A Comparative Study of different ETMs in perovskite solar cell with inorganic copper as HTM

KAMEL MOHAMED MAHMOUD HASSAN ,Mostafa M. Sala, Mohamed Abouelatta ; AhmedShaker.

Abstract

Perovskite solar cells (PSCs) research is substantially increasing because of the fast improvement in their power conversion efficiency (PCE), cheapness, possibility to tune the bandgap, low recombination rate, high open circuit voltage, excellent ambipolar charge carrier transport and strong and broad optical absorption. In this paper, different electron transport materials (ETMs) have been analyzed with a new Copper Iodide (CuI) Hole Transport Material (HTM) to replace the conventional hole and electron transport materials for PSCs, such as TiO2 and Spiro-OMeTAD which have been known to be susceptible to light induced degradation. Moreover, the influence of the ETL, HTL and the perovskite layer thicknesses on the overall cell performance, is studied. The design of the proposed PSC is performed utilizing SCAPS-1D simulator (Solar Cell Capacitance Simulator-one dimension). Because of its high electron affinity and tunable bandgap, ZnOS is found to be the best replacement for TiO2. The results show that lead-based PSC with CuI as HTM is an efficient arrangement and better than the easily degradable and expensive Spiro-OMeTAD. According to the presented simulation and optimization of various layers thicknesses, the highest designed efficiency is 26.11%.

Optik-International Journal for Light and Electron Optics 2019, February