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Understanding 1/f noise in carbon nanotube devices YU-MING LIN, JOERG APPENZELLER, IBM T. J. Watson Research Center, JOACHIM KNOCH, Forschungszentrum Juelich, ZHIHONG CHEN, PHAEDON AVOURIS, IBM T. J. Watson Research Center — Nanotubes and nanowires provide an ideal platform to study the electronic behavior of low-dimensional systems. Although a great deal has been learned about the electronic properties of nanotubes and nanowires, little is known about their noise characteristics. We have characterized the 1/f noise behavior of nano-devices consisting of individual single-walled semiconducting carbon nanotubes. Two types of carbon nanotube field-effect transistors (CNFETs) are fabricated and investigated in order to distinguish between the impacts of the contact and bulk channel on the noise. The first type of CNFET is a back-gated device where the conductance is entirely modulated by the Schottky barriers (SBs) at the nanotube/metal interfaces, while the second type of CNFET incorporates an additional gate electrode so that the device switching can be achieved through the bulk channel of the nanotube. We have also fabricated SB-CNFETs with very different channel lengths using a *single* nanotube in order to elucidate the impact of scattering on $1/f$ noise. The results indicate that that $1/f$ noise in a 1D system with quasi-ballistic transport behavior provides a measure of the total number of transport carriers in the channel. Morover, the intrinsic $1/f$ noise amplitude of individual single-walled carbon nanotube is, in fact, not larger than that of most bulk materials.

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