A comprehensive simulation study of hybrid halide perovskite solar cell with copper oxide as HTM

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Abstract

Perovskite solar cells (PSCs) have attracted considerable attention as a competitor technology in solar cells due to the rapid enhancement in their power conversion efficiency (PCE) in recent years. PSCs have several advantages such as their bandgap tunability, lower cost, tolerance of high impurities, protracted diffusion length and wide optical absorption. In this paper, simulation of PSCs with copper oxide as a hole transport material (HTM) and different electron transport materials (ETMs) has been presented. The proposed materials are a replacement to the ordinary hole and ETMs; such as the titanium dioxide and the expensive spiro-OMeTAD. In addition, a comprehensive study for optimizing the features and parameters of the PSCs, such as the thickness and defect density of the perovskite layer, the doping concentrations, and the bandgap energy, has been introduced. The simulation and the performance evaluation of the designed PSCs have been carried out using SCAPS-1D. The results show that mixed halide PSC with zinc oxysulfide as ETM and copper oxide as HTM has an enhanced performance with a PCE of up to 30.82%.

Semiconductor Science and Technology 2019, October

Future University In Egypt (http://www.fue.edu.eg)

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