

Abstract Submitted
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A high performance humidity sensor based on dielectric detection with a novel coaxial nanostructure¹ 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 Al₂O₃ and Al layers on vertically aligned carbon nanotube arrays. The porosity of Al₂O₃ 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 Al₂O₃ 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 Al₂O₃-mediated capacitance sensing for humidity detection.

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