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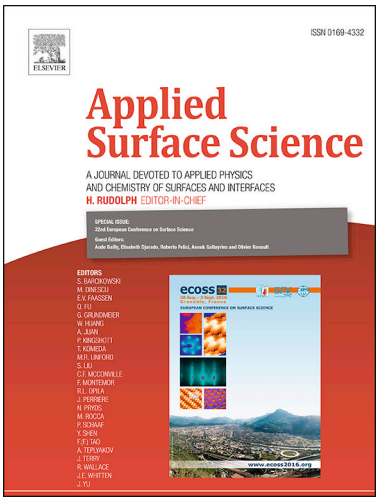

Full Length Article

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Probing of O_2 vacancy defects and correlated magnetic, electrical and photoresponse properties in indium-tin oxide nanostructures by spectroscopic techniques

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ABSTRACT

Indium-tin oxide (ITO) 1D nanostructures with tunable morphologies i.e. nanorods, nanocombs and nanowires are grown on c-axis (0001) sapphire (Al_2O_3) substrate in oxygen deficient atmosphere through pulsed laser deposition (PLD) technique and the effect of oxygen vacancies on optical, electrical, magnetic and photoresponse properties is investigated using spectroscopic methods. ITO nanostructures are found to be enriched with significant oxygen vacancy defects as evident from x-ray photoelectron and Raman spectroscopic analysis. Photoluminescence spectra exhibited intense mid-band blue emission at wavelength of region of 400-450 nm due to the electronic transition from conduction band maxima (CBM) to the singly ionized oxygen-vacancy (V_O^+) defect level within the band-gap. Interestingly, ITO nanostructures exhibited significant room-temperature ferromagnetism (RTFM) and the magnetic moment found proportional to concentration of V_O^+ defects which indicates V_O^+ defects are mainly responsible for the observed RTFM in nanostructures. ITO nanowires being enriched with more V_O^+ defects exhibited strongest RTFM as compared to other morphologies. Current voltage (I-V) characteristics of ITO nanostructures showed an enhancement of current under UV light as compared to dark which indicates such 1D nanostructure can be used as photovoltaic material. Hence, the study