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TCAD design and simulation of InGaN-based high temperature solar cells[1] YI FANG, Department of Physics, Arizona State University, DRAGICA VASILESKA, STEPHEN GOODNICK, School of Electrical, Computer and Energy Engineering — To improve the efficiency of concentrated solar power hybrid system, a photovoltaic (PV) solar cell with high efficiency and operated at high temperatures is needed. In that regard, InGaN material system provides a platform for high temperature PV solar cells since nitride based optoelectronics are demonstrated to operate at high temperatures (>400 °) and, thus, became the basis for high power, high temperature electronics. The direct and tunable band gap of InGaN semiconductor offers a unique opportunity to develop high efficiency solar cells. Considering these advantages, this work involves TCAD simulation and optimization for InGaN solar cell at high temperature. Monolithic and mechanical multi-junction solar cell designs are investigated, and showing promising efficiency under light trapping. Theoretical conversion efficiency of the best devices are larger than 26% at 450 ° with an incident solar radiation concentration of 200 suns. Thus, we demonstrate that 2J tandem solar cells made in InGaN material system are very suitable for concentrated solar power hybrid system.

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