NWS07-2007-000048

Abstract for an Invited Paper
for the NWS07 Meeting of
the American Physical Society

Good defect, bad defect: electronic properties of $CuGaSe_2$ solar cells

JENNIFER HEATH, Linfield College

The $Cu(In,Ga)Se_2$ (CIGS) alloys are promising materials for the absorber layer in solar cell devices. Single junction devices using CIGS absorbers have achieved 19.5% efficiencies. This is remarkable for a device with a thin film, non-crystalline absorber, and for this reason the CIGS electronic properties and especially the nature of defects and grain boundaries are of interest. In this talk, I will discuss several types of electronic defects in CIGS films: those that are beneficial—including defects that allow the material to be intrinsically doped; those that are neutral—apparently grain boundaries fall in this category; and those that may act negatively as traps and recombination centers, limiting device efficiencies. The higher Ga alloys have larger bandgaps, necessary for a multilayer tandem solar cell device. However, solar cells made from higher bandgap CIGS tend to perform more poorly than expected from studies of their low bandgap counterparts. We have studied a series of $CuGaSe_2$ solar cell devices, using techniques based on the measurement of capacitance including admittance spectroscopy and drive-level capacitance profiling, as well as current-voltage measurements as a function of temperature and illumination intensity. These studies allow us to better understand the limitations to device performance, and the population of sub-bandgap traps that are present in the CGS film. Our studies suggest that the p-n interface is particularly problematic in these devices.