PO1081

PECVD of silicon oxide on PTFE surface with non-thermal atmospheric pressure plasma jets

Jan Schäfer[1], Rüdiger Foest[1], Antje Quade[1], Vít Kudrle[2], Jaroslav Hnilica[2]

[1]INP Greifswald e.V., Greifswald, Germany [2]DPE Masaryk University, Brno, Czech Republic

jschaefer@inp-greifswald.de

SiOx films are deposited on polytetrafluoroethylene (PTFE) with two different non-thermal atmospheric pressure plasma jets using argon, oxygen and vapours of tetrakis(trimethylsilyloxy)silane as a precursor of plasma enhanced chemical vapor deposition (PECVD). PTFE is widely used in different industrial applications due to its inert and extremely hydrophobic surface. Another interesting property is the relatively high gas permeation rate. In contrast, the plasticity of the material and the low surface hardness represent limiting factors. Hence, flexible SiOx like films could protect the PTFE surface mechanically, and the grade of cross-linking in the deposited film can be used to control the gas permeation. The study compares the film properties achieved by two plasma jets: (i) microwave (MW, 2.45 GHz, 300 W max.) jet - surfatron and (ii) radiofrequency (RF, 27.12 MHz, 20 W max.) jet. The MW jet is operated in a quartz discharge tube with an inner diameter of 6 mm. The mixture of argon and precursor is introduced into the flow of argon with a coaxial nozzle. A low frequency power modulation (between 10 and 2000 Hz) has been found to modify the operating regimes and allows to influence the shape of the jet effluent. Similarly to this, the RF jet is operated in 4 mm discharge tube and also equipped with the coaxial configuration of gas and precursor flow. As recently published, both jets exhibit revolving operation modes. Moreover, in the RF jet the revolving modes shows fully symmetric and periodic behavior interpreted as a self-organization effect. The low frequency modulation affects revolving modes in both jets. Moreover, the power modulation influences the film properties, too. The morphology of the deposited films has been investigated with SEM and the occurrence of pin-holes and morphological features has been obtained for different modulation frequencies. The variation of the surface morphology is explained with results from chemical analysis of XPS, EDX and FTIR in mapping modes. In both experimental arrangements, deposition rates from 0.1 to 10 nm/s are obtained.

Keywords
PECVD
plasma jet
self-organization