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Modification of hydrophobicity properties of diamond like carbon films using glancing angle deposition method

R. Zarei Moghadam^a, M.H. Ehsani^{*a}, H. Rezagholipour Dizaji^a, P. Kameli^b, M. Jannesari^b

^a Thin Film Lab., Faculty of Physics, Semnan University, P.O. Box: 35195-363, Semnan, Iran

^b Department of Physics, Isfahan University of Technology, Isfahan 84156-83111, Iran

Abstract

We report the effect of glancing angle deposition (GLAD) method on hydrophobicity properties of diamond like carbon (DLC) films. DLC films were manufactured using direct ion beam method by methane (CH₄) precursor gas. DLC films were prepared by GLAD technique at different incident flux angles ($\alpha = 0^\circ$, 45° , 75° , and 85°). We indicated increment in water contact angle from 83.6° to 119.4° with increasing the deposition angle and porosity of films. The top and cross sectional field emission scanning electron microscopy (FESEM) images of films indicated noticeable changes in structure and morphology of the prepared specimens as functions of incident angles.

Keywords: Physical vapor deposition, Carbon materials, Surfaces

*Corresponding author.

1- E-mail: ehsani@semnan.ac.ir (Mohamamd Hossein Ehsani)

1. Introduction

DLC films have been the subject of intensive studies for more than 40 years [1]. DLC films present a metastable form of carbon in an amorphous structure with a mixture of sp² and sp³ hybridized bonds [2]. Such films show high hardness (> 60 GPa) and large Young modulus, chemical inertness, low friction coefficient (< 0.1), high wear resistance, smoothness, good optical transparency, good adhesion, lack of magnetic response, reduced internal stress, and good hydrophobicity [3]. DLC films are mainly used as protective coatings such as optical windows [4], magnetic and optical storage devices [5, 6], non-stick and protective coating of solar cell [7, 8], electrodes for biosensors [9]. Wettability is among the key DLC properties for the above-mentioned applications. This very important property is controlled by both chemical composition and geometrical structure of solid surface [10, 11]. Wettability is a surface property that describes the degree of liquid interaction with a solid surface. Relationship between roughness factor and wettability of a flat solid surface was firstly described by Young's model [12] as a

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