Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

A high performance humidity sensor based on dielectric detection with a novel coaxial nanostructure[1] DONG CAI, HUAIZHOU ZHAO, BINOD RIZAL, TIMOTHY KIRKPATRICK, ZHIFENG REN, MICHAEL J. NAUGHTON, THOMAS C. CHILES, Boston College — High throughput coaxial nanocavity arrays are developed by overlaying porous Al_2O_3 and Al layers on vertically aligned carbon nanotube arrays. The porosity of Al_2O_3 was electrochemically characterized. The dielectric properties of the nanocoax structure were measured by impedance spectroscopy, from 10 mHz to 1 MHz. The capacitance of the sensor responded to humidity applied to the chip, *i.e.* soaking the array with water increased the capacitance by 130%. The detection mechanism was established for sensing changes to the dielectric constant due to adsorbed moisture in the porous Al_2O_3 coax annulus, with theoretical calculations based on the Clausius-Mossotti equation in agreement with the measurements. Highly sensitive humidity detection was demonstrated by applying relative humidity between 0.1% and 100%, with a power-law response, $RH \sim x^{\alpha}$. This nanocoaxial structure thus offers the possibility of unprecedented performance of porous Al_2O_3-mediated capacitancer sensing for humidity detection.

[1]The National Cancer Institute CA137681, the Department of Navy, the National Science Foundation PHY-0804718, and the Seaver Institute. Emails: caid@bc.edu; naughton@bc.edu

Dong Cai
Boston College

Date submitted: 17 Nov 2010 Electronic form version 1.4