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Semiconducting Enriched Carbon Nanotube Aligned Arrays of Tunable Density and Their Electrical Transport Properties[1] SAIFUL I. KHONDAKER, Nanoscience Technology Center, Department of Physics, School of Electrical Engineering and Computer Science, University of Central Florida, BIDDUT K. SARKER, SHASHAK SHEKHAR, Nanoscience Technology Center, and Department of Physics, University of Central Florida — Many proposed applications of semiconducting single walled carbon nanotubes (s-SWNT) require massively parallel array as they can average out inhomogeneity of individual tubes, provide larger on- currents and better transistor properties. Here, we report assembly of solution processed semiconducting enriched (99%) SWNT in an array with varying linear density via ac-dielectrophoresis and investigate electronic transport properties of the fabricated devices. We show that (i) the quality of the alignment varies with frequency of the applied voltage and that (ii) by varying the frequency and concentration of the solution, we can control the linear density in the array from 1 to 25 s-SWNT/μm. We found that with increasing nanotube density the device mobility increases while the current on-off ratio decreases dramatically. For the dense array, the device current density was 16 μA/μm, on-conductance was 390 μS, and sheet resistance was 30 kΩ/. These values are the best reported so far for any semiconducting nanotube array. Our study will have important implications in fabricating high quality devices for digital and analog electronics.

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