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Investigating spectral response of $CuIn_{1-x}Ga_xSe_2$ thin film solar cells by quantum efficiency measurements

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Quantum efficiency (QE) measurement is one of several methods used to investigate solar cell performance, especially the carrier collection. It indicates the amount of photogenerated current produced when a solar cell is illuminated by photons of a particular wavelength. In this study, a quantum efficiency measurement system was constructed and the $CuIn_{1-x}Ga_xSe_2$ (CIGS) – based thin film solar cells with different growth conditions were characterized. The results show an influence of differences in band gap energy on photocurrent collection. The changing in collected current and absorption edges can be observed. In addition, quantum efficiency measurement is used to identify the properties of each thin film layer comprising the devices. The current leakage due to a defective p-n junction leads to sharp drops in QE spectrum at some particular wavelengths. However, not only the basic quantum efficiency measurement was used but the lock-in amplifier technique was also applied to this system in order to enhance signal-to-noise ratio. The results of both techniques were compared and exhibited an improvement of data acquisition.

Summary

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