THE PROPERTIES OF AlCrBN COATINGS DEPOSITED USING CATHODIC ARC EVAPORATION

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AlCrN are one of the most widely studied hard coatings, especially if it is about their thermal resistance and mechanical properties. An improvement of mechanical properties of the coatings can be achieved by doping with a metallic or non-metallic element. The paper presents the results of deposition and testing the AlCrBN coating, especially the effect of nitrogen pressure during coating deposition. The coatings were synthesized by means of cathodic arc evaporation equipped with AlCrB targets with chemical composition (50:30:20).The coatings were deposited in nitrogen pressure p_{N2} ranged from 2 Pa to 5 Pa.
The morphology, phase and chemical composition of the coatings were studied by scanning electron microscopy, X-ray diffraction and energy dispersive spectroscopy, respectively. The mechanical and tribological properties were evaluated by nanoindenation and ball-on-disc test, respectively. Adhesion of the coatings was investigated using scratch test and additionally Daimler-Benz test. The corrosion properties of coating – steel substrate systems were investigated using potentiodynamic polarisation tests in 3.5 wt % NaCl solution. Corrosion potential, corrosion current density and polarization resistance were determined.
In AlCrBN coatings deposited at nitrogen pressure of 2 Pa the diffraction lines characteristic for the hexagonal AlN phase were observed. The increase in nitrogen pressure results in a decrease in the intensity of the observed AlN lines. In coatings formed under nitrogen pressure of 5 Pa there are diffraction lines from the cubic CrN phase. The hardness of the coatings is about 22-23 GPa and is independent of nitrogen pressure during coating deposition. The hardness of the coatings depends on the substrate bias voltage U_B and increases from 18.7GPa (U_B = -50 V) to23.1 GPa (U_B = -150 V). Similar effect is observed for arc current, 20.4 GPa (Ic = 80 A) and 24.0 GPa (Ic = 120). Critical load for coatings is relatively high, the lowest is about 67 N (p_{N2} = 2 Pa) and the highest - about 100N (p_{N2} = 2 Pa). The wear rate decreases with nitrogen pressure from 3.5×10^{-6} mm^3/Nm (p_{N2} = 2 Pa) to 3.9×10^{-7} mm^3/Nm (p_{N2} = 4 Pa).
The AlCrBN coating significantly increases the corrosion resistance of the HS6-5-2 steel substrate in the environment of 3.5 wt% aqueous NaCl solution. The corrosion potential of the coating is about 0.400 V higher in relation to the substrate. This is accompanied by a decrease in the corrosion current density by about two orders of magnitude and an increase in polarization resistance by about two orders of magnitude, which indicates a decrease in the speed of corrosion processes compared to an uncoated steel substrate.

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