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Impedance Spectroscopy, High Frequency Scanning Gate Microscopy and Local Memory Effect of Carbon Nanotube Transistors CRISTIAN STAII, Department of Physics and Astronomy, University of Pennsylvania, RUI SHAO, DAWN A. BONNELL, Department of Material Science and Engineering, University of Pennsylvania, ALAN T. JOHNSON, Department of Physics and Astronomy, University of Pennsylvania — Successful implementation of carbon nanotube field effect transistors (CNFETs) as nanoelectronic devices requires reliable techniques for the characterization of their local electronic properties. At low frequencies, this goal was achieved by using recently developed scanning probe techniques such as Scanning Gate Microscopy (SGM). The extension of these techniques to high frequency is important because, although the low frequency performance of CNFET has been greatly improved, little is known about their high frequency behavior. We will present impedance characteristics of CNFET devices for ac-frequencies up to 15MHz. We also extend SGM to frequencies up to 15MHz, and use it to image changes in the impedance of CNFET circuits induced by the SGM-tip gate. Results of both experiments are consistent with a simple RC parallel circuit model of the CNFET, with a time constant of 0.3 microsec. We also use the tip gate to show that charge injection from the single wall nanotube into the substrate, which is responsible for the memory effect, can be induced at specific locations along the tube length. This result is a strong indication that CNFET-based memory cells may be miniaturized to dimensions far below the micrometer scale of current devices.

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