Contribution ID: **255** Type: **Poster Presentation**

Carbon Ion implanted ZnO Nanorods-Structural and Optical analysis

Incorporation of either metallic or non-metallic ions through implantation persuades structural imperfections which alters the electronic structure and possibly the optical properties of the implanted materials. 50 keV carbon ions were implanted into ZnO-NRs with varying fluences up to 3.0 × 1016 ions/cm2. The successful assimilation of carbon ions into the ZnO is primarily noted by a variation of the full width at half maximum (FWHM), the peak intensity and the reduction in crystallite sizes which is relative to the fluence of the ions. The bombardment of C+ ions into the ZnO lattice did not result in formation of secondary phase or carbon related reflections. At lower fluence, substitution and interstitial preference is observed, whereas increasing the fluence of carbon ions results in interstitial occupancy. The 1D nanorod morphology is retained, however AFM statistical analysis indicates a variation of morphological parameters. A significant increase in the surface roughness is noted and associated to the sensitivity of the intersection angle between neighbouring grains. The variation in the optical absorption and extinction coefficients reveal that the carbon ions are definitely incorporated into the ZnO lattice thus modifying its crystal and electronic structures. Values of 3. 20, 3.22, 3.25, 3.17 and 2.97 eV where estimated as the optical band gaps of C+ implanted with carbon ions of fluence of 1 x1015, 2 x1015, 3 x1015, 1 x1016 and 3 x1016 ions/cm2 respectively. A possible explanation for the reduction of the band gap is that the substitution of carbon species into the ZnO lattice introduces isolated impurity bands of C (2p) between the conduction and valence bands, which often appear above the Fermi level. These states serve as freeway for electrons to swiftly transfer into the CB upon photoexcitation

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

MSc

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Session Classification: Poster Session

Track Classification: Track A - Physics of Condensed Matter and Materials