Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Sensing gas molecules using graphitic nanoribbon films and networks YANBIN AN, JASON L. JOHNSON, ASHKAN BEHNAM, S.J. PEARTON, ANT URAL, University of Florida — We fabricate and study the gas sensing properties of graphitic nanoribbon (GNR) films and networks consisting of multi-layer graphene nanoribbons with an average width of 7 nm. We experimentally demonstrate the high sensitivity of these films and networks for sensing gas molecules at the parts-per-million (ppm) level, in particular hydrogen and ammonia. The sensing response exhibits excellent repeatability and full recovery in air. Furthermore, our results show that functionalization by metal nanoparticles could significantly improve the sensitivity. We characterize the sensing response at various temperatures, gas concentrations, recovery ambients, and film thicknesses. We find that the relative resistance response of the GNR films shows a power-law dependence on the gas concentration, which can be explained by the Freundlich isotherm. The activation energy obtained from the sensing experiments is consistent with the theoretical calculations of the adsorption energies of gas molecules on graphene sheets and nanoribbons. Their simple and low-cost fabrication process and good sensing response open up the possibility of using graphitic nanoribbon films and networks for large-scale sensing applications.

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Date submitted: 22 Dec 2010 Electronic form version 1.4