

ASSESSMENT OF NON-POLLUTING ANODISING PROCESSES FOR ALUMINIUM 2024 ALLOYS

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Anodising is a usual process in aeronautical industry for enhancement of anticorrosive properties of aluminium alloys. The most current processes are the chromic acid anodising (CAA) and sulphuric acid anodising (SAA). The former uses etching and anodising baths containing Cr VI, which are toxic and carcinogenic. Moreover, the environmental impact of this chemical is of growing concern and it is expected that the European Union might legislate in order to impose the abolition of such baths in a near future. Although widely used in aircraft industry, SAA is responsible for a decrease in the fatigue life of anodised aluminium, so it is not allowed in some high strength alloys used for structural parts.

The aim of this work is to show progresses reached with an alternative anodising process based in sulphuric/boric baths, under different operating conditions. Traditional processes of chromic acid anodising and sulphuric acid anodising were used as reference.

The corrosion resistance of the anodised materials was determined by electrochemical impedance spectroscopy and outdoor exposure. The present results show that a good protection is achieved with the sulphuric/boric process.

The structure of the oxide films formed on AA2024 with the different anodising processes and its dependence on the anodising and sealing parameters were investigated by scanning electron microscopy and transmission electron microscopy and compared in order to interpret their corrosion performance. The films formed on commercial aluminium using the same anodising conditions were also investigated, as a way for assessing the influence of the alloying elements.

Photoelectrochemical spectroscopy and capacitance measurements were used to assess the electronic properties of anodic oxide films formed by the different processes, in order to obtain information on the electronic structure of these films. It was found out that capacitance measurements may give valuable information on the characteristics of an anodic film, as different patterns are observed for anodised samples prepared under different conditions.