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Air-Stable Mixed Halide-Chalcogenide Perovskite Materials for Photovoltaic and Photocatalytic Applications



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ABSTRACT:

Demand for energy has continued to increase owing to worldwide industrial development. Halide perovskites that date back to the 1800s, are crystalline semiconductors formed by rather low-energy solid-state reactions. These materials consist of an anionic octahedra connected in 0, 1, 2, or 3 dimensions through shared corners, with organic or inorganic cations providing the charge compensation. Pb-based halide perovskites have recently gained popularity due to their high quantum yields, excellent solar cell efficiency and low-cost manufacturing. Halide perovskite solar cells (HPSCs) have such as MAPbI₃ and (FA,MA,Cs)PbI₃, have shown significant promise for high efficiency tandem solar cells. Despite the outstanding performance of Pb-based HPSCs, issues of stability and toxicity remain. The inherent instability of MAPbI₃ towards moisture and oxygen can be combatted by introducing functional barrier layers, however, this tends to delay the degradation process rather than preventing it. Researchers are exploring stable and non-toxic alternate compositions to mimic the excellent optoelectronic properties of MAPbI₃. This talk will focus on the challenges and opportunities of Pb and Pb-free halide perovskites with ABX₃ and A₂BX₆ structures for photovoltaic and photocatalytic applications. PI has recently demonstrated bandgap engineering in Cs₂PtI₆ by intermixing Ni on B-cation site and chalcogen addition at X anion site, for development of earth abundant Pb-free perovskite solar cells. This research funded by 2021 NSF CAREER award is exploring on the amazing diversity of chemical compositions and electronic structures to develop high performance, cheap and sustainable materials.

BIOGRAPHY:

Dr. Shubhra Bansal is currently an Associate Professor (tenured July 2021) in the Department of Mechanical Engineering at UNLV. Her research interests include materials reliability, solar cells, flexible electronics and packaging. She completed her undergraduate studies in Metallurgical & Materials Engineering from the Indian Institute of Technology Roorkee in 2001. She received his M.S. and Ph.D. in Materials Science and Engineering from the Georgia Institute of Technology in 2006. She worked as a Lead Materials Scientist in GE Global Research, Niskayuna from 2006-2011. Before joining academia, she was also a Senior Technical Advisor with Department of Energy, Solar Energy Technology Office. Her research at UNLV is funded by Department of Energy-EERE, National Science Foundation and NASA. She serves as the Associate Editor of Solar Energy Journal, and is a member of IEEE, MRS and NREL's PV Quality Assurance Task Force. She has a Google Scholar h-index of 14.