11th International Conference on Advanced Materials
Rio de Janeiro Brazil
September 20 - 25
ICAM2009

# Electrical and Optical properties of Diamond-Like Carbon (DLC) films deposited by reactive magnetron sputtering

V. Rizzo[(1)*], R. D. Mansano[(1)],

(1) Laboratório de Sistemas Integráveis da Escola Politécnica, Universidade de São Paulo, e-mail: vzrizzo@gmail.com
* Corresponding author.

**Abstract** – The goal of this work was study the optical and electric properties of Diamond-like Carbon (DLC) films. The films were deposited by reactive magnetron sputtering using a pure graphite target and methane as processing gas. The DLC films properties are consequences from the relation between $sp^3$, $sp^2$ and $sp^1$ hybridizations, which is consequence from the deposition technique and conditions. The optical and electric properties of DLC films are crucial for the development of electro-optical devices as photo detectors. The characteristics of these films were compared by refractive index, dielectric constant, optical reflectance, FTIR (Fourier Transform Infrared) analyzes and electro-optic analyzes. After this research, DLC film with the best properties will be chosen for the development of a high sensibility photo detector.

Production of DLC has started at the end of the 60th decade and then has been produced by different deposition techniques for different applications [1], as electronic and optical [2]. The DLC films properties are consequences from the relation between sp3, sp2 and sp1 hybridizations, which is consequence from the deposition technique and conditions. The optical and electric properties of DLC films are crucial for the development of electro-optical devices as photo detector and photonic devices.

The main goal of this work is to study the deposition process influence on the optical and electrical properties of DLC films deposited by RF reactive magnetron sputtering. After cleaning Si wafers for contaminants, the DLC films were deposited in a 100% methane atmosphere in a RF Magnetron Sputtering system using graphite 99.9999% pure target. The samples were deposited in two working pressures (5 mTorr and 10 m Torr), and in each pressure condition, the RF power was adjusted to 100W, 150W, 200W and 250W, producing eight samples. For electrical measurements, aluminum contacts were deposited on the DLC film side and at the Si side, by thermal evaporation. The dielectric constant was calculated through the maximum capacitance, obtained by high frequency CxV analysis in a HP 4248 system.

In IxV analyses, with a HP 4140A picoamperemeter., some samples showed semiconductor characteristics and photoelectric effect, that occur in some regions because the carriers generation in the electronic gap. This study improves a new generation of photonic devices.

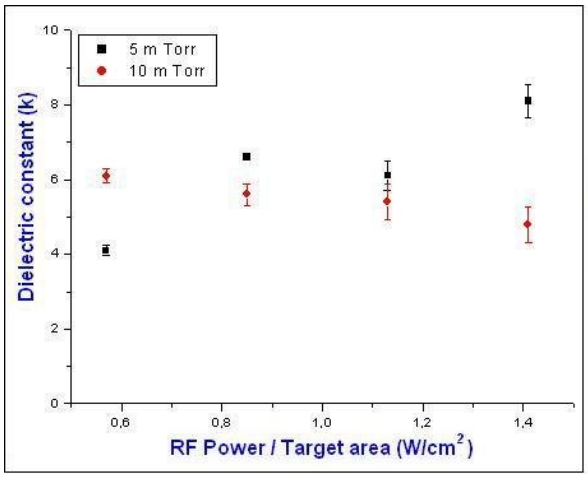


**Figure 1:** Dielectric constant (k) of DLC films deposited by RF reactive magnetron sputtering in different pressure and RF power conditions.

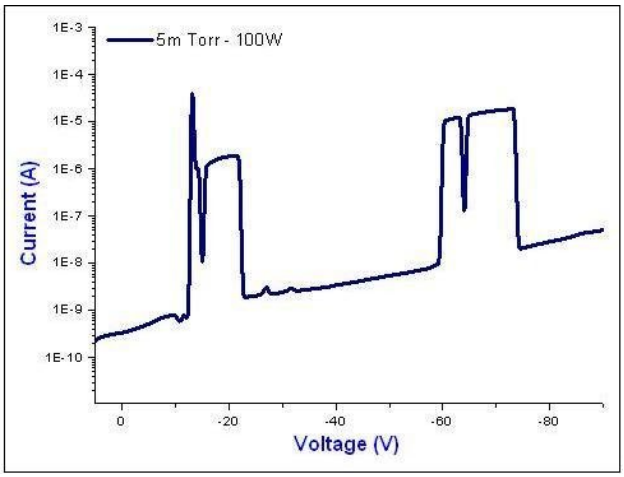


**Figure 2:** IxV analysis of photo current characteristics of a DLC film deposited at 5 m Torr with 100 Watts RF.

## References

[1] TZENG, S. S.; "Mechanical behavior of two dimensional carbon/carbon composites with interfacial carbon layers", Carbon, vol. 37, pp. 2000 – 2020, 1999.
[2] Santos, A. M. dos "Desenvolvimento e aplicação de processos com plasmas de alta densidade para deposição de filmes de carbono" Universidade de São Paulo (2005).