

Perovskite solar cells using polymer electrolytes

ABSTRACT

This study deals with the characterization of methylammonium lead iodide (MAPbI₃) material and the fabrication of perovskite solar cells using gel polymer electrolyte as the charge transport medium. The crystalline lead-based perovskite has been verified by x-ray diffraction (XRD). The [100], [200], [210], [211], [220], [300] and [222] reflection planes can be observed at 2 θ angles of 14.10°, 28.35°, 31.90°, 34.95°, 40.40°, 43.15° and 50.20°, indicating a cubic crystal symmetry for CH₃NH₃PbI₃. EDX spectrum showed a Pb:I ratio of approximately 1:3 as in CH₃NH₃PbI₃. The band gap for lead-based perovskite is 1.45 eV estimated from UV-Vis absorption spectroscopy. The nanocrystalline MAPbI₃ have been observed using field emission scanning electron microscopy (FESEM), where the average cuboid size of perovskite nanocrystals is 380 nm. The cell have been fabricated using gel polymer electrolyte with composition 17.02 wt.% PVA–13.93 wt.% TBAI–0.96 wt.% I₂– 68.09 wt.% DMF. The cell exhibits a power conversion efficiency (PCE) of 1.28% with open circuit voltage (Voc) 0.58 mV, short circuit current density (Jsc) 3.74 mA cm⁻² and fill factor (FF) 59.18%.

Keyword: Gel polymer electrolyte; Transport properties of charge carriers; Perovskite solar cell; FESEM; UV-Vis