عنوان مقاله:

Numerical analysis and simulation of multi-junction cadmium telluride solar cell based on the function of layer thickness

محل انتشار:

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خلاصه مقاله:

Cadmium telluride (CdTe) is a stable crystalline compound formed from cadmium and tellurium. It is mainly used as the semiconducting material in cadmium telluride photovoltaics and an infrared optical window. It is usually sandwiched with cadmium sulfide to form a p–n junction solar PV cell. CdTe is used to make thin film solar cells, accounting for about ۸% of all solar cells installed in ۲۰۱۱. They are among the lowest-cost types of solar cell, although a comparison of total installed cost depends on installation size and many other factors, and has changed rapidly from year to year. The CdTe solar cell market is dominated by First Solar. In ۲۰۱۱, around ۲ GWp of CdTe solar cells were produced; For more details and discussion see cadmium telluride photovoltaics. Cadmium telluride (CdTe), a metallic dichalcogenide material, was utilized as an absorber layer for thin film–based solar cells with appropriate configurations and the SCAPS–۱D structures program was used to evaluate the results. In both known and developing thin film photovoltaic systems, a CdS thin–film buffer layer is frequently employed as a traditional n–type heterojunction partner. In this study, numerical simulation was used to determine a suitable non–toxic material for the buffer layer that can be used instead of CdS, among various types of buffer layers (ZnSe, ZnO, ZnS and In۲S۳) and carrier concentrations for the absorber layer (NA) and buffer layer (ND) were varied to determine the optimal simulation parameters. Carrier concentrations (NA from ۲ × ۱۰۱۲ cm–۳ to ۲ × ۱۰۱۷ cm–۳ and ND from ۱ × ۱۰۱۶ cm–۳ to ۱ × ۱۰۲۲ cm–۳) differed. The results showed that the use of CdS as a buffer–layer–based CdTe absorber layer for solar cell had the highest efficiency (%) of ۱۷.۴۳%. Furthermore, high conversion efficiencies of ۱۷.۴۲% and ۱۶.۲۷% were for the ZnSe and ZnO-based buffer layers, respectively. As a result, ZnO and ZnSe are potential candidates for replacing the CdS buffer layer in thin–film solar cells. Here, the absorber (CdTe) and buffer (ZnSe) layers were chosen to improve the efficiency by finding the optimal density of the carrier concentration (acceptor and donor). The simulation findings above provide helpful recommendations for fabricating high–efficiency metal oxide–based solar cells in the lab.

کلمات کلیدی:

CdTe; ZnSe; conversion efficiency; absorber; layer and buffer layer; SCAPS–۱D; solar cell