GOVERNMENT OF INDIA : THE PATENT OFFICE, 214, ACHARYA JAGADISH BOSE ROAD, CALCUTTA-17.

Complete Specification No. 134121. Application and Provisional Specification filed on 30th December, 1971. Complete Specification filed on 26th March, 1973. Acceptance advertised on 4th January, 1975.

Index at acceptance—70C4[LVIII(5)], 188 [XXXIII(9)]

PROVISIONAL SPECIFICATION

"IMPROVEMENTS IN OR RELATING TO METHODS OF PLATING ON ALUMINIUM"

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, RAFI MARG, NEW DELHI 1, INDIA, AN INDIAN REGISTERED BODY INCORPORATED UNDER THE REGISTRATION OF SOCIETIES ACT (ACT XXI OF 1860)

The following specification describes the nature of this invention :—

This is an invention by BALKUNJE ANANTHA SHENOI, Scientist, a citizen of India and employed in the Central Electrochemical Research Institute, Karaikudi-3, India.

This invention relates to improvements in or relating to methods of plating on aluminium.

Hitherto it has been proposed to use any one of the following procesess as a preplating operation, viz. immersion zinc coating or anodising or immersion tinning. The recent trend is towards immersion tinning followed by bronze strike.

This is open to the objection that in the case of immersion tinning process, one more step namely, "Bronze Strike" is given after immersion tinning before taken to further plating. Wherever this bronze strike is a must, the process involves two steps and two separate baths.

The object of the present invention is to obviate these disadvantages by having a single bath which acts as an activating immersion tin bath as well as bronze strike bath. In the present bath, the articles to be plated are to be kept for 30 seconds to receive an immersion tin deposit by replacing the aluminium surface oxide film and then current is impressed to get a bronze strike.

The bath is so formulated that it contains complexing agents which will not allow aluminium to precipitate down and these addition agents will not interfere with the plating operation. It is found that the bronze strike obtained from this bath is bright and adherent. The bronze strike thus obtained is suitable for further deposition of copper-nickel and chromium. It is also found that the soldering on bronze strike given aluminium is very strong. The bronze strike obtained from this bath is suitable for electroless plating by copper or nickel straight away. The composition developed is of such a nature that the metal ion concentration except stannate content in the bath is much less compared to the conventional bronze plating baths. The dual role of the present bath as an activation tinning bath as well as bronze electroplating bath is due to the higher stannate content in the bath.

The bath used for giving bronze strike consists of potassium stannate, copper cyanide, potassium hydroxide and a complexing agent. Suitable complexing agents have been mentioned in the Examples.

The electrodeposition is carried out between 35° and 60°C. When temperature is increased deposition of tin also increases resulting in a dull more or less white deposit. Conventional current densities for copper-tin alloy plating are suitable. It varies from 1.5 A/dm^2 to 10A/dm^2. Copper or copper-tin anodes can be used for these purposes. The tin-copper alloy can be electrodeposited to any desired thickness. The deposits are also bright and smooth by virtue of the addition agents mentioned in the Examples.

The following typical examples are given to illustrate the invention :

Example 1

Commercially pure aluminum 2S alloy was used for comparative purposes. Before electrodeposition of tin-copper alloy, it was cleaned as follows : It was degreased first with ordinary solvents like trichloroethylene or acetone. It was then immersed into the alkaline solution of 30 g/l sodium carbonate and 30 g/l trisodium phosphate for about 2-3 minutes at 60 °C. After washing thoroughly it was dipped into acid etching solution containing 15%(v) at 70-80 °C for about 5 minutes, washed with tap water and then distilled water. The plate was immersed in the following solution and allowed 30 seconds to receive immersion tinning and thereafter current was impressed for about 2-5 minutes. Tin copper alloy was used as anode material.

Copper cyanide	10 g/l
Potassium cyanide	20 g/l
Potassium stannate	110 g/l
Potassium hydroxide	4 g/l
Triethanolamine	4 ml/l
Temperature	40 °C
Current density	3.5 A/dm^2

The bronze strike obtained was adherent, smooth and bright.

Example 2

With the bath composition given in Example 1 bronze strike was given on 3S aluminium alloy. Rest of the procedures followed are the same as in Example 1. The deposit obtained was very adherent and smooth.

Example 2(a)

Bronze strike can be had on 2S, 3S and 26S aluminium from the undermentioned bath. The work pieces were cleaned and etched as given in Example 1 and 30 seconds' time was allowed for immersion tin deposit to take place Copper-tin alloy was used as anode material. An adherent smooth deposit was obtained.

Copper cyanide	8 g/l
Potassium cyanide	26 g/l
Potassium stannate	120 g/l
Potassium hydroxide	7.5 g/l
D. Mannitol or D. Sorbitol	8 g/l
Temperature	45 °C
Current density	3 A/dm

Example 3

Copper cyanide	13 g/l
Potassium cyanide	15 g/l
Potassium stannate	90 g/l
Potassium hydroxide	6 g/l
Sodium gluconate	3.5 g/l
Temperature	50 °C
Current density	4 A/dm^2

Repeated with aluminium die castings, 2S, 3S and 26S. The specimen was cleaned and etched as in Example 1. 30 seconds were allowed for immersion tinning before giving bronze strike. The deposit obtained was smooth, very bright and adherent.

Example 4

Copper cyanide	12 g/l
Potassium cyanide	23 g/l
Potassium stannate	100 g/l
Potassium hydroxide	5 g/l
Glycolic acid	10 g/l
Temperature	48 °C
Current density	3.5 A/dm^2

Repeated with aluminium die castings, 2S, 3S and 26S. The specimen was cleaned and etched as in Example 1. 30 seconds were allowed for immersion tinning before bronze strike. All the alloys mentioned received smooth adherent deposit.

The following are among the main advantages of the invention :

1. In the present invention, it is possible to electrodeposit adherent bright tin-copper alloy on aluminium and its alloys directly by having a single bath for obtaining immersion tin and bronze strike.

2. Bronze strike followed by copper plating on aluminium is useful as bimetallic printing plate in printing industry. Copper plated aluminium wires and strips can be prepared by follwing the process described in this patent.

3. This process is successful to all aluminium alloys containing even lesser percentage of copper and also super purity aluminium.

Dated this 27th day of December, 1971.

(Sd.)
R. BHASKAR PAI
PATENTS OFFICER
Council of Scientific and Industrial Research

COMPLETE SPECIFICATION

"IMPROVEMENTS IN OR RELATING TO METHODS OF PLATING ON ALUMINIUM"

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH Rafi Marg, New Delhi-1, India, an Indian Registered body incorporated under the Registration of Societies Act (Act XXI of 1960)

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

This an invention by BALKUNJE ANANTHA SHENOI, Scientist, and employed in the Central Electrochemical Research Institute, Karaikudi-3, India, an Indian citizen.

This invention relates to improvements in or relating to methods of plating on aluminium.

Hitherto it has been proposed to use any one of the follwing processes as a preplating operation, viz. immersion zinc coating or anodising or immersion tinning. The recent trend is towards immersion tinning followed by bronze strike.

The immersion tinning process hitherto practised involves two steps namely, (i) immersion tinning followed by (ii) bronze strike prior to plating on aluminium. Wherever this bronze strike is a must, the process involves two steps involving two separate baths and hence the disadvantage.

The object of the present invention is to obviate these disadvantages by having a single bath which acts as an activating immersion tin bath as well as bronze strike bath. In the present bath, the articles to be plated are to be kept for 30 seconds to receive an immersion tin deposit by replacing the aluminium surface oxide film and then current is impressed to get a bronze strike.

The bath is so formulated that it contains complexing agents which will not allow aluminium to precipitate down and these addition agents will not interfere with the plating operation. It is found that the bronze strike obtained from this bath is bright and adherent. The bronze strike thus obtained is suitable for further deposition of copper-nickel and chromium. It is also found that the soldering on bronze strike given aluminium is very strong. The bronze strike obtained from this bath is suitable for electroless plating by copper or nickel straightaway. The composition developed is of such a nature that the metal ion concentration except stannate content in the bath is much less compared to the conventional bronze plating baths. The dual role of the present bath as an activation tinning bath as well as bronze electroplating bath is due to the higher stannate content in the bath.

The bath used for giving bronze strike consist of potassium stannate, copper cyanide, potassium

hydroxide and a complexing agent. Suitable complexing agents have been mentioned in the examples.

The electrodeposition is carried out between 35° and 60°C. When temperature is increased, deposition of tin also increases resulting in a dull more or less white deposit. Conventional current densities for copper-tin alloy plating are suitable. It varies from 1·5 A/dm². to 10 A/dm². Copper or copper-tin anodes can be used for these purposes. The tin-copper alloy can be electrodeposited to any desired thickness. The deposits are also bright and smooth by virtue of the addition agents mentioned in the examples.

The present invention consists of a new bath composition for plating on aluminium (or its alloys) which comprises of potassium stannate, potassium hydroxide, potassium cyanide copper cyanide and a suitable chelating agent.

The following typical examples are given to illustrate the invention :

Example 1

Commercially pure aluminium (99% aluminium) was used for comparative purposes. Before electrodeposition of tin-copper alloy, it was cleaned as follows :

It was degreased first with ordinary solvents like trichloroethylene or acetone. It was then immersed into the alkaline solution of 30 g/1 sodium carbonate and 30 g/1 trisodium phosphate for about 2-3 minutes at 60°C. After washing thoroughly, it was dipped into acid etching solution containing 15% (v) sulphuric acid at 70-80 °C for about five minutes, washed with tap water and then distilled water. The plate was immersed into bath having the following composition and conditions and allowed 30 seconds to receive immersion tinning and thereafter current was impressed for about 2.5 minutes. Tin-copper alloy was used as anode meterial.

Copper cyanide	10 g/l
Potassium cyanide	20 g/l
Potassium stannate :	110 g/l
Potassium hydroxide	4 g/l
Triethanolamine	4 ml/l
Temperature	40 °C
Current density	3.5 A/dm²

The bronze strike obtained was adherent, smooth and bright.

Example 2

With the bath composition given in Example 1 bronze strike was given on aluminium alloy containing 1·25% manganese (3S aluminium alloy). Rest of the procedures followed are the same as in Example 1. The deposit obtained was very adherent and smooth.

Example 2(a)

Bronze strike can be had on 99% aluminium alloy (2S aluminium alloy), 98·75% alluminium and 1·25% manganese alloy (3S aluminium alloy) and on aluminium alloy containing 4·25% copper, silicon 0·75%, 0·75% manganese, magnesium 0·5% (26S aluminium alloy) from the undermentioned bath. The work pieces were cleaned and etched as given in Example 1 and 30 seconds' time was allowed for immersion tin deposit to take place. Copper tin alloy was used as anode material. An adherent smooth deposit was obtained.

Copper cyanide	8 g/l
Potassium cyanide	26 g/l
Potassium stannate	120 g/l
Potassium hydroxide	7.5 g/l
D. Mannitol or D. Sorbitol	8 g/l
Temperature	45 °C
Current density	3 A/dm²

Example 3

Bronze strike was given on aluminium die castings and on aluminium alloys such as 99% aluminium (2S aluminium alloy), 98·75% aluminium and 1·25% manganese alloy (3S aluminium alloy) and on aluminium alloy contaning 4·25% copper, silicon 0·75%, 0·75% manganese and magnesium 0·5% (26S aluminium alloy) from the undermentioned bath composition. The specimens were cleaned and etched as in Example 1. 30 seconds were allowed for immersion tinning before giving bronze strike. The deposit obtained was smooth, very bright and adherent.

Copper cyanide	13 g/l
Potassium cyanide	15 g/l
Potassium stannate	90 g/l
Potassium hydroxide	6 g/l
Sodium gluconate	3.5 g/l
Temperature	50 °C
Current desnsity	4 A/dm .

Example 4

Bronze strike was given on aluminium die castings and on aluminium alloys such as 99% aluminium (2S aluminium alloy), 98·75% aluminium and 1·25% manganese alloy (3S aluminium alloy) and an aluminium alloy contaning 4·25% copper, silicon, 0·75%, 0·75% manganese and magnesium 0·5% (26S aluminium alloy) from the undermentioned bath composition. The specimens were cleaned and etched as in Example 1. 30 seconds were allowed for immersion tinning before giving bronze strike. The deposit obtained was smooth very bright and adherent.

Copper cyanide	12 g/l
Potassium cyanide	23 g/l
Potassium stannate	100 g/l
Potassium hydroxide	5 g/l
Glycolic acid	10 g/l
Temperature	48 °C
Current density	3.5 A/dm²

The following are among the main advantages of the invention :

1. In the present invention, it is possible to electrocdeposit adherent, bright tin-copper alloy on aluminium and its alloys directly by having a single bath for obtaining immersion tin and bronze strike.

2. Bronze strike followed by copper plating on aluminium is useful as bimetallic printing plate in printing industry. Copper plated aluminium wires and strips can be prepared by following the process described in this invention.

3. This process is successful to all aluminium alloys containing even lesser percentage of copper and also super purity aluminium.

WE CLAIM :

1. A method of plating on aluminium and its alloys by electro-deposition of "Bronze strike" which consists in using a bath comprising potassium stannate, potassium cyanide, potassium hydroxide with a chelating agent such as sorbitol, mannitol sodium gluconate or glycolic acid employing a current density of 1·5 A/dm^2 to 10 A/dm^2 at 40-50 °C.

2. A method as claimed in claim 1 wherein the bronze strike bath used for plating comprises potassium stannate 70-120 gpl, potassium hydroxide 4.160 gpl, potassium cyanide 15.34 gpl, copper cyanide 5-16 gpl and with a chelating agent such as sorbital or mannitol or scdium gluconate or glycolic acid 3-12 g/1.

3. A method of plating on aluminium and its alloys as claimed in claim 1 wherein the preferred ranges of ingredients of the bronze strike bath consists of :

Potassium stannate . . .	100-120 g/l
Potassium hydroxide . .	5-8 g/l
Potassium cyanide . . .	20-25 g/l
Copper cyanide . . .	8-12 g/l
Sorbitol or mannitol or Sodium gluconate or Glycolic acid :	5-7.5 g/l

Dated this 23rd day of March, 1973.

(Sd.)

ASST. PATENTS OFFICER,

Council of Scientific & Industrial Research.

GIPN—S7—64(1) CP&D Cal./74—5-4-76—150.