Simulation of a solar cell based on InGaN

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Abstract

The objective of this work is to study the transport of electrical charges in a solar cell based on InGaN. By varying the alloy composition, InGaN can reach all values of bandgap between 3.42 eV and 0.7 eV, which covers almost the entire solar spectrum. At present most of the studies of InGaN photovoltaics are conducted on hetero structures. The aim of this study is therefore to better understand the influence of each parameter of the solar cell for an improved optimization of performance. The yield obtained for a reference cell is 16.62% for optimal values of doping of the layers. For other parameters, such as generation and recombination, performance of the cell varies monotonically with these settings. It has been shown that solar cells based on InGaN have a very low diffusion length due to the dislocation density, with a carrier lifetime around 9.909 ns. However, the minority carrier transport is reinforced because of the bias field in the material. In addition, as the III nitrides have a high absorption coefficient, very thin layers of material are sufficient to absorb most of the light.

Keywords

- solar cell;
- InGaN;
- transport of electrical charges;
- PC1D