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Bias-Dependent Photoluminescence Analysis on InGaN/GaN MQW Solar Cells

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To obtain high conversion efficiency in InGaN-based solar cells, it is critical to grow high indium (In) composed InGaN layer for increasing sun light absorption wavelength rage. At present, most InGaN-based solar cells adopt InGaN/GaN multi-quantum-well (MQW) structure for high crystalline quality of InGaN with high In composition. In this study, we fabricated and compared the performances of two types of InGaN/GaN MQW solar cells which have the 15% (SC 15) and 25% (SC 25) of In composition at quantum well layer. Although both devices showed similar dark current density and leakage current, SC 15 showed better performance under AM 1.5G illumination as shown in Fig. 1. It is interesting to note that SC 25 showed severe current density decrease as increasing voltages. As a result, it lowered short circuit current density and fill factor of the device. However, SC 15 showed steady current density and over 75 % of fill factor. To investigate these differencesmore clearly, we analyzed their photoluminescence (PL) spectra under various applied voltages as shown in Fig. 2. At the same time, photocurrent, which was generated by PL excitation, was also measured as shown in Fig. 3. Further, we investigated the relationship between piezoelectric field and performance of InGaN based solar cell varying indium composition.

Keywords: InGaN, Solar cell, InGaN/GaN MQW solar cells

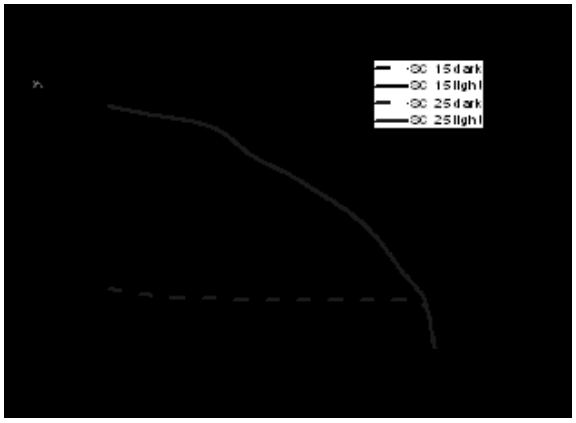

Fig. 1.

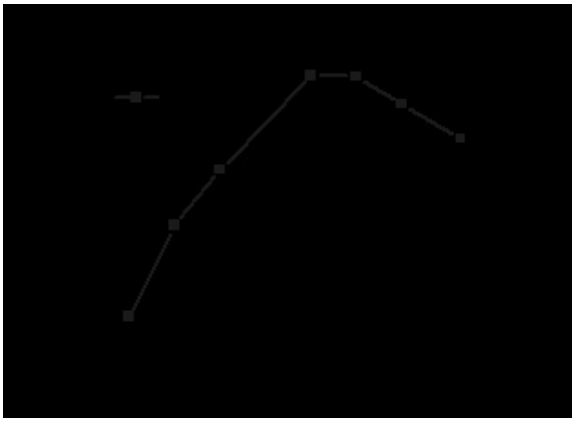

Fig. 2.

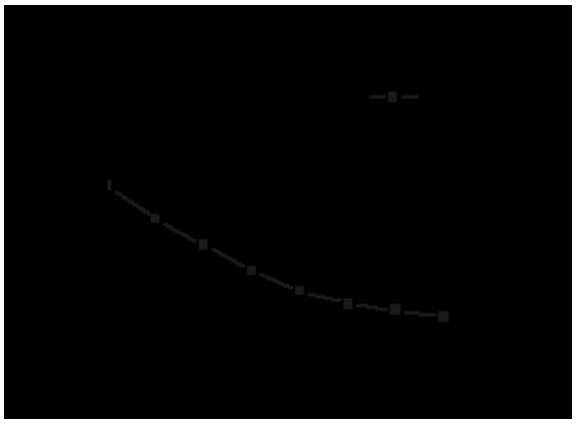

Fig. 3.