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PROPERTIES OF Cr(C,N) HARD COATINGS DEPOSITED IN Ar-C_2H_2-N_2 PLASMA

Marijan Maček[1,2], Miha Čekada[1], , Darja Kek[1], Peter Panjan[1]

1) "Jožef Stefan"" Institute, Jamova 39, 1000 Ljubljana, Slovenia

2) University of Ljubljana, Faculty of Electrical Engineering, Tržaška 25, 1000 Ljubljana, Slovenia

Mechanical properties, microstructure and the average chemical composition of Cr(C,N) hard coatings deposited in Ar-C_2H_2-N_2 plasma strongly depends on the partial pressure of the reactive gases (N_2, C_2H_2) and on the type of the deposition equipment. In this study we report on the properties of Cr(C,N) hard coatings deposited by means of the triode ion plating in the BAI 730 apparatus and those prepared by sputter deposition in Balzers Sputron in the pressure range from 0.12 Pa (pure Ar) up to 0.35 Pa with different ratios (0-100%) between C_2H_2 and N_2.

At first mechanical properties (microhardness and adhesion) of coatings were analyzed on the common way. Internal stress was measured by the radius of substrate curvature. Chemical composition of coatings was analyzed by means of AES while the Raman and XPS spectroscopy was used to determined the nature of carbon bonding in the Cr(C,N) films. Microstructure was determined by XRD as well as by means of TEM and TED.

Results have shown that layers from pure Cr to pure CrC and CrN, as well as ternary alloy of different Cr(C,N) have been successfully prepared in both deposition system. Typical layers deposited at partial pressures above 0.05 Pa constitute of about 50% of Cr and the balance was C and N in different concentrations according to the gas mixture used . XRD have revealed two phases of chromium nitride, namely Cr_2N and CrN, as well as different carbide and carbo-nitride phases, Cr_7C_3, Cr(C,N), Cr_2(C,N). Contrary to the XRD, TED shows in some samples also the existence of the metastable cubic CrC phase.

Chemical state of various elements in the coating has been studied by XPS. The ratio of the carbide bond (C-Cr) against the C-C and C-H bonds was calculated. The existence of the graphite phase in some Cr(C,N) coatings was confirmed by Raman spectroscopy.