Dissertation Title	Influence of Thermal Stress on Diamond-like Carbon (DLC) Film Properties as Related to HDD Slider Applications
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Abstract

Tetrahedral amorphous diamond-like carbon (ta-DLC) films were deposited on alumina titanium carbide (AlTiC), nickel iron (NiFe), and silicon (Si) substrates using filtered cathodic arc (FCA). Prior to the ta-DLC coating on the substrate surface, 1 nm thickness of Si-Si_3N_4 compound was sputtered on the substrate surface as an adhesion layer. The ta-DLC films were then deposited on the top of Si-Si_3N_4 layer using FCA with a thickness of 1.5 nm. All the ta-DLC films were then annealed in an oven at 100, 200 and 300 ºC for 30 and 60 min, respectively. The structure of the ta-DLC films deposited on AlTiC was investigated using Raman spectroscopy and then the optical property of ta-DLC films was verified using spectroscopic ellipsometer. The bonding structures of ta-DLC films and adhesion layers on NiFe substrate were investigated by X-ray photoelectron spectroscopy (XPS). In addition, the wear resistance of ta-DLC films was measured by nanoindenter and the corrosion resistance of ta-DLC films was investigated by hydrofluoric acid (HF) dipping test. Lastly, the ta-DLC film density deposited on Si substrate was investigated by X-ray reflectivity (XRR).

The results showed that the gross changes were observed in the D and G peaks. The detailed investigation of Raman spectra revealed that sp^2 clustering increased with increasing annealing temperature. However, there was no sp^3 to sp^2 conversion after annealing up to 300 ºC. The n and k values showed that ta-DLC films were more opaque after annealing at 300 °C for 60 min. The bonding structures of ta-DLC as investigated by XPS suggested that the oxidation occurred in both ta-DLC film and adhesion layer after annealing at 300 ºC. The sp^2 bond area fraction slightly decreased and sp^3 bond area fraction remained same as that initial deposited after heating up to 300 ºC. The wear test result showed that ta-DLC films degraded after annealing at 300 °C for 60 min. The corrosion test result showed that the amount of pitting corrosion feature increased with increasing annealing temperature and time. The ta-DLC films density was remained in the range of ta-DLC after annealing temperature up to 300 ºC.

Keywords: Diamond-like Carbon/ Filtered Cathodic Arc/ Raman Spectroscopy/ X-ray Photoelectron Spectroscopy