This invention relates more particularly to the improvements in or relating to the development of a new brightener for acid zinc bath to produce bright deposits.

Hitherto the following compounds—

1. Thiourea
2. Cystine
3. Hexamine
4. Naphthalene di-or trisulfonic acid or benzene sulfoic acid
5. Benzaldehyde, venenraldehyde, coumarins, pyrrolaldehyde,
6. Pyridine, pyrrole, quinoline,
7. Mercapto compounds and selenium compounds
8. Urotropin and dihydrocarbonates
9. Di-and tri-ethanolamines

were used as brighteners for bright acid zinc plating.

This is open to the objection that these compounds give such deposits which are mostly semi-bright and they require bright dipping in nitric acid or chromic acid.

The object of this invention is to obviate these disadvantages by using a brightener, which is indigenous available in the country and which gives the bright deposits without any bright dipping.

To these ends, the invention broadly consists in the development of a brightener for the electrodeposition of bright zinc deposit from acid solution. The bath composition is as follows:

- Zinc sulphate : 300-450 g/l
- Boric acid : 20-40 g/l
- Aluminium sulphate : 0-30 g/l
- Sodium chloride : 0-15 g/l
- Dextrin : 2-20 g/l
- Salicylaldehyde : used as an addition agent in this bath and Teepol is added as the wetting agent. The solution at higher current densities that is above 100 a/f requires vigorous stirring and filtration at intervals becomes necessary. The bath works between 50-500 a/f. At low current densities also, it requires some slight stirring. pH is 2.5, adjusted with sulfuric acid.

The following are the typical examples given to illustrate the inventions:

**Example 1**

<table>
<thead>
<tr>
<th>Substance</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc sulphate</td>
<td>350 g/l</td>
</tr>
<tr>
<td>Boric acid</td>
<td>30 g/l</td>
</tr>
<tr>
<td>Aluminium sulphate</td>
<td>20 g/l</td>
</tr>
<tr>
<td>Dextrin</td>
<td>15 g/l</td>
</tr>
<tr>
<td>Salicylaldehyde</td>
<td>0.8 m/l</td>
</tr>
<tr>
<td>Teepol</td>
<td>0.8 m/l</td>
</tr>
<tr>
<td>Current density</td>
<td>300 a/f</td>
</tr>
<tr>
<td>pH</td>
<td>3</td>
</tr>
<tr>
<td>Current efficiency</td>
<td>95-98%</td>
</tr>
</tbody>
</table>

Bright deposits are obtained. Reflectivity : 95% with vigorous agitation either by air or mechanically. (Reflectivity measured with reference to vacuum coated silver mirror). Current efficiency : 95-95%.

**Example 2**

<table>
<thead>
<tr>
<th>Substance</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc sulphate</td>
<td>300 g/l</td>
</tr>
<tr>
<td>Boric acid</td>
<td>30 g/l</td>
</tr>
<tr>
<td>Dextrin</td>
<td>10 g/l</td>
</tr>
<tr>
<td>Salicylaldehyde</td>
<td>1.5 m/l</td>
</tr>
<tr>
<td>Teepol</td>
<td>1 m/l</td>
</tr>
<tr>
<td>Current density</td>
<td>50 a/f</td>
</tr>
<tr>
<td>pH</td>
<td>2.5</td>
</tr>
<tr>
<td>Cathode current efficiency</td>
<td>95-98%</td>
</tr>
<tr>
<td>Reflectivity :</td>
<td>95%; slight agitation is given.</td>
</tr>
</tbody>
</table>

**Example 3**

<table>
<thead>
<tr>
<th>Substance</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc sulphate</td>
<td>400 g/l</td>
</tr>
<tr>
<td>Boric acid</td>
<td>30 g/l</td>
</tr>
<tr>
<td>Aluminium sulphate</td>
<td>10 g/l</td>
</tr>
<tr>
<td>Dextrin</td>
<td>5 g/l</td>
</tr>
<tr>
<td>Salicylaldehyde</td>
<td>1 m/l</td>
</tr>
<tr>
<td>Teepol</td>
<td>1 m/l</td>
</tr>
<tr>
<td>Current density</td>
<td>300 a/f</td>
</tr>
<tr>
<td>pH</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Price : TWO RUPEES
Current efficiency : 95%, reflectivity : 95% ; vigorous agitation and filtration.

The following are among the main advantages of the invention :

1. Very brilliant deposits from acid zinc bath which need no further polishing

2. Relatively cheaper cost of the addition agent
3. Wide range of current density.

Sdr. B. BHASKAR PAI
Patents Officer,
Council of Scientific & Industrial Research.

Dated this 24th day of August, 1972.

COMPLETE SPECIFICATION

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, RASHTRABHAI, NEW DELHI-I, INDIA, AN INDIAN REGISTERED BODY INCORPORATED UNDER THE REGISTRATION OF SOCIETIES ACT (ACT XXI OF 1860).

The following Specification particularly describes and ascertaines the nature of this invention and the manner in which it is to be performed:—

This invention relates to improvements in or relating to the process of electrodeposition of bright zinc from acid baths and this particularly relates to metal finishing industry.

Hitherto it has been proposed to use the following brighteners in the acid zinc bath:

1. Tamiourea
2. Crestine
3. Hexamine
4. Naphthalene di or trimislic acid or benzene sulphonylic acid
5. Benzaldehyde, veratraldehyde, coumarin piperonaldehyde
6. Pyridine, pyrrole, quinoline
7. Mercaptocompounds and selenium compounds
8. Urotropin and dibutylcarbamates
9. Di and triethylammonium bromide
10. Cetyl trimethyl ammonium bromide

Substances like beta naphthol, dextrin, dextrose, gum arabic, glucose etc. have also been reported as grain, refining agents. But they produce only semi-deposits.

These brighteners mostly give semi-bright deposits which require dipping in nitric acid or chromic acid to make it bright.

The main object of this invention is to develop a brightener which is indigenously available and which gives bright deposit in an acid bath that it requires no bright dipping.

The main finding is the development of a new brightener which gives bright deposit even in the as-plated condition.

According to the present invention, there is provided a process for the electrodeposition of bright zinc by zinc plating in an acid bath containing a brightener characterised in that the electrolytic bath consists of zinc sulphate 335-350 g/l, sodium chloride 5-15 g/l, aluminium sulphate 10-30 g/l, boron acid 1030 g/l, to which is added a brightener consisting of dextrin 2.5 g/l, salicylaldehyde 0.5-1 ml/l and teepol 0.5-2 ml/l and is further characterised in that the electrolytic bath is carried out employing a current density of 3.2-21.5 A/dm² at a temperature range of 20-40°C at pH 2-4 with mechanical agitation.

Using this brightener, it is possible to get a bright deposit from an acid sulphate bath. The bath composition and plating conditions are given below:

**Bath composition:**

- Zinc sulphate : 350-350 g/l
- Sodium chloride : 5-15 g/l
- Aluminium sulphate : 10-30 g/l
- Boric acid : 10-30 g/l

**Conditions:**

- Temperature : 20-40°C
- pH : 2-4
- Current density : 3.2-21.5 A/dm²
- Agitation : Mechanical
- Current efficiency : 90-95%

The additional agents used are of the following concentration:

- Dextrin : 2.5 g/l
- Salicylaldehyde : 0.5-1 ml/l
- Teepol : 0.5-2 ml/l

The acid bath is mixed with teepol and then added to the bath. Dextrin can be dissolved in hot water and then added directly to the bath. This brightener produces bright deposit which requires no further post-treatment.

**Example 1**

The deposit has been carried out in 2-litre scale with the following conditions:

- Zinc sulphate : 335 g/l
- Sodium chloride : 15 g/l
- Boric acid : 30 g/l
- Aluminium sulphate : 30 g/l
- Dextrin : 3 g/l
- Salicylaldehyde : 0.5 ml/l
- Teepol : 1 ml/l
- Agitation : Mechanical
- Temperature : 25°C
- pH : 2
- Current density : 8.4 A/dm²
- Reflectivity : 96%

[measured with gloss reflectance meter]
**Example 2**

<table>
<thead>
<tr>
<th>Component</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zinc sulphate</td>
<td>—</td>
</tr>
<tr>
<td>Sodium chloride</td>
<td>—</td>
</tr>
<tr>
<td>Aluminium sulphate</td>
<td>—</td>
</tr>
<tr>
<td>Boric acid</td>
<td>—</td>
</tr>
<tr>
<td>Dextrin</td>
<td>—</td>
</tr>
<tr>
<td>Salicylaldehyde</td>
<td>—</td>
</tr>
<tr>
<td>Teepol</td>
<td>—</td>
</tr>
</tbody>
</table>

**Agitation**
- Mechanical

**Temperature**
- 35°C

**pH**
- 4

**Current density**
- 31.5 A/dm²

**Reflectivity**
- 90%

*(measured with gloss reflectance meter)*

**Cathode current efficiency** 90%

The main advantage of this process is that the deposit obtained from this bath with indigenous available chemicals does not require any post-treatment. Moreover, the cyanide disposal problem is eliminated which saves a large amount of expenditure and the cost incurred by way of importing cyanide is also avoided.

In sum, the acid zinc sulphate bath gives bright deposit under the conditions stated in the examples.

**WE CLAIM:**

1. A process for the electrodeposition of bright zinc in an acid bath containing a brightener characterized in that the electrolytic bath consists of zinc sulphate 260-360 g/l, sodium chloride 5.15 g/l, aluminium sulphate 10-30 g/l, boric acid 10-30 g/l with a brightener consisting of dextrin 2-5 g/l, salicylaldehyde 0.6-1 ml/l and teepol 0.3-2 ml/l which is characterized in that the electrodeposition is carried out employing a current density of 3.5-21.5 A/dm² at a temperature range of 20-40°C at pH 4.4 with mechanical agitation.

2. A process for the electrodeposition of bright zinc substantially as hereinafter described.

_Sd/- Eligible_

_Ass. Patent Officer_

_Council of Scientific & Industrial Research_

*DATED this 18th day of October, 1971.*

*Printed by: Nelys Printing Pvt. Limited, 2, Barretto Lane, Calcutta-700010.*
PROVISIONAL SPECIFICATION

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH
No. 138579.

Fig. 1

INTENSITY (Arbitrary Units)

λ (μm)

S. Kumar
Patents Officer, CSIR.