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One-Dimensional Carbon Nanotube Electrodes CARLA AGUIRRE, BENOIT ST. ANTOINE, Departement de Genie Physique, Ecole Polytechnique de Montreal, MATHIEU PAILLET, Departement de Chimie, Universite de Montreal, PATRICK DESJARDINS, Departement de Genie Physique, Ecole Polytechnique de Montreal, RICHARD MARTEL, Departement de Chimie, Universite de Montreal —
The study of the transport properties of organic semiconducting materials has been limited by the lack of suitable electrical contacts. Inappropriate charge injection at the electrode - organic semiconductor interface results in large contact resistances that often dominate device performance. We describe a strategy for circumventing charge injection barriers by using 1D metallic carbon nanotube electrodes. The favorable electrostatics at the tip of an individual carbon nanotube allows for efficient field assisted charge injection into organic semiconducting layers. A detailed finite element numerical study has allowed us to determine the scaling parameters required to optimize the performance of carbon nanotube electrodes. We present experimental results for pentacene organic thin-film transistors connected using individual metallic carbon nanotube source and drain contacts. Different gate oxide thicknesses (20 - 100 nm), channel lengths (2 - 100 nm) and carbon nanotube diameters (1 - 3 nm) were explored using experimental and numerical techniques.

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