11th International Conference
on Advanced Materials

Rio de Janeiro Brazil
September 20 - 25

Hydrofobicity of Hydrogenated Carbon films as a function of substrate temperature and environment humidity

L. L. Ferreira, M. de Pauli, C. F. da Silva, J. F. Fragalli, A. L. de Oliveira, R. A. S. Zanon and M. M. Lacerda*

Physics Department at Universidade do Estado de Santa Catarina, Joinville – Santa Catarina 89223-100, monica_lacerda@joinville.udesc.br
* Corresponding author.

Abstract – Hydrogenated amorphous carbon films (a-C:H) have important technological application and recent studies associate devices performance with their hydrophobic surface character. a-C:H films were grown by plasma enhanced chemical vapor deposition on metallic substrates. The deposition temperature varied from room temperature up to 200°C and samples were analyzed by scanning electron microscopy (SEM) and by calculating the contact angle between the surface and a water droplet. Hydrofobicity was also analyzed as a function of the humidity ambient. Results show thinner films and better adhesion at high temperature and that small humidity variation does not change samples hydrophobic character.

This work evaluates hydrofobicity of hydrogenated amorphous carbon film (a-C:H) deposited on metallic surface at different temperature condition of the substrate. Hydrogenated amorphous carbon films and correlated materials have important application in many technological areas, from bio to space technologies and recent studies associate micro- and nano-devices performance with their hydrophobic surface character [1]. a-C:H films were grown on steel and brass by plasma enhanced chemical vapor deposition (PECVD) at constant deposition pressure and constant electric discharge to ignite plasma. Base pressure of the vacuum system was better than 10^{-6} Torr. The temperature of the substrates (T_s) varied from room temperature up to 200°C and samples were analyzed by scanning electron microscopy (SEM), energy dispersive x-ray spectroscopy (EDX) and by calculating the contact angle between the surface and a water droplet. A controlled humidity ambient setup was constructed to compare coatings hydrofobicity experimental results with theoretical models proposed by Cassie [2] and Wenzel [3]. Primary results show thinner films, better adhesion of the film to the substrate and smoother surface texture of the samples as a function of the deposition temperature. Hydrophobicity is also a function of temperature and results show a hydrophilic character of the film deposited at temperatures around 150°C (figure 1) and a small environment humidity variation does not change coatings hydrofobic character (figure 2).

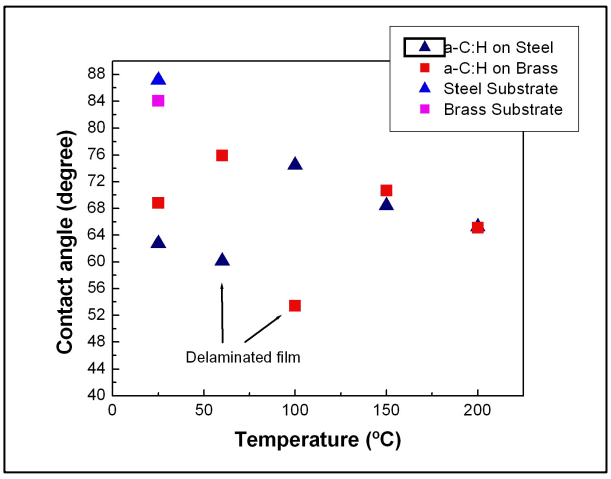

Figure 1: Contact angle as a function of substrate temperature during growth procedure.

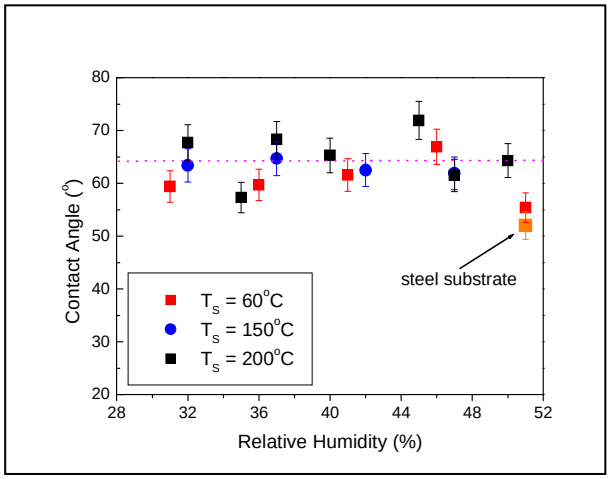

Figure 2: Contact angle as a function of the ambient relative humidity. Films deposited on steel

References

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