Micro-arc oxidation behavior of aerospace aluminium alloys and the enhanced corrosion resistance achieved by ultrasonic assistance

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Abstract

New generation Al-Cu-Li alloy has been increasingly used in aircraft structures due to its high specific strength, which could efficiently reduce the structure weight and thus improve fuel efficiency. However, its high corrosion susceptibility may endanger the safe operation of aircraft, which thus limits its wider application.

PEO of aluminium has been extensively studied with the related industrial process available. Unfortunately. Little attention has been paid to the influence of the aluminium substrate on the micro-arc oxidation (MAO) behaviour, which may dramatically affect the corrosion resistance of the resultant film.

In the present work, the influences of coarse intermetallics, dispersoids and precipitates on the MAO behaviour of 2A97 alloy, a representative Al-Cu-Li alloy, have been systematically studied. It was revealed that coarse intermetallics may cause micron-sized voids that compromise the defectiveness of the MAO ceramic film whereas the precipitate mainly affects the MAO behaviour by affecting the Cu content of the substrate. Following the illustration of the MAO behaviour, an ultrasound assistant MAO process was proposed, which successfully achieves a ceramic film with enhanced compactness and thus promotes the corrosion resistance of the substrate.

Keywords

Al-Cu-Li alloy; Micro-arc oxidation; Second phase; Ultrasonic assistance; Corrosion resistance