

Abstract Submitted  
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**Toward Quantifying the Electrostatic Transduction Mechanism in Carbon Nanotube Biomolecular Sensors** MITCHELL LERNER, NICHOLAS KYBERT, RYAN MENDOZA, JENNIFER DAILEY, A.T. CHARLIE JOHNSON, University of Pennsylvania — Despite the great promise of carbon nanotube field-effect transistors (CNT FETs) for applications in chemical and biochemical detection, a quantitative understanding of sensor responses is lacking. To explore the role of electrostatics in sensor transduction, experiments were conducted with a set of similar compounds designed to adsorb onto the CNT FET via a pyrene linker group and take on a set of known charge states under ambient conditions. Acidic and basic species were observed to induce threshold voltage shifts of opposite sign, consistent with gating of the CNT FET by local charges due to protonation or deprotonation of the pyrene compounds by interfacial water. The magnitude of the gate voltage shift was controlled by the distance between the charged group and the CNT. Additionally, functionalization with an uncharged pyrene compound showed a threshold shift ascribed to its molecular dipole moment. This work illustrates a method for producing CNT FETs with controlled values of the turnoff gate voltage, and more generally, these results will inform the development of quantitative models for the response of CNT FET chemical and biochemical sensors. As an example, the results of an experiment detecting biomarkers of Lyme disease will be discussed in the context of this model.

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