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Microstructural and electrochemical comparison between TiN coatings deposited through HIPIMS and DCMS Techniques

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Abstract

Recently, high power impulse magnetron sputtering (HIPIMS) technique has been widely applied to deposit hard coatings such as Ti-based coatings on industrial tools due to its strong merits of high coating density, smooth surface, and excellent adhesion. In this work, TiN (Titanium Nitride) nanostructured coatings were deposited by two different methods (HIPIMS and DCMS techniques) with constant processing parameters and their electrochemical behaviors were investigated in a 3.5% NaCl solution. X-ray diffraction (XRD), field emission scanning microscopy (FE-SEM), and atomic force microscopy (AFM) were used to characterize and evaluate the coatings composition, surface morphology, and surface roughness, respectively. It is found that the preferred orientation depends on the applied deposition technique. Potentiodynamic polarization measurements and electrochemical impedance spectroscopy (EIS) were used to compare the electrochemical responses of these nanostructured coatings in 3.5% NaCl solution. The results indicate that HIPIMS-TiN coating is of well-defined denser nanocrystalline structure, which not only is smoother but also has a superior passivation and better protects the substrate against the ingress of aggressive anions.

Keyword: HIPIMS; DCMS; TiN nanostructured coating; Electrochemical behavior.

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