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High Frequency Rectification by Carbon Nanotube Schottky Diodes[1] ENRIQUE D. COBAS, STEVEN M. ANLAGE, MICHAEL S. FUHRER, Center for Nanophysics and Advanced Materials, University of Maryland, College Park, MD 20742-4111, USA — Carbon nanotubes (CNTs) display many properties that make them appealing for RF electronics, including room-temperature mean-free paths approaching 1 μm and a carrier mobility of 10^5 cm^2 / Vs. Further, small junction capacitances on the order of 10 aF promise cut-off frequencies approaching 1 THz, but high impedances make microwave measurements of individual CNTs challenging. We have fabricated single and few-tube CNT Schottky diodes on high-frequency compatible substrates and measured their ac rectification as a function of dc bias, ac power and frequency, up to 40 GHz. The bias dependence of the cut-off frequency is used to extract the effective junction capacitance for diodes of various channel lengths. This capacitance is found to have a weak dependence on applied bias and a strong relation to channel length. Electrostatic simulations corroborate that stray capacitance from the 1D channel to the metal electrode dominates over the effect of carrier depletion near the junction. The results demonstrate that chottky rectification is a viable method of probing transport in high-impedance semiconducting nanostructures.

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