Characteristics and Tribological Performance of DLC and Si-DLC Films Deposited on Nitrile Rubber

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Abstract

The characteristics and tribological performance of DLC and Si-DLC films with and without Si-C interlayers were studied in this paper. The films were deposited on nitrile rubber using a closed field unbalanced magnetron sputtering ion plating system. The film properties and characteristics were determined by scanning electron microscopy (SEM), hydrophobicity studies, Raman spectroscopy and tribological investigations. Tribological performance of these films was investigated using a pin-on-disk tribometer under applied loads of 1 N and 5 N under conditions of dry and wet sliding. The effect of immersing the films in water on tribological performance was also examined. The results show that the morphology of the films had a crack-like network. At substrate bias of -30 V, the coatings were characterized by a very dense non-columnar microstructure. The highest value of the ratio of intensities of the D and G peaks (I_D/I_G) was 1.2 for Si-DLC film with Si-C interlayer. The lowest value of 0.7 was observed for DLC film. The Contact Angle (CA) of water droplets showed that the films were hydrophobic. These results are interpreted in terms of hybridization of carbon in these coatings. The tribological investigation showed a dependence on both the tribological condition under investigation and the atomic percentage of Si in the films. At 5 N normal load the lowest wear depth was observed for DLC films.

Keywords: *Coefficient of friction; Contact angle; Diamond-like carbon; Si-DLC film; Raman spectroscopy; Tribology*