Introducing Cu_2O in *p-i-n* Planar Perovskite Solar Cells (PV-3)

A joint India-U.S. research consortium funded under the *Joint Clean Energy Research & Development Center (JCERDC)*

Scientific Achievement:

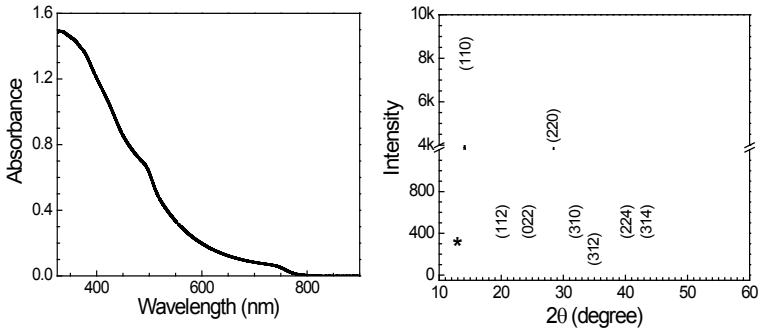
Introduction of cuprous oxide (Cu_2O) thin films formed by Successive Ionic Layer Adsorption and Reaction (SILAR) method as a hole-transport layer in perovskite ($CH_3NH_3PbI_3$) solar cells. Formation of planar *p-i-n* (direct) structure heterojunction perovskite solar cells positively modifies efficiency and reliability.

Significance and Impact:

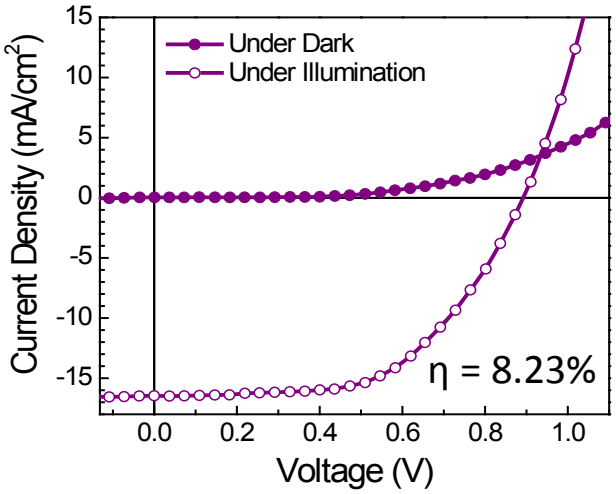
Introduction of Cu_2O as an inorganic oxide hole-transport layer in perovskite solar cells resulted in a photo-conversion efficiency of over 8%. This offers a potential alternative to unstable and costly Spiro-MeOTAD in forming *p-i-n* junction solar cells without a high work-function top electrode (gold).

Research Details:

- Demonstration of the formation of $CH_3NH_3PbI_3$ perovskite thin films by one-step solution approach and their characterization.
- Fabrication of *p-i-n* structure with a perovskite absorber and Cu_2O and PCBM as a hole- and electron-transport layer.
- Estimation of the band-edges of the semiconductors by scanning tunneling spectroscopy to derive the energy band diagram.



Absorbance spectrum (left) and X-ray diffraction pattern (right) of $CH_3NH_3PbI_3$ thin film.



JV profile of heterojunction cells.

Publication: S. Chatterjee, A. J. Pal, Introducing Cu_2O thin-films as a hole-transport layer in efficient planar perovskite solar cell structures, *J. Physical Chemistry C* **120**, 1428−1437 (2016). DOI: 10.1021/acs.jpcc.5b11540

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