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Self-Assembled, Self-Aligned Carbon Nanotube Thin Film Transistors MICHAEL ENGEL, JOSHUA SMALL, YU-MING LIN, IBM T. J. Watson Research Center, ALEX GREEN, MARK HERSAM, Northwestern University, PHAEDON AVOURIS, IBM T. J. Watson Research Center — Carbon nanotube field effect transistors possess superb device characteristics for electronic applications. However, the non-selective nature of nanotube synthesis, difficulty in accurate nanotube placement, and the high device impedance of single tube devices pose major challenges in the integration of carbon nanotubes in large-scale electronic devices. Here we present a novel approach to address these issues. Carbon nanotubes used in this study have been purified and separated by their electronic structure, where the semiconducting tube percentage is as high as 99%, confirmed by both transport measurements on individual nanotubes and by optical absorption spectra. Through a simple self-assembly technique, we have produced aligned nanotube arrays. Thin film transistors based on these aligned nanotube arrays are fabricated with both back- and top-gate layouts, showing good switching performance and a high drive current. It is found that top-gated and back-gated devices exhibit distinct switching behaviors due to screening effects. Results on device channel length dependence will also be presented.

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