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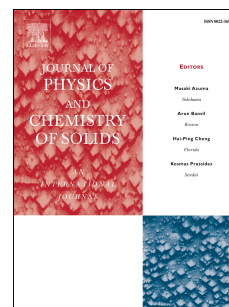
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Analysis of Sb₂Se₃/CdS based photovoltaic cell: A numerical simulation approach

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Abstract

Sb₂Se₃ is a promising earth-abundant and nontoxic material suitable for photovoltaic applications. In the present study, Sb₂Se₃/CdS heterojunction solar cells are numerical analyzed by the program SCAPS (Solar Cell Capacitance Simulator). The influence of thickness, hole mobility and defect density of Sb₂Se₃ layer, as well as the CdS layer thickness and the work function of back contact on the devices performance are simulated and analyzed in detail. Our studies show that, the optimal thickness for Sb₂Se₃ absorber and CdS buffer layer is 600 nm and 60 nm, respectively. The absorber defect density less than 10¹⁴ cm⁻³, interface defect density less than 10⁸ cm⁻³ and hole mobility higher than 15 cm²/V.s in Sb₂Se₃ layer is required to guarantee good device performance. Meanwhile, the work function of back contact larger than 4.8 eV is beneficial. A maximum efficiency of 16.5% can be obtained after optimization of different parameters. The simulation results provide useful insights and guideline for the designing and fabricating of Sb₂Se₃ solar cells.

Key words: Sb₂Se₃; Solar cell; Numerical analysis

1. Introduction

The urgent need for low-cost, high-performance solar cell drives the sustained study on new absorber materials for photovoltaic applications. In recent years, antimony selenide (Sb₂Se₃) has emerged as an excellent photovoltaic absorber due to its attractive optoelectronic properties such as large absorption coefficient (>10⁵ cm⁻¹ at short wavelength) [1], suitable bandgap (1–1.2 eV) [2], simple binary composition

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