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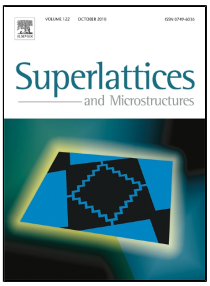

Study of the reverse saturation current and series resistance of p-p-n perovskite solar cells using the single and double-diode models

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Study of the reverse saturation current and series resistance of p-p-n perovskite solar cells using the single and double-diode models

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Abstract

The effects of the offset level and of the doping level in the perovskite layer upon both the reverse saturation current (J_0) and the series resistance (R_s) of p-p-n perovskite solar cells have been researched in this paper, using five different materials such as spiro-OMeTAD, Cu_2O, CuSCN, NiO and CuI, as Hole Transporting Material (HTM). The analysis was carried out by means of the single and double-diode models of a solar cell and of genetic algorithms based on optimization technique, in order to extract the desired parameters. The minor degradation of J_0 and R_s has been found for the condition offset equal to zero and for the highest doping level in p-type perovskite layer. Also, a comparison has been made of the behavior of two reverse saturation currents (J_{01} and J_{02}). The power conversion efficiency (*PCE*) has shown to be more strongly dependent on J_{02} than on J_{01}. Results obtained in this work can be used to improve the manufacturing process of these devices.

Keywords: Perovskite solar cells; Hole Transporting Material (HTM); One and two-diode models; Genetic algorithm; Parameters extraction

1. Introduction

Energy is a strategic resource for the development of any country. The continuous increase in energy demand together with the associated environmental impact of fossil fuel combustion is strong incentives to promote the study and development of new technologies based on renewable energies such as photovoltaic (PV) and wind power generation systems. Solar energy is the most promising renewable energy source to generate electric power and to reduce the carbon dioxide (CO_2) emissions to the atmosphere.

The study of materials and their microscopic properties together with the development of advanced device fabrication processes has opened the way to new research possibilities in photovoltaic technology in order to improve the performance of the PV cells.