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IMPROVEMENTS IN OR RELATING TO ELECTRODEPOSITION OF BLACK CHROMIUM PLATING
COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, RAY NAGAR, NEW DELHI-1, INDIA, AN INDIAN REGISTERED BODY INCORPORATED UNDER THE REGISTRATION OF SOCIETIES ACT (ACT XXI of 1860).

THIS IS AN INVENTION BY BALKUNJE ANANTHA SHENOI, SCIENTIST, KARAIKUDI SANKARANARAYANA SHAASTRI INDIA, Senior Scientific Assistant, and SEETHURAMAN GOWRI, Senior Laboratory Assistant, all of Central Electro-chemical Research Institute, Karai-kudi-3, India, all INDIANS.

The following specification describes the nature of this invention.

This invention relates to improvements in or relating to Electrodeposition of Black Chromium Plating from aqueous electrolyte.

Hitherto it has been proposed to resort to electrodeposition of black chromium from (1) acetate (2) nitrate (3) sulfocate acid containing baths.

This is open to the objection that baths (1) and (2) are short-lived and colour of the finish is not good and bath (3) operates at low current densities and contains microcracks.

The object of this invention is to obviate these disadvantages by using acids or compounds containing amino or amido groups such as sulfinates, sulffamic acid, formamide and acetamide etc.

To these ends, the invention broadly consists in electrolyzing an aqueous solution containing chronic acid and a compound selected from the class consisting of any compounds suggested above with lead antimony anode and copper brass or steel or any other metal on which bright chrome can be plated as cathode at temperature ranging from 10-40°C. and at c.d. of 15-150 amperes/sq.dm.

The following typical examples are given to illustrate the invention:

**Example 1.**

Chronic acid = 150-400 gm/1
(From sulphates)

Sulphamic acid or its salt = 5-40 gm/1

Boric acid = 20 gm/1

Barium salt = 10-30 gm/1

Current density = 20-100 ampere/dm²

Time = 5 min to 2 hrs.

Temperature = 19-29°C.

**Example 2.**

Chronic acid (free from sulphates) = 150-400 gm/1

Formamide = 5-40 ml/1

Operation conditions as in Example 1.

The following are among the main advantages of the invention:

1. A cold process.
2. Deposit is homogeneous.
3. Composition is easily controlled.
4. Deposits are crack-free.
5. Resistant towards many of the mineral acids.
6. Jet black adherent deposit.

R. BHASKAR PAI
Patent Officer,
Council of Scientific & Industrial Research,
Dated this 11th day of December, 1984.

COMPLETE SPECIFICATION

IMPROVEMENTS IN OR RELATING TO THE ELECTRODEPOSITION OF BLACK CHROMIUM PLATING
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The following specification particularly describes and ascertains 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 Electrodeposition of Black-Chromium Plating from aqueous electrolyte.

Hitherto it has been proposed to resort to electrodeposition of black chromium from (1) acetate (2) nitrate (3) fluosilicic acid containing baths.

This is open to the objection that baths 1 and 2 are short-lived and colour of the finish is not good and bath (3) operates at low current densities and the deposits contain micro cracks and requires preplating (nickel) treatments.

The object of this invention is to obviate these disadvantages by using acids or compounds containing amino or amido groups such as sulphamates, sulphamic acid, formamide and acetamide etc.

To these ends, the invention broadly consists in electrolyzing an aqueous solution containing chronic acid and a compound selected from the class consisting of any compounds suggested above with lead antimony anode and copper brass or steel or any other metal on which bright chrome can be plated as cathode at temperature ranging from 10-40°C. and at current density of 15-150 ampere/dm².

Good adherent black hard wear resistant uniform coatings are obtained from bath containing chronic acid with addition of sulphamic acid or its salt. The deposits obtained from this new type of bath compares equally well with other baths known. The effect of altering the composition of the bath current density, temperature, time of treatment, pH etc. on the characteristics of the deposit are worked and in detail.

The investigation shows that promising results could be obtained with regard to black chromium deposits from baths containing "sulphamate". The functional use of sulphamic acid has been extended to black chromium.

The following typical examples are given to illustrate the invention:

**Example 1.**

Chronic acid (free from sulphate) = 250-300 gpd

Sulphamic acid or its salt = 10-20 gpd

Barium Carbonate = 10-50 gpd

Prices: TWO RUPEES.
The operating conditions for the above bath are given below:

Current density 60-100 amp/dm²
Time of treatment 5 hrs - 15 hrs.
Temperature 20-30°C.

**Example 2.**

Chromic acid 250 gpl
(formerly from sulphate)
Formamide or any other amine or amido aliphatic 5-40 gmt/l
or aromatic compound
Operating conditions As in Example 1.

The chromic acid used in the above solution is of commercial grade from which the traces of “sulphate” is removed by barium treatment. 250 gpl of chromic acid is beneficial since below 250 gpl the efficiency is poor, and above this concentration, the CrO₃ crystallizes as H is operated at low temperature and drag out loss is also high.

The deposits are sound and varied from grey black to jet black in appearance. The deposits obtained under the typical conditions which are covered in the patent are hard, adherent shining black and smooth.

The following are among the main advantages of the invention:

1. It is a cold process.
2. The deposits are homogeneous.
3. The composition of the bath is easily controlled.
4. Deposits are crack free.
5. The deposits are resistant towards many of the mineral acids.
6. Jet, black adherent deposit.
7. The deposit can be grown to sufficient thickness without any change in the ductility of the deposit.

8. Black chromium from sulphamate bath is readily wetted by both oil and water.
9. Particularly advantageous in the field of application where friction is to minimum.
10. Apart from the appearance the properties of black chromium deposits from the sulphamate bath including micro hardness, structure etc. are almost superior to equal with those of deposits from the fluorohyde type baths produced under typical conditions.
11. The use of ‘sulphamate’ as catalyst for black chromium plating is proposed for the first time.

We claim:

1. A process for the electrodeposition of black chromium plating which consists in electrolyzing an aqueous solution containing chromic acid and a compound selected from the class consisting of any of the following compounds, namely, acids or compounds containing amine or amido groups such as sulphamates, sulphamic acids, formamide and acetamide etc., with lead antimony anode and copper, brass or steel or any other metal on which bright chrome can be plated as cathodes at temperature ranging from 60-40°C and at current density of 15-200 amp/dm².
2. A process for the electrodeposition of black chromium plating substantially as described in the examples.

**R. BHASKAR PAI**

Patents Officer,

Council of Scientific and Industrial Research.

*Date: 7th day of September, 1965.*