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Noise in single-wall carbon nanotubes under high electric field stress CURT RICHTER, Semiconductor Electronics Division, NIST, OANA JURCHESCU, Dept of Physics, Wake Forest Univ, XUELEI LIANG, Dept of Electronics, Peking Univ, DAVID GUNDLACH, Semiconductor Electronics Division, NIST, ALBERT LIAO, ERIC POP, Micro & Nanotechnology Lab, Dept of ECE, Univ. Illinois Urbana-Champaign — We characterized the noise properties of field effect transistors made from individual semiconducting single-walled carbon nanotubes (CNTs) under high electric field stress to probe scattering mechanisms during avalanche and self-heating conditions. Single-walled CNTs were grown from patterned Fe catalyst by CVD on oxidized p-doped Si wafers which serve as a back gate. Pd source/drain (S/D) contacts were used to form devices ranging in length from 1 μm to 4μm. $1/f$ noise measured at room temperature in air shows conventional changes in amplitude as a function of gate voltage and low S/D voltages. As the S/D bias on the CNTs increases, we observe an unexpected increase in noise at $\approx$3 V. This change occurs at fields and voltages below those necessary to induce avalanche generation of free electrons and holes. Thermal modeling reveals that the average temperature of the CNTs reaches $\approx$370 K when the noise behavior increases, which is consistent with oxygen desorption. Thus, our measurements and modeling provide insight into noise at high field in CNTs, uncovering the role of changes in doping and threshold voltage at high operating temperature.

Curt Richter
Semiconductor Electronics Division, NIST

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