Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Optimization of the Thermoelectric Effect in GaN-based Materials IAN FERGUSON, University of North Carolina at Charlotte, NA LU, UNC Charlotte — III-Nitride, primarily InGaN, based solar cells have gained importance owing to the band gap range from 0.7 eV to 3.4 eV covering most of the solar spectrum. However, to harvest further energy benefits other properties these materials such as the thermoelectric effects need to be investigated. Current research demonstrates that the electrical conductivity decreases and the Seebeck coefficient increases for GaN up to $\sim$ 1000K. The maximum power factor ($S^2\lambda$) for GaN is observed at 373K which is a typical temperature for solar cell operation. This paper will report a systematic study of GaInN-based materials to optimize the TE effect in these materials. This will be achieved by varying the indium concentration, the intelligent control dislocations and the incorporation of transition metals (Mn, Fe, Cu, etc.) to decouple σ/λ. For example, alloy disorder effectively scatters high frequency phonons, while low frequency phonons which are responsible for heat transfer through the material respond to boundary scattering. Consequently fine-grained materials exhibit a lesser thermal conductivity in comparison with single crystal structures. Growth of these materials will be performed using standard epitaxy techniques used in solar cell manufacturing.

Ian Ferguson
University of North Carolina at Charlotte

Date submitted: 07 Dec 2009 Electronic form version 1.4