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Noise Characterization of Semiconductor Nanowires C.A. RICHTER, H.D. XIONG, Semiconductor Electronics Division, NIST, V.M. STANFORD, Information Access Division, NIST, WENYONG WANG, XIAOXIAO ZHU, SED, NIST, QILIANG LI, Elect. and Comp. Engn, George Mason University, WOONG-KI HONG, TAKHEE LEE, Mat. Sci. and Engn, Gwangju Institute of Sci and Technology, Korea — A thorough understanding of the noise properties of emerging nanoelectronic devices such as those based on semiconductor nanowires is critical because the signal-to-noise ratio is a fundamental factor limiting their performance. We present the systematic characterization of the low frequency noise properties of Si and ZnO semiconductor nanowire field effect transistors. At room temperature, the noise power spectra have a classic 1/f dependence while random telegraph signals (RTS's) are observed in the drain current at 4.2 K leading to a Lorentzian type noise spectra. The RTS's are characterized by estimating a hidden Markov model based on a Gaussian mixture, and quantified using a Viterbi decoder to measure the discrete current switching events. This analysis enables the estimation of parameters such as event lifetime, event amplitudes, and trap cross-section. Under some conditions, three-level switching is observed that can be attributed to two near-interface oxide traps. These data illustrate that the characterization of two- and multi-level RTS's is a valuable tool to determine the energetic and spatial position of individual defects in semiconductor nanoelectronic devices.

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