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Miniature Organic Transistors with Carbon Nanotubes as Quasi-One-Dimensional Electrodes. PENGFEI QI, ALI JAVEY, MARCO ROLANDI, QIAN WANG, ERHAN YENILMEZ, HONGJIE DAI, Stanford University — As the dimensions of electronic devices approach those of molecules, the size, geometry and chemical composition of the contact electrodes play increasingly dominant roles in device functions. It is shown here that single-walled carbon nanotubes (SWNT) can be used as quasi one-dimensional (1D) electrodes to construct organic field effect transistors (FET) with molecular scale width (about 2 nm) and channel length (1 to 3 nm). An important feature owing to the quasi 1D electrode geometry is the favorable gate electrostatics that allows for efficient switching of ultra-short organic channels. This affords room temperature conductance modulation by orders of magnitude for organic transistors that are only several-molecules in length, with switching characteristics superior to similar devices with lithographically patterned metal electrodes. With nanotubes, covalent carbon-carbon bonds could be utilized to form contacts to molecular materials. The unique geometrical, physical and chemical properties of carbon nanotube electrodes may lead to various interesting molecular devices.

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