

Abstract

Moustafa Hussein Aly

Solar cell performance enhancement with optimized CIGS absorber bandgap and buffer layer

In the past years, copper-indium-gallium-diselenide (CIGS) based solar cells have improved the efficiency records reaching to 22.6%. This result shows that CIGS absorbent is idealistic for thin-film solar cells. The most attractive feature in CIGS is the tunable bandgap of the absorber layer that varies from 1.06 eV to 1.7 eV according to the gallium fraction in the absorber layer. As a result of this feature, the solar spectrum can be best matched. In the presented work, the influence of the bandgap of the absorber is investigated using solar cell capacitance simulator (SCAPS). An optimum bandgap of 1.39 eV results in a maximum efficiency of 24.288%. In order to get a Cd-free CIGS thin film solar cell, In₂S₃ has been used as a buffer layer instead of CdS. The results show that In₂S₃ is a proper alternative that does not degrade the cell performance.