorter than those conventional zinc coatings methods.

Another object of the invention is to provide a novel electro-plating process to obtain a uniform plating coating even in complicated forms to have superior uniform galvanizing properties.

Still another object of this invention is to provide a novel electro-plating process to obtain anti-corrosive properties and to be enduring for mechanical proceedings after the plating.

Various further and more specific objects, features and advantages of the invention will become apparent as the description proceeds.

It is now found, according to the invention, that by adding a small amount of titanium and zirconium to the zinc coating layer, physical and chemical properties of the plating are substantially more superior than in the case of conventional zinc plating.

The plated coating layers according to this process consist of highly uniform fine-grained structures in view of their crystallization and free from the pinholes. The zinc-titanium-zirconium alloy coatings are well-deposited and superior in anti-tension, and have workability for deep-pressing after the plating, and have a remarkable higher hardness the Vickers value is 110 up as compared with the value of conventional zinc coating the Vickers hardness is 30-40, and have the superior brightness. Further, the galvanized layers have superior anti-corrosive properties.

One of the remarkable advantages of this invention may be carried into effect with use of such a high current density as is 8-120 amperes per square decimeter as compared with a conventional alkaline zinc plating which is 2-3 amperes per square decimeter.

The plating according to this process may be carried with advantageous efficiency as rapid as several times than in the case of conventional zinc plating, without any porous deposition.

In the case of the barrel plating, the process may be carried into effect with use of a current density of 6-8 amperes per square decimeter, with equal results.

In the process of the plating according to this invention, metallic zinc is employed as anode, so that titanium and zirconium compounds contained in the plating bath will be consumed as the plating proceeds. The electrolysis, therefore, must be carried into effect with periodical replenishment of the titanium compound and the zirconium compound. In practice, therefore, it is preferred, that a continuously operating filter is connected to the plating tank and the filter is charged with the titanium compound and the zirconium compound. In the course of the process, the plating bath is continuously circulated

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through the filter, thereby dissolving the titanium and the zirconium compounds in the solution to the saturated concentration. By this procedure, the concentration of the titanium and the zirconium compounds in the plating bath can be always kept at a constant value.

Next, the invention will be described more in detail, referring to two preferred numerical examples.

Example 1

To a zinc cyanide plating bath, containing 60 grams of zinc cyanide, 45 grams of sodium cyanide and 90 grams of caustic soda per liter of solution, are continuously added sodium pertitanate and sodium perzirconate so as to maintain the concentration at a rate each of 0.5-1 gram per litre of solution, in such a way that the liquid is continuously passed through a filter charged with the titanium and the zirconium compounds. The plating is carried into effect, using a metallic zinc plate as anode with a cathodic current density of 10 amperes per square decimeter for a duration of 4 minutes, thus obtaining a uniform, bright, superior and well-deposited layer of zinc-titanium-zirconium alloy. The thus coated layer is 15 microns in its thickness and contains about 0.3% of titanium and about 0.3% of zirconium, as determined by the spectrum analysis, and perfectly certified by the Mat-tauch's mass analysis that titanium and zirconium in the deposited layer remain in metallic state.

Example 2

In the case of the barrel plating, the process may be carried into effect with use of a current density of 6 amperes per square decimeter for a duration of 10 minutes, thus obtaining a coated layer of 13 μ in its thickness, with equal results.

The thus obtained coating shows a higher anticorrosive quality as strong as several times than in the case of conventional zinc platings, as determined upon a number of tests using salt spray and dew point by the exposure tests.

It will be clear from the foregoing, that according to the invention, zinc-titanium-zirconium alloy plating may be produced in an amazingly effective manner and with substantially superior anti-corrosive qualities, and in much shorter time than those obtainable in the case of conventional zinc plating. The plating also is obtainable in a uniform layer on complicated forms to have superior uniform galvanizing properties and enduring for mechanical proceedings after the plating. The process according to this invention, therefore, represents thus a highly advantageous plating method, which is easily carried into practice industrially and on the anti-corrosive techniques of iron and steel.

Although substantially two preferred examples of invention have herein been disclosed for purpose of illustration, various modification thereof, after study of this specification, will be apparent to those skilled in the art to which the invention pertains. Reference should accordingly be had to the appended claims in determining the scope of the invention.

What is claimed as new and desired to be secured by Letters Patent is:

1. An aqueous electrolytic bath for electroplating an alloy of zinc-titanium-zirconium in the following quantities per liter of water:

60 grams of zinc cyanide
45 grams of an alkali metal cyanide
about 0.5-1 gram of an alkali metal pertitanate
about 0.5-1 gram of an alkali metal perzirconate

2. An aqueous electrolytic bath for electroplating an

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alloy of zinc-titanium-zirconium in the following quantities per liter of water:

60 grams of zinc cyanide
45 grams of sodium cyanide
About 0.5-1 gram of sodium pertitanate
about 0.5-1 gram of sodium perzirconate

3. An aqueous electrolytic bath for electroplating an alloy of zinc-titanium-zirconium in the following quantities per liter of water:

60 grams of zinc cyanide
45 grams of sodium cyanide
About 0.5-1 gram of sodium pertitanate
about 0.5-1 gram of sodium perzirconate
90 grams of sodium hydroxide

4. A process for electroplating an alloy of zinc-titanium-zirconium on a cathode comprising employing a zinc anode, an aqueous electrolytic bath in the following quantities per liter of water:

60 grams of zinc cyanide
45 grams of an alkali metal cyanide
about 0.5-1 gram of an alkali metal pertitanate
about 0.5-1 gram of an alkali metal perzirconate

and undertaking the electroplating with a current density of 10 amperes per square decimeter for 4 minutes.

5. A process for electroplating an alloy of zinc-titanium-zirconium on a cathode comprising employing a

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zinc anode, an aqueous electrolytic bath in the following quantities per liter of water:

60 grams of zinc cyanide
45 grams of sodium cyanide

5 about 0.5-1 gram of sodium pertitanate
about 0.5-1 gram of sodium perzirconate

undertaking the electroplating with a current density of between 6-10 amperes per decimeter for between 10-4 minutes.

10 6. A process for electroplating an alloy of zinc-titanium-zirconium on a cathode comprising employing a zinc anode, an aqueous electrolytic bath in the following quantities per liter of water:

60 grams of zinc cyanide
45 grams of sodium cyanide
About 0.5-1 gram of sodium pertitanate
about 0.5-1 gram of sodium perzirconate
90 grams of sodium hydroxide

undertaking the electroplating with a current density of between 6-10 amperes per decimeter for between 10-4 minutes.

References Cited in the file of this patent

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