Tab 1

FMES-2027

March 26-28, 2027

Fabrication of Co-doped PbS Quantum Dot for Photovoltaic Applications

Sangjukta Yesmin[1], **A. N. Chowdhury**[2]*
[1]Bangladesh University of Engineering and Technology, Bangladesh; M.Sc. Student
[2]*Bangladesh University of Engineering and Technology, Bangladesh; Professor
*Corresponding Author: Dr. Al- Nakib Chowdhury, *nakib@chem.buet.ac.bd, +8801716620026*

Abstract

Quantum dots (QDs) are promising candidates for cost-effective next-generation photovoltaics due to their tunable bandgap, high absorption efficiency, and potential. In this study, cobalt-doped lead sulfide (Co-doped PbS) QDs were developed and adsorbed on the zinc oxide (ZnO) nanoflower surface for application in quantum dot solar cells (QDSCs). Cobalt ions were incorporated into the PbS quantum dots lattice to modify optoelectronic properties and enhance power conversion efficiency. ZnO nanoflowers were synthesized via a hydrothermal process, while Co-doped PbS QDs were prepared using the successive ionic layer adsorption and reaction (SILAR) method. To comprehend the successful quantum dot formation and effectiveness of cobalt doping, the structural, morphological, electrical, and optical properties of the quantum dots were analyzed. The highest efficiency was achieved with the device structure of FTO/ZnO/Co-doped PbS QDs (8 SILAR cycles)/Polysulphide/rGO-Cu_2S/FTO, yielding a Voc of 0.12 V, Jsc of 3.09 mA/cm^2, and a PCE of 0.1%. However, contrary to theoretical expectations, the J-V curve only exhibits marginal improvements in Voc and Jsc, resulting in lower-than-anticipated overall efficiency. Further analysis indicates that cobalt doping may have introduced defects, contributing to moderate degradation and increased non-radiative recombination that adversely affect the device performance. Despite current challenges, this study underscores the potential of cobalt-doped PbS QDs for advancing low-cost, highly efficient QDSCs.

Keywords: Zinc oxide nanoflowers; Co-doped PbS QD; QDSSC; TEM

References:

Brown B, Aaron M (2001) The politics of nature. In: Smith J (ed) *The rise of modern genomics*, 3rd edn. Wiley, New York, pp 230–257.

Abstract ID (For organizers use only):

Tab 2