IMPROVEMENTS IN OR RELATING TO ETCHING AND DECORATIVE ANODIZING OF ALUMINIUM AND ITS ALLOYS.

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, RASHTRIYA SAINIK POONCHIT, 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 the invention and the manner in which it is to be performed.

**Etching Solution**

<table>
<thead>
<tr>
<th>Composition</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium chloride</td>
<td>10 gms</td>
</tr>
<tr>
<td>Water</td>
<td>1 litre</td>
</tr>
<tr>
<td>Hydrochloric acid</td>
<td>10 ml</td>
</tr>
<tr>
<td>Temperature</td>
<td>20-30°C</td>
</tr>
<tr>
<td>Time</td>
<td>5 minutes to 1 hour</td>
</tr>
<tr>
<td>Current density</td>
<td>40 mA/m² to 100 mA/m²</td>
</tr>
<tr>
<td>Cathode</td>
<td>Aluminium or Steel</td>
</tr>
</tbody>
</table>

The following are among the main advantages of the invention:

1. The preplated aluminium gives better green contrast and the spangle effect is obtained at lesser time, say even in less than 5 minutes.
2. Cheap, working at room temperature with low current densities.
3. Etching time after heat treatment is lowered to bring out the same grain contrast.
4. The decorative effect obtained on aluminium after etching is unique and attractive and have different shades. This can be anodised and can be given different colours.
5. Suitable for tableware, camera-finishes, etc.

**REFERENCES**

1. Ornamental surfaces for dyed aluminium, B. P. 955,344, C A 60 No. 13 P 15463

R. Bhaskar Pai,
Patent Officer,
Council of Scientific & Industrial Research.

Dated the 13th day of November 1964.

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**COMPLETE SPECIFICATION**

**IMPROVEMENTS IN OR RELATING TO ETCHING AND DECORATIVE ANODIZING OF ALUMINIUM AND ITS ALLOYS.

COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH, RASHTRIYA SAINIK POONCHIT, 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 the invention and the manner in which it is to be performed.

This specification describes an invention by BALUKUNDE ANANTHA SENGON, Scientist, and MISS KARAKIUDI SANGARA NARAYANA SASTRI INDIRA, Senior Scientific Assistant, both of the Central Electrochemical Research Institute, Karakhudi, India, both Indian citizens.

This invention relates to improvements in or relating to etching and decorative anodising of aluminium and its alloys.

Hereafter it has been proposed to resort to decorative anodising of aluminium and its alloys having a mottled effect by (1) costly engraving, printing and (2) by recrystallisation process. The process (1) is open to the objection that it is (a) costly, (b) laborious and (c) time consuming. We have made improvement over the process (2) by introducing the pre-etching treatment which has not mentioned in the literature so far. In this process, recrystallisation process in aluminium is made easier by introducing this pretreatment.

The specimen of aluminium is cleaned in solutions consisting of chromic acid, phosphoric acid, sodium hydroxide, etc., then heat treating aluminium and etching in sodium chlorate solutions containing hydrochloric acid and the aforesaid specimen at the anode and steel or aluminium as the cathode.

**Example**

The specimen of aluminium or its alloys were cleaned in solutions like HF, HCl, NaOH or desmutting solutions for 30 seconds to 2 minutes, heat treated in a furnace at 500-800°C for 2 minutes to 1 hour. The specimens were then etched in the following solution anodically. The specimens are then anodised and coloured.

**References**

1. Ornamental surfaces for dyed aluminium, B. P. 955,344, C A 60 No. 13 P 15463

R. Bhaskar Pai,
Patent Officer,
Council of Scientific & Industrial Research.

Dated the 13th day of November 1964.
EXAMPLE

The specimen of aluminium or its alloys were cleaned in suitable etchants such as HF, HCl, NaOH or desmutting solution for 20 seconds to 2 minutes, strained and heat treated in a furnace at 300-400°C for 2 minutes to 1 hour. Specimens can be either cooled slowly, i.e., annealed at any time interval at desired temperature or quenched in water, depending upon the mechanical properties and crystallinity as desired. The samples are then etched in the following solution ana-
dically or alternately chemically etched.

Composition: Sodium chloride 10-100 gms
Water 1 litre
Hydrochloric acid 10 ml/l
Operating Temperature 50-50°C
Enamelling Time 5 min-1 hr.
Current density 40 mA/cm²-160mA/cm²
Cathode Aluminium or steel

Superpurity aluminium or its alloys containing magnesium gives the best results with respect to its controlled grain growth and retention of the same reflectivity even after enamelling. Aluminium alloys with purity 99.5 per cent gives the best results with regard to surface finish. 26, 55, 56 aluminium alloys also give satisfactory finishes.

The enamelling conditions are given below:
Concentration of sulphuric acid 12% - 20% V/V
Current density 10 - 20 asf
Temperature 10 - 20°C
Time 5 - 20 minutes
Voltage 10 - 15V

The plates after enamelling are washed with warm water and coloured using organic dye stuff solutions and sealed in boiling water.

The following are among the main advantages of the invention:
1. The preplated aluminium gives better grain contrast, and the spangle effect is obtained at lower time, say even in less than 5 minutes.
2. Cheap, working at room temperature with low current densities.
3. Etching time after heat treatment is lowered to bring out the same grain contrast.

We claim:
1. A process for etching and decorative enamelling of aluminium and its alloys which consists in cleaning the aluminium surface in etchants of acid halides or in solutions of chromic acid, phosphoric acid, sodium hydroxide or sodium carbonate; then heat treating aluminium and etching electrolytically in solutions containing sodium chloride, hydrochloric acid with the above mentioned speciments as the anode and steel or aluminium as the cathode.
2. A process as claimed in Claim 1 wherein the heat treated aluminium pieces are etched chemically in solutions containing nitric acid, hydrochloric acid and hydrofluoric acid in suitable concentrations as to control the depth of preferential etching to any desired extent.
3. A process for the etching and decorative enamelling of aluminium and its alloys, substantially as described in the example.
4. A process for the etching and decorative enamelling of aluminium and its alloys, substantially as hereinafter described.
5. Etched and decoratively enamelled aluminium and its alloys whenever obtained according to a process substantially as hereinafter described.

R. BHASKAR PAI,
Patents Office.
Council of Scientific & Industrial Research.

Dated this 31st day of August 1965.