Excitation Power Controlled Luminescence and Structural Investigation of $SrZnO_2$

Manju (Department of Physics, Punjabi University, Patiala-147002, Punjab, India), Ankush Vij (Department of Applied Physics, Amity School of Applied Sciences, Amity University Haryana, Gurgaon-122413, Haryana, India), Anup Thakur (Department of Basic and Applied Sciences, Punjabi University, Patiala-147002, Punjab, India)
manju.rao007@gmail.com

Wide band gap semiconducting metal oxide $SrZnO_2$ (3.4 eV) is widely explored for its applications in lighting devices, light emitting diode, photo catalyst, magnetic semiconductor. $SrZnO_2$ actively shows luminescence in pure form as well as when incorporated with dopant. The present study deals with the structural and optical study of $SrZnO_2$ phosphor. $SrZnO_2$ belong to orthorhombic family having *Pnma* space group. Zn and Sr are surrounded by four and seven oxygen atoms, respectively. Sr is situated in the lattice sites around Zinc oxide tetrahedrons.

In present work, $SrZnO_2$ phosphor is synthesized using novel and single step solution combustion synthesis as this process is non-toxic and user friendly. The nitrate precursors and urea fuel were mixed in appropriate amount of water and afterwards, placed in preheated muffle furnace for combustion. A quick and efficient combustion reaction yielded fine and porous $SrZnO_2$. The phase confirmation and optical study were done by X-ray diffraction (XRD) and photoluminescence (PL) spectroscopy, respectively. The extended X-ray absorption fine spectroscopy (EXAFS) of Zn *K*-edge helps to investigate the atomic arrangement in the lattice.

The XRD analysis reveals that orthorhombic phase of $SrZnO_2$ appeared significantly after annealing at 1200 ^{0} C. The carbonate and hydroxide phase of strontium were eliminated after annealing. The PL response of annealed sample was studied at various excitation powers of laser source (2 mW, 20 mW, 100 mW and 200 mW), keeping the excitation wavelength and expose time fixed. It was observed that $SrZnO_2$ shows a wide band luminescence spanning around red region with maximum at 604 nm. The emission is attributed to the probable presence of surface defects such as oxygen vacancy sites or cationic vacancy sites, as band to band emission is not favorable. The luminescence intensity showed applaudable change with increasing excitation power. The emission intensity not only increased, but also showed a converging behavior with increasing excitation power, as full width half maxima of emission peaks decreased towards higher side of excitation power. This revealed that defects generated luminescence is sensitive to excitation power of source. The Fourier transform of EXAFS function was fitted against theoretical model with the help of ARTEMIS software package and various structural parameters were calculated.

From the presented study, it is concluded that excitation power appears to be driving force in enhancing the visible emission in $SrZnO_2$ phosphor, which can be used to extract potential application of phosphor for various applications.

The author is thankful to UGC-DAE Consortium for Scientific Research for financial support through project CSR-IC-BL-74/CRS-191/2016-17/855.