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# Seminar

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## Institute for Plasma Research

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**Title :** Ion implanted TiO<sub>2</sub>, 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](https://meet.ipr.res.in/Dr.AshisManna_PDFtalk)

### Abstract :

The present work discusses nanostructured films of TiO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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 ( $1 \times 10^{15}$  ions/cm<sup>2</sup>). PA properties in both TiO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> thin film surfaces have been investigated via scaling formalism. The surface dynamics of the ion implanted TiO<sub>2</sub> thin films has been investigated here by via scaling formalism. Scaling parameters like roughness exponent ( $\alpha$ ) and growth exponent ( $\beta$ ) 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<sub>2</sub> (110) single crystal surfaces, after ion irradiation, has also been investigated via the scaling studies.

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