High Frequency Anodising of Aluminium-TiO₂ Surface Composites: Anodising Behaviour and Optical Appearance

High frequency anodising of Al–TiO₂ surface composites using pulse reverse pulse technique was investigated with an aim to understand the effect of the anodising parameters on the optical appearance, microstructure, hardness and growth rate of the anodic layer. Friction stir processing was employed to prepare the Al–TiO₂ surface composites, which were anodised in a 20 wt.% sulphuric acid bath at 10 °C as a function of pulse frequency, pulse duty cycle, and anodic cycle voltage amplitudes. The optical appearance of the films was characterized and quantified using an integrating sphere-spectrometer setup, which measures the total and diffuse reflectance from the surface. The change in optical reflectance spectra from the anodised layer was correlated to the applied anodising parameters and microstructure of the anodic layer as well as the Al–TiO₂ substrate. Change in hardness of the anodised layer was also measured as a function of various anodising parameters. Anodic film growth, hardness, and total reflectance of the surface were found to be highly dependent on the anodising frequency and the anodic cycle potential. Longer exposure times to the anodising electrolyte at lower growth rates resulted in lowering of the reflectance due to TiO₂ particle degradation and low hardness due to increased dissolution of the anodised layer during the process. [All rights reserved Elsevier].

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