

Seminar

Institute for Plasma Research

- Title:** Investigation of ion-assisted pattern formation scenario on the soda-lime glass substrate and erosion testing of BN-based composites
- Speaker:** Dr. Radhe Shyam
Institute for Plasma Research, Gandhinagar
- Date:** 22nd October 2024 (Tuesday)
- Time:** 11.00 AM
- Venue:** Seminar Hall, IPR

Abstract

Ion beam-based research has emerged as a cutting-edge foundation in the field of science and technology, encompassing both basic and applied perspectives. The ion beam facility has offered the new opportunities for the synthesis and modification of materials at the nanoscale. Ion irradiation-induced large area self-organized surface pattern formation plays a crucial role in diverse applications such as electronics, photonics, optoelectronics, biotechnologies, etc[1-3]. In the current studies ion irradiation experiments were performed on two specific problems, first the development of self-organized nanoripple/nanofacets formation on soda-lime glass [2] and second the erosion rate of boron nitride (BN) based ceramic shield used in plasma thrusters [3]. The glass experiments were performed at different incident ion energies (500, 750, 1000, 1250, and 1500 eV), fluences (2×10^{18} to 1×10^{19} ions/cm²), and substrate temperatures (300–700 °C) at an ion incident angle of 40° with respect to surface normal. The increase in ion beam energy leads to the systematic growth of ripple wavelength and height of pattern at room temperature, analyzed using the power spectral density curves derived from atomic force microscopy images. Interestingly, the substrates undergo near the glass transition temperature from the ion beam at higher energies, creating surface layer instability, resulting in the growth of high-aspect-ratio nanoripples/wrinkles/facets at room temperature. These large area patterned formed on glass surface can be used to synthesize the metal nanoparticles arrays for various applications. Besides, the sputtering of BN-based composites has been studied using various parameters, such as incident ion energies, target angles, and substrate temperatures with rotating quartz crystal microbalance for capturing the sputtered material. These findings assist in obtaining essential outcomes for the designing the ceramic material for the plasma thruster application.

Reference :

- [1] Ion beam-induced nanoripples patterns for SERS based saliva analysis to detect oral cavity cancer
Sebin Augustine, Arti Hole, Sooraj K P, Mahesh Saini, Atul Deshmukh, Vikram Gota, Pankaj Chaturvedi, Mukesh Ranjan, C. Murali Krishna
Radiation Effects and Defects in Solids (2024).
 - [2] Anisotropic wettability transition on terraced glass surface by Ar ions
Sukriti Hans, Basanta Kumar Parida, Sebin Augustine, Vivek Pachchigar, Sooraj K P, Mukesh Ranjan
Journal of Material Science (2024).
 - [3] **Sputtering yield and nanopattern formation study of BNSiO₂ (Borosil) at elevated temperature relevance to Hall Effect Thruster.**
Basanta Kumar Parida, Sooraj K P, Sukriti Hans, Vivek Pachchigar, Sebin Augustine, Remyamol T, M. R. Ajith, Mukesh Ranjan
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