**THE EFFECT OF GRAIN SIZE ON THE SEMICONDUCTING, ELECTRICAL, AND STRUCTURAL PROPERTIES OF ZINC OXIDE**

R. Mansourian *, GB. González Avilés
Department of Physics, DePaul University, Chicago, IL, USA

Zinc oxide (ZnO) has the potential to become the future choice for transparent electrodes in commercial applications replacing the current, more expensive indium-based materials. The effects of annealing temperature, duration of the heat treatment, and reduction atmospheres on the electrical properties of nano-ZnO samples were studied. Pellets of ZnO powder were pressed and fired at various temperatures and for different lengths of time followed by thermopower and four-point electrical conductivity measurements. Some pellets were then reduced under forming gas to introduce atomic defects in the structure and thereby increase their conductivity. The electrical properties of reduced pellets significantly improved. Each zinc oxide nano-powder batch was characterized using high-resolution x-ray diffraction, x-ray florescence, and scanning electron microscopy methods to ensure its purity and determine its particle size. *Ex situ* x-ray diffraction measurements provided valuable information about the average grain size, phase purity, and overall crystal structure of quenched pellets. The oxygen contents of the samples were additionally investigated using neutron diffraction. *In situ* synchrotron x-ray diffraction measurements were also performed at high temperatures and under reducing environments to investigate the kinetics of grain growth.