Nanocomposite a-C:Cr coatings deposited by shielded cathodic vacuum arc

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Chromium incorporated amorphous carbon (a-C:Cr) coatings were deposited onto silicon substrates by cathodic vacuum arc deposition using a Cr target in an Ar/C_2H_2 gas mixture atmosphere. A linear magnetic shield was employed to reduce the macroparticles density in the films. Various negative bias voltages ranging from 50 to 450 V were applied to the substrates. X-ray diffraction (XRD) analysis shows that amorphous structures are formed in all cases. X-ray photoelectron spectroscopy (XPS) analysis was used to quantify the sp^3/sp^2 ratio bonding in the films. Raman spectroscopy was used to study the presence of different forms of free amorphous carbon. The Raman spectra were decomposed into four single Gaussians and the results are discussed in terms of the ratio of the areas of the two D bands to the areas of the two G bands, I(D)/I(G), and the position and width of the peaks. The results showed that the sp^3 fraction is inversely proportional to the negative bias voltage and to the I(D)/I(G) ratio. The higher the sp^3 fraction, the lower the positions of the Raman peaks.