Effect of Electrical Parameters on Plasma Electrolytic Oxidation Coatings of 6061 Al Alloy

Plasma electrolytic Oxidation (PEO) is a novel technique to create ceramic coatings on light weight metals particularly aluminum and magnesium alloys. PEO is a simple, high efficiency and eco-friendly technology. The wear and corrosion resistance of components manufactured from Al-based alloys can be drastically increased by the application of ceramic coatings produced by PEO. The PEO process operates at potentials greater than typical breakdown voltages of the original oxide films (typically \(0.6-4.0\) V). Breakdown of the film is accompanied by multiple sparking on treated surfaces. Currently, PEO processes are in a transition phase from research to commercial applications, mainly focused on the corrosion and wear protection of light alloys. The properties of the coatings produced by PEO can be controlled and altered by changing process parameters. Although a lot of researchers have studied the PEO process, there is not much information available about the role of electrical parameters such as frequency and duty cycle. In this study, the effects of frequency and duty cycle on morphology, phase contents and growth rate of PEO coatings on Al\(_{60.41}\) alloy produced by pulsed uni-polar DC current was investigated using X-ray diffraction (XRD), scanning electron microscopy (SEM) and energy-dispersive spectroscopy (EDX). Coatings were found to consist primarily of two phases: \(\alpha\)-Al\(_{2}\)O\(_3\) and \(\gamma\)-Al\(_{2}\)O\(_3\) with varying ratios. It was observed that changing the electrical parameters affects microstructure, ratio of phases and surface morphology of produced coatings.

Keywords: Plasma electrolytic oxidation, alumina coating, duty cycle, frequency

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