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Synthesis, Characterizations and application of Sb_2Se_3 in solar cell with ZnSe as buffer layer

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Abstract: Solar energy is one of the most common renewables and environment-friendly energy sources that are currently undergoing rapid research and implementation to fulfill rising global energy demand, owing to its relative abundance. Furthermore, the growing usage of solar energy necessitates the advancement of innovative and efficient photovoltaic (PV) technologies with lower production prices and improved power conversion efficiency (PCE). Antimony selenide is the chemical compound with the formula Sb_2Se_3 which crystallizes in an orthorhombic space group. These non-toxic and earth-abundant materials are having a high absorption coefficient (>10^5 cm^{-1}) and optimal bandgap (1.2 eV). Sb_2Se_3 is a very promising solar absorber material because of these attractive material, optical and electrical properties and it has become a popular PV absorber, with power conversion efficiency rising gradually compared to other developing compounds. The main objective of this work is to replace the commonly used toxic CdS as buffer layer. Here, a non-toxic buffer layer ZnSe is used and the efficiency of solar cell has been determined by varying the thickness and carrier concentration of buffer and absorber materials and their effect on efficiency is analyzed. A solar cell capacitance simulator in 1 dimension (SCAPS-1D) software has explored of the solar-cell properties of the antimony selenide (Sb_2Se_3).

Keywords: Antimony Selenide; ZnSe; SCAPS; non-toxic; synthesis

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