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Electrochemical Properties of Multilayered WC-Ti1-xAlxN Coatings on AISI D2 Steel

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WC-Ti1-xAlxN multilayered coatings are performed by their periodically repeated structure of lamellae of WC-Ti/WC-Ti1-xAlxN materials. WC-Ti1-xAlxN coatings with variable Al content were deposited onto AISI D2 steel by cathodic arc deposition method. The electrochemical behavior of multilayered WC-Ti1-xAlxN coatings with different phase (WC-Ti0.6Al0.4N, WC-Ti0.53Al0.47N, WC-Ti0.5Al0.5N and WC-Ti0.43Al0.57N) was investigated in deaerated 3.5% NaCl solution at room temperature.

The corrosion behaviors for the multilayered coatings were investigated by electrochemical techniques (galvanic corrosion tests, potentiodynamic polarization tests and electrochemical impedance spectroscopy (EIS)) and surface analyses. The multilayer microstructure was characterized by X-ray diffraction (XRD), scanning electron microscopy (SEM), and the chemical composition by glow discharge optical emission spectroscopy (GDOES) and Rutherford backscattering spectroscopy (RBS). The results of the galvanic corrosion test indicated small galvanic current densities. In the potentiodynamic polarization test and EIS measurement, the corrosion density of WC-Ti0.5Al0.5N was lower than others and presented higher Rct values than others after 240 h immersion time. The SEM observation of the cross-sectional view and sample surfaces reveal a homogeneous structure and typical corroded surface.

Key words : RBS, GDOES, galvanic current density, EIS, potentiodynamic polarization test, hydrogen evolution, localized corrosion.