NCPRE NEWS

September 2018

National Centre for Photovoltaic Research and Education
www.ncpre.iitb.ac.in
A Project of the Ministry of New and Renewable Energy at IIT Bombay

Development of semi-transparent and large-area perovskite cells

NCPRE has research activities grouped in five major areas: Crystalline Silicon Solar Cells, Thin Film Materials and Devices, Energy Storage, Power Electronics and Module Reliability. **This month's Newsletter focuses on recent research activities on Thin Film Materials and Devices.**

The Thin Film Materials and Devices group in NCPRE is a **highly inter-disciplinary group, bringing together faculty members and students from several Department at IIT Bombay**: Energy Science & Engineering, Materials Science & Metallurgical Engineering, Electrical Engineering, Physics and Chemistry.

The main deliverables of the Thin Film Materials and Devices Group are to develop: (a) high efficiency large-area **perovskite-Si tandem solar cells**; (b) **new compositions** in the perovskite family; (c) new low-cost **hole-transport materials** for perovskites. The first deliverable will leverage NCPRE's unique capabilities in both silicon and perovskite solar cells, and can provide a pathway for **indigenous futuristic solar cell manufacturing.**

We can reproducibly make perovskite-based single junction devices with ~ 16% PCE (cell area of 0.045 cm^2) and ~ 12 % PCE (cell area of 0.32 cm^2).

We are currently focused on obtaining single junction perovskite cells with transparent contacts on both sides, shown below, as this is necessary for integration in a tandem architecture.

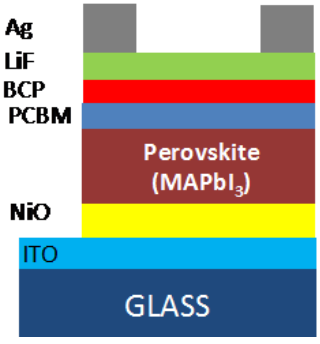

Fig.1 *Schematic of semi-transparent perovskite device*

The highest efficiency obtained in this effort is 7.64%.

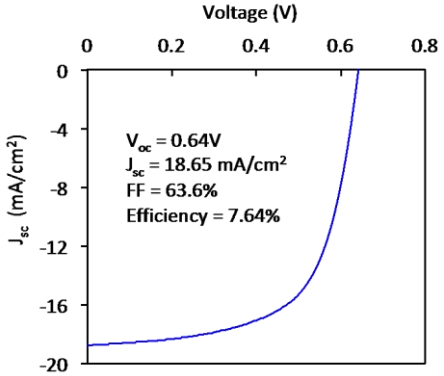

Fig. 2 J-V characteristics of semi-transparent perovskite device under 1 Sun illumination

$FACsPbI_3$ based devices with an active area of 0.42 cm^2, with a PCE of 7.2 % had been developed. Temperature stability of the $FACsPbI_3$, unto 150 ˚C was also demonstrated.

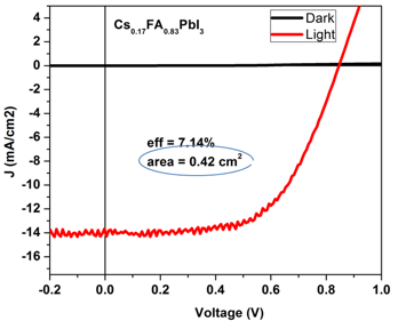

Fig. 3 J-V characteristics of mixed cation perovskite device under 1 Sun illumination

Our theory group simulated many compounds in the perovskite family. They predict that double perovskites are more stable than the conventional perovskites. Work on optimizing the devices based on these materials is underway.

Several new organic HTMs (Hole-Transport Material), carbon-based transport layers and Perovskite TCO (Transparent Conductive Oxide) are also being developed at NCPRE.