Plasma formation inside of a long metallic tube used as a chamber to growth DLC film by using Pulsed-DC PECVD process

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Plasma enhanced chemical vapor deposition (PECVD) is an efficient technique used for the three-dimensional surface modification of materials. However, treatment in pieces with concave geometry, such as pipes, piston, tubes, etc., result difficult to be obtained. Electrical or aspect ratio problems are some of causes related to it. In this work, it is reported the study of discharge conditions carried out in a long stainless tube with 200 cm-long and 10 cm-diameter, used as reactor, for the growth of DLC film inside it. The results have shown an argon plasma formation at negative applied bias voltage as low as 500V and at a working pressure around 10^{-2} Torr. An important characteristic of this system is their low discharge current even considering the large area inside of the tube. The experiment was complemented with numerical studies to analyze the distribution of electric field inside of the tube by using the COMSOL software. Finally, using the better discharge parameter, some feature of this system as uniformity along the inside wall are also studied after growing the DLC film on SS304 samples, previously placed on it. Raman scattering spectroscopy, nanoindentation, and 1500N Hockwell C indentation will be used for DLC film quality and structure evaluation, nanohardness and adhesion, respectively.

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