9th INTERNATIONAL CONFERENCE ON COMPUTATIONAL AND EXPERIMENTAL SCIENCE AND ENGINEERING (ICCESEN-2022)

28-31 October 2022, ANTALYA-TURKEY

Optimization of Lead-Free $CsSnI_3$-based Perovskite Solar Cell structure

Hayat Arbouz[1]✉

[1] *University of Blida1, Department of Physics, Blida-ALGERIA*

Abstract

Hybride metal-Halide perovskites are considered as the leading and low-cost materials of the latest generation of solar cells. However, the presence of lead Pb, known for its high toxicity, in the composition is one of the main factors opposing the large-scale production. The development of lead-free perovskite cells has therefore become a very attractive objective. In this work we have simulated and modeled and then optimized a solar cell structure based on the Pb-free perovskite material CsSnI3 with 1.3 eV bandgap energy using TiO2 and PTAA as ETL and HTL materials respectively. A model of simulation describing charge carrier processes, J-V characteristics calculation taking in consideration the dominant interfacial recombination was presented. The effect of interface defect density at front and back interfaces of the active layer was investigated in addition to the effect of layer thicknesses. Various alternative ETL and HTL materials were proposed, in order to choose adequate materials that lead to best performance. An optimal device structure was proposed on the base of the obtained results. An efficiency of 22.23% was reached with Voc=1.04 V Jsc = 26.25 mA/cm² and FF= 76.9 % using C60 and NiO as ETL and HTL materials with 100 nm and 150 nm thickness respectively and 1µm-thick absorber. The aim of the work is to develop a low-cost and performing Pb- free perovskite single junction cell which can be used as a part of a multi-junction solar cell device

Keywords: *Perovskite, Solar Cell, Photovoltaic*

✉ *arbouzhayet@yahoo.fr*