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METHOD OF COATING TIN OVER
BASIS METALS

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This invention relates to a method of coating tin over
basis metals, and more particularly to a method of coat-
ing tin over lead or zinc.

It is desirable in plating metals that the plate be bright,
uniform and free of pin holes. Further, it is desirable
that the rate of coating or plating be relatively rapid.
Previously known methods of coating tin over basis metals
such as suggested in Metal Finishing Guidebook, gen-
erally result in thin coatings which are dull in the unpol-
ished state, are porous, and are accumulated on the base
metal at a slow rate.

I have discovered a method whereby tin may be coated
over basis metals to produce a tight, lustrous, substan-
tially pin-hole free surface at a rate which is substan-
tially more rapid than the previously known methods.

In accordance with my invention, tin may be plated or
coated over basis metal by contact with an aqueous bath
containing from about 6 percent by weight to the satura-
tion limit of tin salt, and preferably from about 10 per-
cent by weight to the saturation limit of the salt in the
aqueous solution. When concentrations of tin salt in the
6 to 10 weight percent range are employed, it is generally
advantageous to have present at least about 20 percent
by weight $ZnCl_2$.

Plating or coating in accordance with the present inven-
tion takes place at a temperature of from about 200 to
about 250 degrees centigrade, while a plating or coating
temperature range of from about 230 to about 250 degrees
centigrade is preferred. Coating at the desired tempera-
ture may be accomplished in a variety of ways. The
solution may be held at the desired coating temperature
and room temperature basis metal subsequently immersed
therein; the bath may be maintained at room temperature
and the basis metal preheated to the desired coating tem-
perature range prior to immersion, or both the bath and
the metal may be heated to the desired coating tempera-
ture range prior to immersion. The present invention is
not limited to immersion coating. Any other suitable
method of contacting the solution with the basis metal
at the desired temperature, such as by spraying solution
onto the basis metal, may be employed.

Coating or plating in accordance with the present in-
vention generally takes place in a short time, two seconds
at the appropriate temperature being an effective mini-
mum time. When a hot solution and cool basis metal, or
cool solution and hot basis material are employed, tem-
peratures at the surface being plated are generally transi-
tory. What is required, for purposes of the present in-
vention, is that for a period of at least two seconds the
surface of the basis metal, or the solution, or both
are within the temperature range of from about 200 to
about 250 degrees centigrade.

Basis metals contemplated for use in the present inven-
tion are lead and zinc. The basis metal may be a mix-
ture or alloy containing major proportions (at least 50
percent by weight) of lead or zinc, or may be another
material having a plate or coating of lead, zinc, or mix-
tures or alloys containing major proportions thereof.

Suitable tin salts for use in the aqueous coating solu-
tions of the present invention are those which are soluble
in water and relatively stable at the temperatures of coat-
ing (e.g., 200-250° C.). Non-limiting examples of typical

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salts are tin chloride, tin fluoride, tin iodide, tin bromide,
tin tartarate, tin sulfate, tin chromate, and the like.

The following examples are set forth to illustrate, and
are not to be construed to limit, the present invention.

Example 1.—A chemically pure molten zinc bath was
used to hand dip a galvanized coating from 2 to 2½
mils thick on 16 gauge steel. After the galvanizing treat-
ment, the metal, at a temperature of from about 455 de-
grees centigrade, was immediately quenched in a room
temperature aqueous solution containing about 17 percent
by weight stannous chloride. After the metal reached the
quench bath temperature (passing through the tempera-
ture range 200-250° C. in approximately 2 seconds) it
was removed and washed with water. Observation of the
metal revealed a bright, tight, tin coating that did not
rapidly react with hydrochloric acid.

Example 2.—Employing the molten zinc galvanizing
bath described in Example 1, coupons of 16 gauge steel
were galvanized by hand dipping. One such coupon was
hand dipped to apply zinc coating, removed from the gal-
vanizing bath, and delayed five seconds before immersion
in a room temperature saturated aqueous tin-chloride solu-
tion for about 3 seconds. At the time of immersion, the
coupon had a temperature of from about 430 to about 440
degrees centigrade. Coating temperature was within the
desired range (200-250° C.) for about two seconds.
The tin coating had a good appearance, was bright, and
no pin holes were observed.

Another coupon was treated in substantially the same
manner except that immersion in the tin-chloride solu-
tion was delayed for 120 seconds after removal from the
galvanizing bath. On immersion, the coupon had a tem-
perature of from about 230 to about 240 degrees centi-
grade and was immersed for about 3 seconds. Coating
temperature was within the desired range (200-250° C.)
for about two seconds. Inspection of the tin coating re-
vealed a bright, pin-hole free coating.

Example 3.—Weathered zinc-galvanized steel coupons
having the dimensions 1 inch by 4 inches by 16 gauge
were heated with a natural gas flame to temperatures in
the range of from about 300 to about 450 degrees centi-
grade. They were immediately quenched in a 200 degree
centigrade, aqueous tin chloride solution as described
in Example 1 for from about 2 to about 4 seconds and
removed. Coating temperature was within the desired
range (200-250° C.) for about two seconds or more.
A typical coupon weighed 17.8836 grams prior to quench-
ing and 18.2162 grams after quenching. The tin coatings
obtained were bright, tight, and free of pin holes.

Example 4.—Galvanized coupons were immersed in
aqueous tin chloride solutions of various concentrations
for from about 2 to about 4 seconds. Representative data
are tabulated below.

	Weight Percent			Solution Temp., ° C.	Coupon Temp. on Immersion, ° C.	Percent Coating Bright and Tight 1
	$SnCl_2$	H_2O	$ZnCl_2$			
60	(2)	-----	0	200	200-250	100
	46.4	53.6	0	Room	200-250	100
	13.0	87.0	0	Room	200-250	100
	6.25	94.75	0	Room	200-250	90
	6.25	50.0	43.15	Room	200-250	100
65	4.26	51.6	44.14	Room	200-250	70
	36.7	42.3	21.1	Room	200-250	100
	(2)	-----	0	190	Room	10
	(2)	-----	0	230	Room	100
	(2)	-----	0	230	Room	100

1 Remainder dark and spongy. Less than 100% represents an unaccept-
able coating.

2 $SnCl_2 \cdot 2H_2O$.

Example 5.—A steel coupon, substantially as described
above, was dip-coated with lead in a molten (370° C.)

lead bath, removed from the molten-lead bath, and immediately immersed in a room-temperature, saturated aqueous tin chloride solution. After immersion at coating temperature (200–250° C.) for a period of time of about two seconds, the coupon was removed from the aqueous solution.

Inspection of the tin coating thus obtained revealed a lustrous, tight coating which was free of pin holes.

Example 6.—A zinc galvanized steel coupon was heated to a temperature of about 430° degrees centigrade. Saturated aqueous stannous chloride solution at room temperature was sprayed onto the coupon so as to thoroughly cover it with solution. Coating temperature was within the desired range (200–250° C.) for at least two seconds. The solution was then removed by rinsing.

Observation of the coating of tin thus obtained revealed a tight, pin-hole free coating. Further tests indicated that the coating did not readily react with aqueous HCl.

Various modifications may be made in the present invention without departing from the spirit or scope thereof, and it is to be understood that I limit myself only as defined in the appended claims.

I claim:

1. A method of coating tin over a basis metal selected from the group consisting of lead, zinc, and mixtures and alloys containing major proportions thereof which comprises providing an aqueous solution containing from about ten percent by weight to the saturation limit of a water-soluble tin salt, providing a basis metal to be coated, contacting said basis metal with said aqueous solution for at least two seconds at a temperature of from about 200 to about 250 degrees centigrade, and removing the solution from the tin-coated basis metal.

2. A method of coating tin over a basis metal selected from the group consisting of lead, zinc, and mixtures and alloys containing major proportions thereof which comprises providing an aqueous solution containing from about six percent by weight to the saturation limit of a water-soluble tin salt and at least about 20 percent by weight of zinc chloride, providing a basis metal to be coated, contacting said basis metal with said aqueous solution for at least two seconds at a temperature of from about 200 to about 250 degrees centigrade, and removing the solution from the tin-coated basis metal.

3. A method of coating tin over zinc which comprises providing an aqueous solution containing from about ten percent by weight to the saturation limit of a water-soluble tin salt, contacting said zinc with said aqueous solution for at least two seconds at a temperature of from about 200 to about 250 degrees centigrade, and removing the solution from the tin-coated zinc.

4. A method of coating tin over zinc which comprises providing an aqueous solution containing from about six percent by weight to the saturation limit of a water-soluble tin salt and at least about 20 percent by weight of zinc chloride, contacting said zinc with said aqueous solution for at least two seconds at a temperature of from about 200 to about 250 degrees centigrade, and removing the solution from the tin-coated zinc.

5. A method of coating tin over zinc which comprises heating zinc-galvanized steel to a temperature of from about 300 to about 450° degrees centigrade, quenching said zinc-galvanized steel in an aqueous solution containing about 17 percent by weight stannous chloride, said solution being at a temperature of about 200 degrees centigrade, thereby coating tin over the zinc at a coating temperature of from about 200 to about 250 degrees centigrade, and removing the tin-coated zinc-galvanized steel from the solution after at least about two seconds at the coating temperature.

6. A method of coating tin over zinc which comprises providing zinc-galvanized steel at a temperature of from about 230 to about 470 degrees centigrade, providing an aqueous bath containing about 17 percent by weight stannous chloride, said bath being at room temperature, immersing said zinc-galvanized steel in said bath, thereby coating tin over the zinc at a coating temperature of from about 200 to about 250 degrees centigrade, and removing the tin-coated zinc-galvanized steel from the solution after at least about two seconds at the coating temperature.

7. A method of coating tin over zinc which comprises providing zinc-galvanized steel at a temperature of about 430 degrees centigrade, providing a saturated aqueous stannous chloride solution, spraying said stannous chloride solution on said zinc-galvanized steel in an amount sufficient to cover said steel, thereby coating tin over the zinc at a coating temperature of from about 200 to about 250 degrees centigrade, and removing the solution from the tin-coated zinc.

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