MULTILAYER CHROMIUM NITRIDE/CARBON COATINGS DEPOSITED BY MAGNETRON SPUTTERING

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Multilayer chromium nitride/carbon coatings (~0.9 μm) were deposited by magnetron sputtering in Ar atmosphere at 0.2 Pa. This study focuses on the effect of the layer thickness (50, 100, 150 and 225 nm) on structural and mechanical properties of the multilayer coatings.

The crystal structure of the deposited coatings was investigated by X-ray diffraction and Raman spectroscopy. A cubic structure of CrN and an amorphous carbon phase could be identified within the coatings. The increase in layer thickness results in an increase in grain size of CrN from 11 to 53 nm as well as in the occurrence of strains inside the CrN phase. The ratio of I_D to I_G measured by Raman spectroscopy slightly changed from 1.045 to 1.103.

The film morphology is significantly improved (R_a from 12.8 to 23.5 nm) for the thin coatings.

Hardness and elastic modulus of the CrN/C coatings were measured by nanoindentation at a penetration depth up to 0.3 μm. Highest hardness and lowest elastic modulus were measured for the CrN/C coating with a layer thickness of 225 nm.

The coating adhesion to stainless steel substrate was determined by a scratch-test. The resistance to coating chipping of the CrN/C films could be improved from 10.7 to 41.9 N with the decrease in layer thickness.