Seminar

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Institute for Plasma Research

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Title: Development of Superhydrophobic PTFE Polymer Surface using Oxygen Plasma Processing

Speaker: Ms. Shruti Kumari
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Date: 9th June 2023 (Friday)

Time: 11:00 AM

Venue: Join the talk online:
https://meet.google.com/krw-ouru-equ

Abstract

In this work, we have studied the effect of oxygen plasma processing on the polytetrafluorethylene (PTFE) surfaces. The effect of radiofrequency power (50-300 W) and exposing time (5 min – 30 min) on surface morphology, chemical composition and wettability of PTFE surface was investigated in detail. The transformation from hydrophobic to the superhydrophobic surface was achieved by etching with oxygen plasma at different RF Power and treatment times. After treatment of 5 min at 200 W, measured water contact angle (θ) was about 135° which became superhydrophobic (θ = 152°) when the treatment time was increased to 30 min. The surface topography and roughness were studied by using scanning electron microscope (AFM) and atomic force microscope (AFM), respectively. The surface roughness is responsible for changes in the wettability of the PTFE surfaces. An increase in RF power and processing time increased the surface roughness through nanopillar formation which in turn increased the water contact angle of the surface. The chemical modification of the PTFE surface after oxygen plasma treatment is studied by using attenuated total reflectance, Fourier transformation infrared spectroscopy (ATR-FTIR), and X-ray photoelectron spectroscopy (XPS). There were no significant changes in the observed group frequencies of the FTIR spectra of the treated samples from the untreated samples. Slight differences in the intensity value of the absorbance peaks were found for all the samples. XPS analysis revealed that the F/C ratio remained the same (F/C ~ 1.4) even after 30 min of treatment. Hence, surface morphological evolutions are mainly responsible for induced superhydrophobicity. Results correlated with the wettability characteristics of the oxygen plasma-modified PTFE samples, which are studied utilizing contact angle, hysteresis, and surface energy measurements.