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Improvements in or relating to electrolytic bath composition for electropolishing of Aluminium and its alloys.

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH RAJ 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 and THIRUMANAMCHERI SESHADRI KRISHNAN, Senior Laboratory Assistant, both are Indian Nationals employed in Central Electrochemical Research Institute, Karaikudi-3, India.

This invention relates to improvements in or relating to electropolishing of aluminium and its alloys.

Hitherto it has been proposed to adopt the following electrolyte/processes for electropolishing of aluminium and its alloys:

- (1) Brytal electropolishing process
- (2) Alzak Process
- (3) Phosphoric acid baths
- (4) Perchloric acid baths
- (5) Sulphuric-chromic acid baths.

This is open to the objection that in the Brytal electropolishing process, alkaline solution is used. It gives good results only with super purity aluminium. It produces a thick smudge over the polished surface which must be removed prior to anodising process. The pH of the brightening bath is important to produce reproducible results and the dissolution of aluminium is also high. Therefore, the maintenance and control of the bath is difficult.

In the Alzak process, corrosive acid like hydrofluoric acid and fluoboric acid are employed. This bath is suitable only for the treatment of aluminium of high purity. Generally polishing of aluminium will be followed by anodising in sulphuric oxalic acid etc. where the carry over electrolyte from this process may spoil the anodising electrolyte in due course.

Even though a series of aluminium and its alloys can be successfully processed in phosphoric acid bath it requires at least 50 to 80% of the acid which is very costly and not readily available in the country.

In Perchloric acid process, the acid is very dangerous for operation due to its explosive nature and it is not available indigenously.

Simple mixtures of chromic and sulphuric acid cannot be used for polishing. The addition agents which are essential for obtaining polishing are covered by patent.

The object of this invention is to obviate these disadvantages by employing sulphuric-chromic acid as electropolishing electrolyte containing either gum arabic or fish glue as an addition agent.

To these ends, the invention broadly consists in electropolishing of aluminium and its alloys in a bath containing sulphuric acid, chromic acid and any one of the above-said addition agents.

The electrolytes are kept in lead-lined vessel. To minimise the cathodic reduction of chromic acid, the cathode is kept in a separate porous pot containing concentrated sulphuric acid.

The polished surface is compared with standard silver mirror and the percentage reflectivity of the polished surface is calculated.

Generally, the reflectivity depends upon the composition of the alloy and the operating parameters.

The following typical examples are given to illustrate the invention:

EXAMPLE 1

The super purity aluminium is degreased with trichloroethylene and is then polished anodically in the following electrolyte:

Sulphuric acid	39% w/v
Chromic acid	15% w/v
Fish glue	3% w/v
Water	12% w/v

The polishing is carried out at 70° to 80°C for 10 minutes using a current density of 216 asf. A polished surface with 100% reflectivity is produced.

EXAMPLE 2

A 2S alloy is degreased with trichloroethylene and it is polished anodically in the following electrolyte:

Sulphuric acid	27.5% w/v
Chromic acid	20.0% w/v
Glue	1.0% w/v
Water	29.0% w/v

The polishing was carried out at 70° to 80°C for 15 minutes using a current density of 175 asf. A polished surface with 88% reflectivity is produced.

EXAMPLE 3

The 3S alloy is degreased with trichloroethylene and then polished anodically in the following electrolyte:

Sulphuric acid	39% w/v
Chromic acid	15% w/v
Fish glue	3% w/v
Water	12% w/v

The polishing is carried out at 70° to 80°C for 10 minutes using a current density of 216 asf. A polished surface with 92% reflectivity is produced.

EXAMPLE 4

The super purity aluminium is degreased with trichloroethylene and then polished anodically in the following electrolyte.

Sulphuric acid	39% w/v
Chromic acid	15% w/v
Gum arabic	3% w/v
Water	12% w/v

The polishing was carried out at 70° to 80°C for 10 minutes using a current density of 216 asf. A polished surface with 100% reflectivity is produced.

EXAMPLE 5

A 2S alloy is degreased with trichloroethylene and then polished anodically in the following electrolyte:

Sulphuric acid	39% w/v
Chromic acid	15% w/v
Gum arabic	3% w/v
Water	12% w/v

The polishing is carried out at 70° to 80°C for 10 minutes using a current density of 216 asf. A polished surface with 94% reflectivity is produced.

EXAMPLE 6

A 3S alloy was degreased with trichloroethylene and is then polished anodically in the following electrolyte:

Sulphuric acid	43.5% w/w
Chromic acid	10.0% w/w
Fish glue	1.0% w/w
Water	9.0% w/w

The polishing is carried out at 70° to 80°C for 15 minutes using a current density of 175 asf. A polished surface with 90% reflectivity is produced.

The following are the main advantages of this invention:

1. The electrolytes employed in the present work are cheap when compared with phosphoric and perchloric acid baths. The ingredients of the electrolyte are readily available in our country. Maintenance and control of the bath is very simple.
2. In the continuous anodising plants, this can be very easily incorporated and the carry-over electrolyte would not affect the anodising bath which is mostly sulphuric acid.

Dated this 29th day of June, 1971.

(Sd/.)

PATENTS OFFICER,

Council of Scientific & Industrial Research.

COMPLETE SPECIFICATION

Improvements in or relating to the electropolishing of Aluminium and its alloys

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 1860)

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

This is an invention by BALKUNJE ANANTHA SHENOI, Scientist, and THIRUMANAMCHERI SESHADRI KRISHNAN, Senior Laboratory Assistant, both are Indian Nationalis employed in the Central Electrochemical Research Institute, Karaikudi-623003, India.

This invention relates to the electropolishing of aluminium and its alloys.

Hitherto it has been proposed to adopt the following electrolyte/processes for electropolishing of aluminium and its alloys:

1. Brytal electropolishing process
2. Alzak process
3. Phosphoric acid baths
4. Perchloric acid baths
5. Sulphuric-chromic acid baths.

This is open to the objection that in the Brytal electropolishing process, alkaline solution is used. It gives good results only with super purity aluminium. It produces a thick smudge over the polished surface which must be removed prior to anodising process. The pH of the brightening bath is important to produce reproducible results and the dissolution of aluminium is also high. Therefore, the maintenance and control of the bath is difficult.

In the Alzak process, corrosive acid like hydrofluoric acid and fluoboric acid are employed. This bath is suitable only for the treatment of aluminium of high purity. Generally polishing of aluminium will be followed by anodising in sulphuric, oxalic acid etc. where the carry over electrolyte from this process may spoil the anodising electrolyte in due course.

Even though a series of aluminium and its alloys can be successfully processed in phosphoric acid bath it requires at least 50 to 80% of the acid which is very costly and not readily available in the country.

In Perchloric acid process, the acid is very dangerous for operation due to its explosive nature and it is not available indigenously.

Simple mixtures of chromic and sulphuric acid cannot be used for polishing.

We have found that these disadvantages can be obviated by employing sulphuric-chromic acid as electropolishing electrolyte containing one or more of the following namely glue, gum arabic or fish glue as an addition agent.

To these ends, the invention broadly consists in electro-polishing of aluminium and its alloys in a bath containing sulphuric acid, chromic acid and any one or

more of the above said addition agents, namely, glue, gum arabic or fish glue.

It is noteworthy that the mere admixture of chromic acid and sulphuric acid does not give proper polishing at all. Addition of gum arabic and fish glue forms a complex which gives good polishing. So after adding fish glue and gum arabic the original properties of chromic acid sulphuric acid mixture completely changes.

The electrolytes are kept in lead-lined vessel. To minimise the cathodic reduction of chromic acid, the cathode is kept in a separate porous pot containing concentrated sulphuric acid.

The polished surface is compared with standard silver mirror and the percentage reflectivity of the polished surface is calculated.

Generally, the reflectivity depends upon the composition of the alloy and the operating parameters.

The following typical examples are given to illustrate the invention:

Example 1

The super purity aluminium is degreased with trichlorethylene and is then polished anodically in the following electrolyte:

Sulphuric acid	w/v
Chromic acid	39%
Fish glue	15%
Water	3%
	12%

The polishing is carried out at 70° to 80°C for 10 minutes using a current density of 216 asf. A polished surface with 100% reflectivity is produced.

Example 2

A 2S aluminium alloy is degreased with trichlorethylene and it is polished anodically in the following electrolyte:

Sulphuric acid	w/v
Chromic acid	27.5%
Glue	20.0%
Water	1.0%
	29.0%

The polishing was carried out 70° to 80°C for 15 minutes using a current density of 175 asf. A polished surface with 88% reflectivity is produced.

Example 3

The 3S aluminium alloy is degreased with trichlorethylene and then polished anodically in the following electrolyte :

	w/v
Sulphuric acid	39%
Chromic acid	15%
Fish glue	3%
Water	12%

The polishing is carried out at 70° to 80°C for 10 minutes using a current density of 216 asf. A polished surface with 92% reflectivity is produced.

Example 4

The super purity aluminium is degreased with trichlorethylene and then polished anodically in the following electrolyte :

	w/v
Sulphuric acid	39%
Chromic acid :	15%
Gum arabic	3%
Water	12%

The polishing is carried out at 70° to 80°C for 10 minutes using a current density of 216 asf. A polished surface with 100% reflectivity is produced.

Example 5

A 2S aluminium alloy is degreased with trichlorethylene and then polished anodically in the following electrolyte :

	w/v
Sulphuric acid :	39%
Chromic acid	15%
Gum karabic :	3%
Water	12%

The polishing is carried out at 70° to 80°C for 10 minutes using a current density of 216 asf. A polished surface with 94% reflectivity is produced.

Example 6

A 3S aluminium alloy was degreased with trichlorethylene and is then polished anodically in the following electrolyte :

	w/v
Sulphuric acid	43.5%
Chromic acid	10.0%
Fish glue	1.0%
Water	9.0%

The polishing is carried out at 70° to 80°C for 15 minutes using a current density of 175 asf. A polished surface with 90% reflectivity is produced.

The following are the main advantages of the invention :

1. The electrolytes employed in the present work are cheap when compared with phosphoric and perchloric acid baths. The ingredients of the electrolyte are readily available in our country. Maintenance and control of the bath is very simple.
2. In the continuous anodising plants, this can be very easily incorporated and the carry-over electrolyte would not affect the anodising bath which is mostly sulphuric acid.

WE CLAIM :

1. A process for electropolishing aluminium and its alloys using a bath which comprises sulphuric acid, chromic acid and one or more of the following addition agents namely glue, gum arabic or fish glue employing a current density of 175 to 225 A/sq. ft. at 70—80°C for 10—15 minutes.

2. A process as claimed in claim 1 wherein the sulphuric acid is used in the range 25—45% w/v and chromic acid in the range of 8—20% w/v and the addition agent is present in the range of 0.5—5% w/v of the electrolyte.

Dated this 29th day of March, 1972.

(Sd./-)

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