Effect of microstructure of AlMg0.8Cu and AlMg0.7Si on the optical quality of anodic film

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Abstract

Self-colouring of the anodized layer is often a problem during conventional and decorative anodizing of aluminium alloys. Miscolouring is believed to be controlled by the alloy constituents and microstructure of the aluminium substrate - mainly the alloying elements and their chemical stability in the anodizing bath, grain structure, and secondary phases with size varying from nanometers to micrometers. Very little is known on the influence of these factors on the appearance of the resulting anodic film. The intermetallic particles of impurity elements entrapped in the oxide film in undissolved or partially dissolved state is an important aspect.

In this paper optical quality of anodic film grown on an extruded 6063 (EN AW-AlMg0.7Si) aluminium alloy and on plasma coated pure aluminium Peraluman 853 (EN AW-AlMg0.8Cu) in sulphuric acid was studied by microstructural investigation of both oxide film and the substrate. Mainly the effect of grain size and intermetallic particles was investigated. Optical microscopy, Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray (EDX) are used for investigation. Depth profiling of chemical composition of the anodized layer was carried out using Glow Discharge Optical Emission Spectroscopy (GDOES). Chemical mapping as function of sputtering is carried out using X-ray Photoelectron Spectroscopy (XPS) and colour measurements using CIE Lab. Preliminary results indicate some of the most important parameters that influence miscolouring of the anodized layer are alloying elements, type of intermetallic particles and their size and distribution, and dissolution behaviour of alloying elements in the anodizing electrolyte.

Conclusions

1. Appearance of the anodised layer on the extruded profile was different depending on the profile thickness as found for the sample M00. Microstructural difference between these specimens were found to be minimal, however, points to the fact that a small change in microstructure, intermetallic particles or composition of the alloy could have significant influence.

2. Incorporation of alloying elements and intermetallic particles in the oxide state or as undissolved intermetallic particles might be an important factor determining the appearance of the oxide film due to effect such as light scattering and local changes in refractive index.

3. GDOES results clearly show presence of surface enrichment of elements as well as local changes in composition in the oxide layer, although direct comparison of this result to appearance of oxide film needs more investigation, which is underway.

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