Coating of DLC film on the inner surface of a metallic tube with high aspect ratio using PECVD method

Elver Juan de Dios Mitma Pillaca[1], Jesus Manuel Gutierrez Bernal[2], Vladimir Jesus Trava-Airoldi[1]

[1]Instituto Nacional de Pesquisas Espaciais, [2]Universidad Nacional de Colombia

e-mail: mitma.elver@gmail.com

In this work, it is reported the study of the longitudinal distribution of DLC film coated on the inner surface of a stainless steel AISI 304 tube with high aspect ratio. The effects of the working gas inlet were studied in presence of various configurations too. The experiment was carried out in a AISI 304 tube with 200 cm in length and 10 cm in diameter, which is used as a reactor for the growth of the film. Three arrangements for the inlet of gas were prepared: a) gas inlet from edge-left of the tube; b) gas inlet from the edge-right of the tube and c) gas inlet from the edge-left and from the edge-right of the tube. For the characterization of the surface coated, five samples of AISI 304 were longitudinally distributed on it. The coating was performed by the Plasma Enhanced Chemical Vapor Deposition (PECVD) process and acetylene gas, as precursor. The system was pumped down to a base pressure of 10^{-4} Torr by a set of mechanical and diffusion pump. The discharge is carried out by a bipolar pulsed voltage feed. The pulse width, the repetition rate, the voltage and the working pressure were kept constant in all experiments at 15 μs, 21 kHz, 500 V and 70 mTorr, respectively. An interesting result obtained in this system was the generation of a low discharge current (0.5 mA/cm^2), even thought the tube exhibit a large inner area. Amorphous carbon hydrogenated (a-C:H) films were obtained. Results of Raman scattering spectroscopy have shown dependence of structure and quality of the DLC film with the longitudinal distribution. Nanoindentation and 1500N Rockwell C indentation were used for evaluation of nanohardness and adhesion, respectively.

Acknowledgments: This work was supported by grant #15/09781-0, São Paulo Research Foundation, FAPESP.