

## The Effects of Applied Negative Bias Voltage on Structure and Optical Properties of a-C:H Films

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**Abstract :** Hydrogenated amorphous carbon (a-C:H) films have been synthesized by a radio frequency plasma enhanced chemical vapor deposition (rf-PECVD) technique with different bias voltage from 0.0 to -0.5 kV. The Raman spectra displayed the polymer-like hydrogenated amorphous carbon (PLCH) film with 0.0 to -0.1 and a-C:H films with -0.2 to -0.5 kV of bias voltages. The surface chemical information of all films were studied by X-ray photo electron spectroscopy (XPS) technique, presented to C-C (sp<sup>2</sup> and sp<sup>3</sup>) and C-O bonds, and relative carbon (C) and oxygen (O) atomics contents. The O contamination had affected on structure and optical properties. The true density of PLCH and a-C:H films were characterized by X-ray refractivity (XRR) method, showed the result as in the range of 1.16-1.73 g/cm<sup>3</sup> that depending on an increasing of bias voltage. The hardness was proportional to the true density of films. In addition, the optical properties i.e. refractive index (n) and extinction coefficient (k) of these films were determined by a spectroscopic ellipsometry (SE) method that give formation to in 1.62-2.10 (n) and 0.04-0.15 (k) respectively. These results indicated that the optical properties confirmed the Raman results as presenting the structure changed with applied bias voltage increased.

**Keywords :** negative bias voltage, a-C:H film, oxygen contamination, optical properties

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