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Plasma diagnosis and growth mechanism by the preparation of fluorocarbon films by plasma enhanced chemical vapor deposition

Jose Cotrino[1], Antonia Terriza[2], Manuel Macias[3], Francisco Yubero[3], Rafael Alvarez[3], Agustín R. Gonzalez-Elipe[3]

[1]Instituto de Ciencia de Materiales, Sevilla, Spain [2]Instituto de Ciencia de Materiales (Universidad de Sevilla-CSIC), Sevilla, Spain [3]Instituto de Ciencia de Materiales (Universidad de Sevilla-CSIC), Sevilla, Spain

cotrino@us.es

Diamond Like Carbon (DLC) and two fluorocarbon materials with different fluorine contents have been prepared by plasma enhanced chemical vapor deposition by dosing different proportions of argon, acetylene, hydrogen and C4F8. The films were characterized by AFM, XPS, Raman and FT-IR spectroscopies. The growth mechanism of these films has been ascertained by using the concepts of the Dynamic Scaling Theory (DST) of surface growth and correlated with the plasma characteristics during the thin film growth as determined by Optical Emission Spectroscopy (OES) and Plasma Mass Spectrometry (PMS).
The analysis of the plasma by OES and PMShas revealed the formation of different fluorine containing intermediate species. A general observed trend was the detection in the plasma of bigger CxFy fragments as the concentration of the fluorine precursor in the plasma gas increased. This tendency correlates with the evolution of the films composition from a situation where fluorine is the form of –CF- groups to another where fluorine appears in the form of -CF2 and –CF3 functional groups. These findings, together with the analysis of the thin film growth by DST, permits to account for the basic mechanisms responsible for the formation of the different thin film structures and composition ranging from DLC to a polymeric-like fluorocarbon film.

Keywords
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