Optical Spectroscopy Study of ZnO and other nanowires
for Chemical sensor Application

Bin Chen[1], Jing Li[1], Houtee Ng[1] and Meyya Meyyapan[2]

Eloret Corporation[1]
Sunnyvale CA 94087

NASA Ames Research Center[2]
Moffett Field, CA 94035

Nanowire Optical Spectroscopy Study

One-dimensional nanostructural materials such as inorganic nanowires are expected to play an important role in improving the selectivity, sensitivity, stability and Integratability as well as reducing power consumptions. Understandings of the novel physical properties such as grain boundary and charge transfer of these nanostructures are critical to sensor miniaturization. Among these, zinc oxide (ZnO), a widely studied CHEMFET sensor in its bulk material, has excellent stability, sensitivity and relative low operation temperature.

Highly oriented ZnO nanowire is studied with Raman and photoluminescence spectroscopy. The high efficiency of the phonon and electron coupling enable us to observe up to 4th order of the Raman scattering. The Raman bandwidths and shifts were studied to reveal the difference in the nanowire orientation and interwire interaction. Similar nanowires with wurtzite structure, such as GaN, are also studied with photoluminescence spectroscopy to compare with the bounded exciton states. Quauntum confinement is reflected in the optical spectroscopy. The orientation of the nanowire relative to the substrate and the one-dimensional characteristics can be utilized for unique sensor application as nanowires sensor fabrication interplays with the material characterization. The application of those nanowires is explored with the O_2 absorption and CHEMFET characterization in different gas environments such as methane, ammonia, nitrogen dioxide and carbon monoxide and carbon dioxide. Preliminary results from other nanowire such as Ga_2O_3, In_2O_3, CdO, InN and GaN will also be discussed.