# Plasma electrolytic oxidation coatings on AZ31 magnesium alloys with $Si_3N_4$ nanoparticle additives

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## Abstract

The magnesium AZ31 alloys have been used in a wide range of lightweight applications such as aerospace, automotive and personal computers due to its unique properties. However, high chemical reactivity, poor corrosion and wear resistance limit their widespread uses in many fields. The plasma electrolytic oxidation (PEO) process can produce protective oxide layer on the magnesium alloy to improve its mechanical property, wear resistance and corrosion resistance. In this work, the silicon nitride ($Si_3N_4$) nano particles were added into the electrolyte of PEO treatment on AZ31 alloy to improve the mechanical and anticorrosion properties of oxide coating. Surface and cross-sectional structure of the oxide layers was studied by scanning electron microscope (SEM). Energy dispersive spectrophotometry (EDS), X-ray diffraction (XRD) techniques were employed to determine the phase structure and chemical composition of the layers. The adhesion and mechanical properties of coating were analysis by scratch test, pin-on-disk wear test and hardness test, respectively. Potentiodynamic polarization tests were employed to investigate the electrochemical corrosion behavior of PEO treated AZ31 alloy. Effects of $Si_3N_4$ addition concentration on the microstructure, mechanical and anticorrosion properties were further discussed in this work.

Keywords: Plasma electrolytic oxidation, $Si_3N_4$, AZ31 alloy, adhesion, pin-on-disk wear, corrosion resistance