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## FABRICATION AND CHARACTERISATION OF REGULAR AND COMPLEX CERAMICS SHAPES BY PEO PROCESS

Husein Meshreghi<sup>1</sup>, Mikhail Gorbatkov<sup>2</sup>, Allan Matthews<sup>3</sup>, Aleksey Yerokhin<sup>4</sup>

<sup>1</sup>The University of Sheffield, Sheffield, United Kingdom <sup>2</sup>Ufa State Aviation Technical University, Ufa, Russian Federation <sup>3</sup>University of Manchester, Manchester, United Kingdom <sup>4</sup>University of Sheffield, Sheffield, United Kingdom

hdmeshreghi1@sheffield.ac.uk

Alumina thick and thin films are widely used as dielectric substrates in semiconductors, electronics, and functional device applications. The films can be produced by conventional methods such as roll compaction and tape casting from ceramic slurry. However, these methods offer limited part geometries and cause defects in the film structure. In contrast, plasma electrolytic oxidation (PEO) allows production of ceramic surface layers on valve metals with various shapes. This technique was applied to convert 50- $\mu\text{m}$  thick pre-formed Al substrates into freestanding ceramic alumina shapes under the pulsed bipolar potentiostatic current mode in alkaline electrolytes. Composition of plasma discharge and evolution of its main components during the PEO process were investigated by optical emission spectroscopy. The plasma electron temperature was calculated using two independent peaks of aluminium in the near ultraviolet band. COMSOL Multiphysics software was used to model the distribution of electric field in the electrolyser and investigate a possibility of achieving a uniform coating thickness on complex shape. The coating thickness, morphology, phase composition and micromechanical properties were analysed using SEM, XRD and nanoindentation techniques. The effect of the electrolyte contents on the current density, surface morphology and phase composition of oxide layers were studied. The results show that depending on treatment parameters, the metal-to-ceramic conversion ratio varies from 10 to 80%. The shape of samples has strongly affected the coating thickness. Phase analysis has revealed presence of crystalline gamma and alpha alumina phases in the ceramic surface layer. Correlations have been studied between characteristics of plasma discharge, such as plasma electron temperature, and phase transitions in the surface layer to develop in situ diagnostic methods for the PEO processes.

### Keywords

Plasma electrolytic oxidation  
Thin walled ceramics  
Optical emission spectroscopy  
Electric field modelling