Role of Si-C Interlayer on the Properties of DLC and Si-DLC Films Deposited on Nitrile Rubber

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Proceedings of the 15th International Conference on Advances in Materials and Processing Technologies (AMPT), September 23rd – 25th, 2012, Wollongong Australia.

Abstract

Diamond-like Carbon (DLC) and Silicon doped diamond-like carbon (Si-DLC) films were deposited on nitrile rubber substrates by closed field unbalanced magnetron sputtering ion plating system. Comparison was made for DLC and Si-DLC films deposited with and without Si-C interlayers. The film properties were determined by scanning electron microscopy (SEM), Raman spectroscopy, hydrophobicity studies, micro-hardness tests and adhesion investigations. Tribological performance under dry and wet sliding was also investigated. The fracture cross-section of the films showed a very dense, non-columnar microstructure at bias voltage of -30 V. Values of the ratio of the intensities of the D and G peaks (I_D/I_G) generally tended to increase in both the DLC and Si-DLC film compared to when the Si-C interlayer was included in the films. The increase in the sp^2 content was a result of the Si-C interlayer which also determined the hydrophobicity of these films. The hybridization of carbon in terms of sp^2 and sp^3 bonding was used to interpret these results. The tribological investigation showed dependence on the tribological condition under investigation and the atomic percentage of Si in the film.

Keywords: *Adhesion; Magnetron sputtering; Micro-hardness; Raman spectroscopy; Si-C interlayer; Tribology*