Optimizing the Position of Silver Nanoparticles in Plasmonic Solar Cells (PV-2)

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Scientific Achievement:

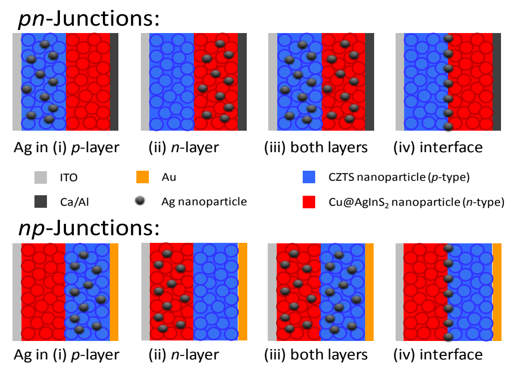
Study of plasmonic effect of silver nanoparticles in *pn*-heterojunction solar cells comprising Earth-abundant, non-toxic nanocrystals (CZTS and Cu@AgInS$_2$). Optimization of the position of the plasmonic nanoparticles for both direct and inverted structures.

Significance and Impact:

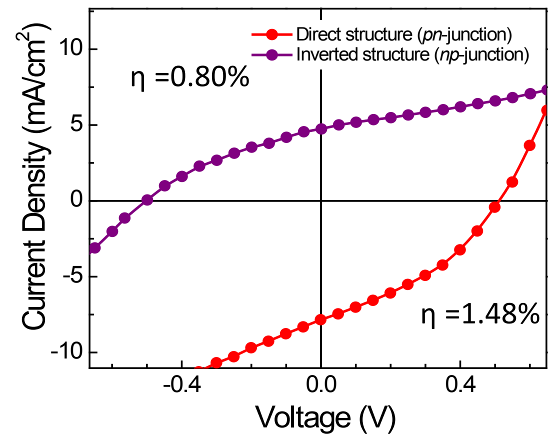
The appropriate location of silver nanoparticles in *pn*-heterojunction solar cells was optimized by introducing them (1) in the *p*-layer, (2) in the *n*-layer, (3) in both the layers, and (4) at the interface between the layers of *p*- and *n*-type nanocrystals. Presence of the nanoparticles in the *p*-layer is superior compared to nanoparticles in the *n*-layer, with 1.48% (direct) and 0.80% (inverted) conversion efficiencies.

Research Details:

- Synthesis of CZTS and Cu@AgInS$_2$ nanoparticles by colloidal synthesis approach and their characterization.
- Fabrication of heterojunction solar cells with plasmonic nanoparticles with both direct (*pn*) and inverted (*np*) structures.
- Characterization of the photovoltaic devices.



Schematic of plasmonic devices with silver nanoparticles



JV profile of heterojunction cells.

Publication: U. Dasgupta, S. K. Saha, A. J. Pal, Plasmonic effect in pn-junction solar cells based on layers of semiconductor nanocrystals: where to introduce metal nanoparticles?, *Solar Energy Materials & Solar Cells* **136**, 106-112 (2015). DOI: 10.1016/j.solmat.2015.01.004

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