Towards high efficiency thin film solar cells

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ABSTRACT

As an alternative to single crystal silicon photovoltaics, thin film solar cells have been extensively explored for miniaturized cost-effective photovoltaic systems. Though the fight to gain efficiency has been severely engaged over the years, the battle is not yet over. In this review, we comb the fields to elucidate the strategies towards high efficiency thin films solar cells and provide pointers for further development. Starting from the photoelectron generation, we look into the fundamental issues in photoelectric conversion processes, including light harvesting and charge handling (separations, transportations and collections). The emerging organic-inorganic halide perovskite systems, as well as the rapidly developed polycrystalline inorganic systems, organic photovoltaics and amorphous silicon cells are discussed in details. The biggest bottleneck for the cost-effective polycrystalline inorganic cells is the composition sensitivity and deep defects; for amorphous silicon cells, it is the quantum of the dangling bonds; for organic cells, it is the low charge carrier mobility and high exciton binding energy; and for perovskite cells, it is the environmental degradation and the controversial mechanisms of generation of I-V hysteresis. Strategies of light harvesting and charge handling as well as directions to break the bottlenecks are pointed out.

Keywords: Thin film solar cell; Light harvesting; Charge dissociation; Charge transport and collection Perov...

REFERENCES


