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Conductance switching in carbon nanotube transistors induced by electrochemical reactions JAAN MANNIK, BRETT R. GOLDSMITH, ALEXANDER A. KANE, PHILIP G. COLLINS, Department of Physics and Astronomy, University of California Irvine, Irvine, CA 92697-4576 — Carbon nanotube transistors provide a promising architecture for studying biomolecular dynamics at the single molecule level. To achieve this goal, single bioactive molecules must be integrated into the circuits in a controllable and reliable way. While techniques can be borrowed from bulk chemical functionalization, we focus on the controlled production of a single, chemically-functional site on the sidewall of an operational nanotube transistor circuit. Our approach allows real-time, in situ monitoring of electrical signals from the transistor in order to discern reaction events. Using an electrochemical cell biased under oxidizing or reducing conditions, we have observed sharp, reversible conductance switching events consistent with single-site reactions. The reactions have well-defined electrochemical thresholds, which provides an electronic means to control their production. The dynamics of the switching events, including the rates and degree of reversibility, changes in different electrolyte solutions. This work is partly supported by NSF grant EF-0404057.

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