

MASTER'S THESIS

A study on the electronic structure of a-C:H deposited using Saddle-field glow-discharge CVD

Leung, Tsan Yan Amy

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A Study on the Electronic Structure of a-C:H
Deposited using Saddle-field Glow-discharge CVD

LEUNG Tsan Yan, Amy

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Abstract

Diamond-like amorphous carbon films prepared using Saddle-field glow-discharge CVD were characterized by X-ray photoelectron spectroscopy, Auger electron spectroscopy and optical absorption techniques. DLC films produced under different substrate bias voltages and doped with different boron and phosphorus concentrations were studied. By detailed analysis of the C1s peak of the XPS spectra for samples produced using saddle-field glow-discharge decomposition of methane, the sp^3/sp^2 ratio of the films were determined and found to be dependent on deposition parameters such as substrate bias voltage and impurity doping. These results agree very well with those obtained by Auger electron spectroscopy. Apart from that, a relationship between the Auger KVV spectrum and valence band density of states was derived and applied to the calculation of the electronic structures of the valence band of DLC films. The band gap and band tail states of the films were also measured by photothermal deflection spectroscopy and optical transmission measurement. Results showed that the electronic and optical properties of DLC films were strongly dependent on the deposition conditions and the reasons for these variations were discussed.

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