**Abstract**

Perovskite solar cells are emerging as highly potent and efficient sustainable energy source. The stability issue of hybrid perovskite like methyl ammonium lead bromide, can be improved by all inorganic perovskites (AIP) like cesium lead bromide (CsPbBr₃). Metal ion doping can improve optical and electrical properties of AIP. The present work is about the synthesis and characterization of metal doped CsPbBr₃ nano crystals (NCs) for efficient perovskite solar cells. The synthesis is carried out using hot injection method. The resulting nanocrystals (NCs) are characterized using XRD, SEM, AFM, UV/Vis Spectroscopy, PL spectroscopy and Hall Effect measurements. The NCs are tested for their performance in solar cells.

**Introduction**

All Inorganic Perovskite (AIP) material emerged as promising candidate for solar cell application due to its superior stability then its organic counterpart (HOIP), as well as provide exceptional optoelectrical properties. AIP is extremely versatile, as a large portion of elements can be used as the building block of Perovskite lattice that is the reason behind the fact that several properties of AIP are exceptionally tunable. These materials adopt a general stoichiometry of ABX₃, the A site can be occupied by a monovalent inorganic cation (e.g., K⁺, Rb⁺, Cs⁺). The B site is a divalent metal cation (e.g., Pb²⁺, Sn²⁺, Ge²⁺) and the X site is occupied by halide anions (F⁻, Cl⁻, Br⁻, I⁻).

**Methodology**

The synthesis of the CsPbBr₃ NCs are carried out using the hot injection method. The resulting nanocrystals (NCs) are characterized using XRD for crystalline structure, SEM for morphological studies, AFM for surface roughness, and UV/Vis spectroscopy for optical properties. PL spectroscopy is used to study the emission properties of the NCs. Hall Effect measurements are carried out to study the electrical properties of the NCs.

**Results**

The XRD pattern of the CsPbBr₃ NCs shows sharp peaks corresponding to the (100), (002), (200), and (202) planes, indicating the high crystallinity of the NCs. The SEM images show the uniformity and size distribution of the NCs. The AFM images reveal the surface morphology of the NCs. The PL emission spectra show a broad band at around 700 nm, indicating the optical properties of the NCs.

**Conclusion**

- Reduced Lead Sr/Ni co doped All Inorganic perovskite NCs were synthesized and characterized successfully.
- Resistivity of modified co doped perovskite is reduced successfully from 1.43×10⁶ ohm cm to 4.61×10⁵ ohm cm.
- Bulk Concentration of modified co doped perovskite is increased successfully from 5.59×10¹⁰ cm⁻³ to 3.70×10¹⁶ cm⁻³.
- Stability of modified co-doped perovskite is up to 12 weeks and thermally stable up to 545°C.

**Acknowledgment**

We would like to pay our special gratitude to SCME-NUST for providing a platform for the students to implement their knowledge and to get valuable research experience under their kind supervision.