Seminar

Institute for Plasma Research

Title: Polytetrafluoroethylene (PTEF) plasma (Ar &O2) treatment via Bi-polar pulse power supply for hydrophobic application

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Date: 07th May 2026 (Thursday)

Time: 11:15 AM

Venue: Seminar Hall, IPR

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Abstract

Controlling the wettability of polytetrafluoroethylene (PTFE) is inherently challenging due to its chemical inertness and low surface energy. Here we show that bi-polar pulse-driven plasma processing enables precise tuning of PTFE surface properties through synergistic morphological and chemical modification. While argon plasma produces limited structural evolution and induces hydrophilicity, the introduction of oxygen drives the formation of hierarchical micro/nano-scale textures that dramatically alter surface behavior. Atomic force microscopy reveals the progressive development of roughened features with increasing Ar + O_2 plasma exposure, accompanied by a marked rise in surface roughness. This structural transition correlates with a shift in wettability, with contact angles increasing to ~145°, indicating strongly hydrophobic surfaces. X-ray photoelectron spectroscopy further confirms substantial changes in surface chemistry, including enhanced fluorine content and oxygen-functionalized species. These results establish the decisive role of reactive oxygen species in coupling surface texturing with chemical modification, enabling a transition from hydrophilic to highly hydrophobic regimes. The approach provides a scalable and versatile route for engineering PTFE interfaces, opening opportunities in self-cleaning materials, anti-fouling coatings, water harvesting and advanced functional surfaces.

Keywords: PTFE, Argon and oxygen plasma, AFM, hydrophobicity/philicity

Reference:

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2. Barshilia, H. C. & Gupta, N. Superhydrophobic polytetrafluoroethylene surfaces with leaf-like micro-protrusions through Ar + O2 plasma etching process. *Vacuum* **99**, 42–48 (2014).