

Seminar

Institute for Plasma Research

Title: Investigation of ripple formation in soda-lime glass substrate and erosion testing of BN-based composites using ion beam irradiation at different temperatures

Speaker: Dr. Radhe Shyam
FCIPT, Institute for Plasma Research, Gandhinagar

Date: 27th October 2025 (Monday)

Time: 11.00 AM

Venue: Seminar Hall, IPR

Abstract

The present talk describes two distinct projects involving low-energy ion beam irradiation, specifically: i) surface patterning of soda-lime glass substrates at energies ranging from 500 to 1500 eV at various temperatures for SERS application, and ii) erosion of boron-nitride-based composites at 300 eV for plasma thruster application.

A systematic investigation reveals the dependency of surface temperature raised during ion beam irradiation, as well as the effect of the applied substrate temperature from an external source on the ripple pattern formation. A different set of experiments was performed using a Kaufman-type ion beam source with variation in incident angle, ion beam energies, fluences, process pressure, and substrate temperatures (300-700 °C). Further, the stability of the patterned glass substrate is also investigated with a range of post-annealing temperatures. Interestingly, the substrates undergo a phase transition near the glass transition temperature when exposed to the ion beam at higher energies, resulting in a surface layer instability that leads to the growth of high-aspect-ratio nanoripples/facets at room temperature. Irradiation at higher substrate temperatures leads to an increase in both wavelength and height of ripple patterns. A common observation from irradiation at increasing ion beam energy and substrate temperature is that the evolution of ripple height is more pronounced than that of the wavelength.

In the other work, the sputtering of BN-based composites has been studied at different substrate temperatures (RT, 200, 400, and 600 °C) for a continuous exposure of 5 hrs at the energies of 300-500 eV. The measurements of erosion rates were performed using Quartz Crystal Microbalance (QCM). These findings helped to achieve essential outcomes that can extend the lifetime of a plasma thruster operation.
