United States Patent Office 3,095,362
Patented June 25, 1963



3,095,362

# ZINC PLATING COMPOSITION AND PROCESS

John B. Winters, Bay Village, Ohio, assignor to Incar, Inc., Cleveland, Ohio, a corporation of Ohio

No Drawing. Filed Nov. 21, 1960, Ser. No. 70,436
9 Claims. (Cl. 204—55)

This invention relates to the electrodeposition of zinc from aqueous solutions of its salts and is particularly directed to acid zinc plating baths and processes whereby lustrous deposits of zinc can be obtained by the use of para vinyl benzene sulfonic acid as an addition agent, and to compositions of matter containing para vinyl benzene sulfonic acid or its salts as acid zinc plating bath addition agents.

Zinc plated from conventional acid electrolytes is dull, coarsely crystalline and sometimes dark in appearance. The throwing and covering powers of the baths are poor which means that deposits on recesses or low current density areas are thin or non-existent, thus providing poor protection or none to such areas.

I have found that para vinyl benzene sulfonic acid as an addition agent in acid zinc plating baths is particularly effective in greatly improving the appearance of zinc deposits from such baths by producing fine grained deposits with a white luster, free from dark areas.

Para vinyl benzene sulfonic acid imparts to acid zinc baths containing it the property of plating zinc uniformly over irregular shaped surfaces by improving both the throwing power and the covering power of the bath.

Para vinyl benzene sulfonic acid is effective as an addition agent in, and is compatible with, all the well known acid zinc plating baths which in general consist of aqueous solutions of zinc salts such as, for example, the sulfate, sulfamate or fluoborate, either alone or in combination, and with or without such inorganic compounds as boric acid, sodium acetate, ammonium chloride, etc. which act as buffers or stabilizers, and sometimes small amounts of aluminum chloride or aluminum sulfate, all of which are optional and their uses well known to those skilled in the art.

The following bath formulations are cited as illustrative:

| (A) Zinc Sulfate Base | Concentration in grams per liter | | |
|---|---|---|---|
| Bath No. | 1 | 2 | 3 |
| Zinc Sulfate ($ZnSO_47H_2O$) | 360 | 360 | 360 |
| Sodium Acetate | | 15 | |
| Boric Acid | | | 20 |

| (B) Zinc Fluoborate Base | Concentration in grams per liter | |
|---|---|---|
| Bath No. | 4 | 5 |
| Zinc Fluoborate | 375 | 375 |
| Ammonium Fluoborate | | 45 |

Operating conditions for both types of bath are essentially the same:

| | | |
|---|---|---|
| pH | approximately | 3.5–4.5 |
| Temperature | ° F. approximately | 70–120 |
| Current density | amps per square foot | 20–50 |

These values are by no means binding but are cited as illustrative of average conditions only.

The effective concentration of para vinyl benzene sulfonic acid as addition agent in acid zinc plating baths is not critical, and the free acid or any of its bath soluble



salts may be used providing the anion is not objectionable in the bath. Generally either the sodium or zinc salt is preferred. Normally about 1 to 10 grams per liter of the sodium salt of para vinyl benzene sulfonic acid is effective, the amount depending on bath composition, operating conditions, contour of work being plated and results desired. Under average conditions about 5 grams per liter will produce optimum results. In any case it is best added to the bath in the form of an aqueous solution, and the amount can be adjusted to suit the needs of the operator.

For the convenience of the plater it is advantageous to offer to the trade a liquid brightener composition containing para vinyl benzene sulfonic acid or its sodium or zinc salt for addition to acid zinc plating baths. One such composition that has been found to be effective and may be cited here as an example is:

| (1) Acid zinc brightener: | Grams per liter |
|---|---|
| Para vinyl benzene sodium sulfonate | 100 |
| Zinc sulfate ($ZnSO_47H_2O$) | 10 |

This liquid brightener is added to any acid zinc plating bath in amounts necessary to produce the results desired, usually in the proportion of about 50 cc. per liter of bath, or around 6–7 ounces of the brightener per gallon of bath. It is obvious from the discussion that the inclusion and identity of the water soluble zinc salt is optional and the concentration used is not critical.

Having thus described this invention in such full, clear, concise and exact terms as to enable any person skilled in the art to which it pertains to make and use the same, and having set forth the best mode contemplated of carrying out this invention, I state that the subject matter which I regard as being my invention is particularly pointed out and distinctly claimed in what is claimed, it being understood that equivalents or modifications of, or substitutions for, parts of the above specifically described embodiment of the invention may be made without departing from the scope of the invention as set forth in what is claimed.

What is claimed is:

1. In the process of electroplating zinc from an aqueous acid solution of a zinc salt, the step of adding to said solution between about 1.0 and about 10 grams per liter of para vinyl benzene sulfonic acid.

2. In the process of electroplating zinc from an aqueous acid solution of a zinc salt, the step of adding to said solution about 5 grams per liter of para vinyl benzene sulfonic acid.

3. In the process of electroplating zinc from an aqueous acid solution of a zinc salt, the step of adding to said solution between about 1.0 and about 10.0 grams per liter of a bath compatible salt of para vinyl benzene sulfonic acid.

4. In the process of electroplating zinc from an aqueous acid solution of zinc sulfate, the step of adding to said solution about 15 grams per liter of sodium acetate, and between about 1.0 and about 10 grams per liter of para vinyl benzene sulfonic acid.

5. In the process of electroplating zinc from an aqueous acid solution of zinc sulfate, the step of adding to said solution about 20 grams per liter of boric acid, and between about 1.0 and about 10 grams per liter of para vinyl benzene sulfonic acid.

6. In the process of electroplating zinc from an aqueous acid solution of zinc fluoborate, the step of adding to said solution about 45 grams per liter of ammonium fluoborate and between about 1.0 and about 10 grams per liter of para vinyl benzene sulfonic acid.

7. An additive for use in acid zinc electroplating comprising water having dissolved therein, at room tempera-

ture, about 10 grams per liter of a soluble zinc salt and about 100 grams per liter of a bath compatible salt of para vinyl benzene sulfonic acid.

8. An additive for use in acid zinc electroplating comprising water having dissolved therein, at room temperature, a soluble zinc salt and about 100 grams per liter of para vinyl benzene sodium sulfonate.

9. An additive for use in acid zinc electroplating comprising water having dissolved therein, at room temperature, a soluble zinc salt and about 100 grams per liter of para vinyl benzene sulfonic acid.



**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 2,455,555 | Brown | Dec. 7, 1948 |
| 2,523,190 | Brown | Sept. 19, 1950 |
| 2,712,522 | Kardos et al. | July 5, 1955 |
| 2,910,413 | Strauss et al. | Oct. 27, 1959 |
| 2,999,056 | Tanner | Sept. 5, 1961 |

OTHER REFERENCES

Gray, Chem. Abstracts, 1957, volume 51, col. 15169 bc.