

NASA has an increasing interest in the development of advanced energy conversion devices with high radiation tolerance and the ability to operate in extreme environments (high and low temperatures and over wide temperature ranges). An example would be solar cells that can operate at high temperatures (up to 450°C) for near sun missions (< 0.2 AU). Despite large radiation tolerance and the potential to operate at high temperature, spontaneous and piezoelectric fields hamper electron transport in InGaN solar cells due to a strong potential barrier formed at their n-GaN/n-InGaN interface. This has reduced their effectiveness as an efficient, extreme environment solar cell solution. Our initial modeling efforts indicate that a graded InGaN junction has the capability to directly compensate for this phenomenon. The innovation of the approach is to utilize a graded GaN/InGaN p-n junction design to improve current transport across the semiconductor structures used in single element solar cells. We propose to optimize the design of the InGaN/GaN based solar cell structure through modeling of energy band diagrams and electrical characteristics. The optimized structure will be grown and a graded InGaN/GaN solar cell will be fabricated for temperature dependent performance testing to verify the viability of this approach.