Seminar

Institute for Plasma Research

Title : Ion implanted TiO_2, ZnO thin films for investigating structural phase transition, dynamics of surface evolution, resistive switching and photo-absorbance property

Speaker: Dr. Ashis Manna
Institute of Physics, Bhubaneswar

Date : 21st October 2020 (Wednesday)

Time : 3.30 PM

Venue : Online - Join the talk: https://meet.ipr.res.in/Dr.AshisManna_PDFtalk

Abstract :

The present work discusses nanostructured films of TiO_2 and ZnO as well as their various functional properties such as resistive switching (RS) properties, band-gap modification and photoabsorbance (PA) response. The dynamics of surface evolution and phase transition behaviour have also been discussed for ion implanted TiO_2 films.The sputter deposition and ion implantation techniques have been utilized to produce these nanostructures. Several techniques such as Atomic Force Microscopy(AFM), Transmission Electron Microscopy (TEM), X-ray Photoelectron Spectroscopy (XPS), X-ray Diffraction (XRD), Raman Spectroscopy and UV-Vis Spectroscopy (UV-Vis) have been employed for investigating these nanostructures and their functional properties. RS and PA properties have been investigated for sputter deposited TiO_2 and ZnO nanostructured thin films that were subsequently ion implanted with 50 keV Ti ions. Both these films display RS characteristic when implanted with highest fluence ($1x10^{15}$ ions/cm^2). PA properties in both TiO_2 and ZnO films, demonstrate a bandgap tailoring with increasing fluence. Role of oxygen vacancies in modulating RS and PA behavior has been investigated here. Formation of conducting filaments are responsible for the appearance of RS phenomena here. In case of TiO_2 thin films, a phase transition from anatase to rutile is observed at a critical fluence. Role of oxygen vacancies and dimensions of nano- crystalline anatase zones, in the transformation, have also been explored. Dynamical evolution of these as-deposited and ion implanted TiO_2 thin film surfaces have been investigated via scaling formalism. The surface dynamics of the ion implanted TiO_2 thin films has been investigated here by via scaling formalism. Scaling parameters like roughness exponent (α) and growth exponent (β) have been estimated via height-height correlation and power) have been estimated via height-height correlation and power spectral density calculations. Dynamical evolution of Rutile TiO_2 (110) single crystal surfaces, after ion irradiation, has also been investigated via the scaling studies.