Adhesion and Composite Micro-hardness of DLC and Si-DLC films Deposited on Nitrile Rubber

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Abstract

Thin films of hydrogenated diamond-like carbon (DLC) and silicon (Si) doped diamond-like carbon (Si-DLC) have been deposited on acrylonitrile butadiene rubber (NBR) using a closed field unbalanced magnetron sputtering ion plating system. A sputter cleaning process was integrated into the deposition process so as to reduce the likelihood of re-contamination between the cleaning and deposition stages. The deposited coatings showed excellent adherence with an adhesion rating of 4 A for films with a Si-C interlayer. The composite micro-hardness was highest for DLC films at 15.5 GPa for indentation load of 147.1 mN using a Vickers microhardness tester. Tribological tests undertaken under normal load of 5 N using a pin-on-disc tribometer for all of the samples of DLC and Si-DLC films, with and without Si-C interlayer, show a friction increase between 0.25 and 0.4 to between 0.45 and 0.6. This friction increase has been related to the micro-hardness of the films

Keywords: *Adhesion; Closed field unbalanced magnetron sputtering ion plating; DLC; Micro-hardness; Si-DLC; Tribology*