

The Effects of Al Addition on the Corrosion Behavior
of Multilayered WC-Cr_{1-x}Al_xN Coatings by PVD Technique.

PVD법에 의한 다층박막 WC-Cr_{1-x}Al_xN의
부식거동에 미치는 Al의 효과

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Multilayered WC-Cr_{1-x}Al_xN coatings were deposited on AISI D2 steel by PVD technique. The Al concentration could be controlled by using evaporation source for Al and fixing the evaporation rate of the other metals (WC alloy and Cr). Five kinds of WC-Cr_{1-x}Al_xN were deposited : WC-Cr_{0.6}Al_{0.4}N, WC-Cr_{0.57}Al_{0.43}N, WC-Cr_{0.53}Al_{0.47}N, WC-Cr_{0.48}Al_{0.52}N, and WC-Cr_{0.45}Al_{0.55}N. The corrosion behavior in deaerated 3.5 wt.% NaCl solution for the prepared samples was investigated by electrochemical tests (potentiodynamic polarization test, galvanic corrosion test, electrochemical impedance spectroscopy (EIS) and Mott-Schottky method) and surface analyses (scanning electron microscopy (SEM), X-ray diffractometry (XRD), glow discharge optical emission spectroscopy (GDOES), scratch adhesion test (SAT), and electron probe micro analyzer (EPMA)).

The results of potentiodynamic polarization test showed that the WC-Cr_{0.48}Al_{0.52}N coating with a lower porosity enhanced the corrosion resistance. Galvanic corrosion test was accomplished using the galvanic couple between the substrate and the coating. The WC-Cr_{0.6}Al_{0.4}N showed a higher galvanic current density. In EIS measurements, the corrosion current density of WC-Cr_{0.48}Al_{0.52}N coating presented higher charge transfer resistance (R_{ct}) values than others after 96 hr immersion time. The measured electrochemical tests indicated that the WC-Cr_{0.48}Al_{0.52}N coating with a lower corrosion current density (i_{corr}) and higher charge transfer resistance (R_{ct}) enhanced corrosion resistance.

Key words : Multilayerd coating, PVD, Galvanic corrosion test, EIS, Porosity, Scratch adhesion test