

MASTER'S THESIS

Fluorinated diamond-like carbon films deposited by ion beam CVD

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Fluorinated Diamond-like Carbon Films

Deposited by Ion Beam CVD

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Abstract

Fluorinated diamond-like amorphous carbon films deposited using $\text{CF}_4\text{-CH}_4$ source gases and ion beam chemical vapor deposition were studied as a function of the flow rates of CF_4 and CH_4 , and ion extracting voltage. The films were characterized by X-ray photoelectron spectroscopy and X-ray excited Auger electron spectroscopy. By analyzing the XPS spectra of the films, it was found that fluorine atoms were incorporated into the film and its concentration varied from 0 to 47%. Oxygen was also found in the film. The C1s , O1s and F1s peaks in the XPS spectra showed complicated structures, which changed with the fluorine concentration. With detailed analysis of the three peaks for all the samples, the complex situation could be sorted out consistently. It was also found that when the fluorine concentration is low, the film mainly contained carbon atoms in sp^2 and sp^3 hybridization and the CF group. When the fluorine concentration was above 4.8 %, CF_2 group started to appear and its concentration increased with the concentration of fluorine. When the fluorine concentration was further increased to above 39%, the CF_3 was observed in the film. The Auger C KVV spectra of the films were also found to vary with the fluorine concentration, as well as oxygen concentration. Besides, using the relative intensity of carbon atoms in sp^2 and sp^3 hybridizations, the percentage of sp^3 were determined and found to be dependent on the fluorine concentration and ion extracting voltage. The percentage of sp^3 was found to increase with the fluorine concentration. This sp^3 was also found to depend on the ion extracting voltage and a maximum was obtained at about 150V. Similar results were also obtained from XAES measurement. Finally the valance band density of states was calculated from the Auger spectrum for fluorinated a-C:H film, which agreed qualitatively with the XPS valance band spectrum.

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