

## NANO HIGHLIGHT

### Large Scale, Horizontally Aligned Arrays of Single Walled Carbon Nanotubes for Flexible Thin Film Transistors

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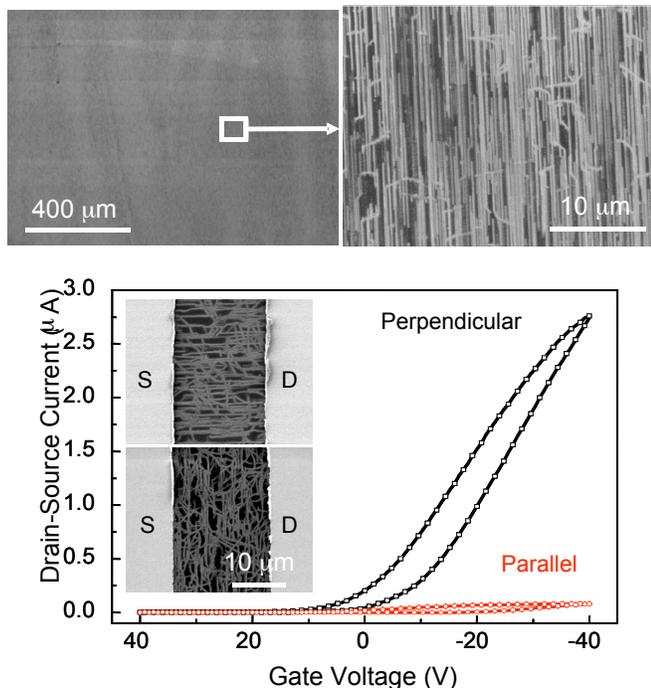
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The excellent electronic properties of single-walled carbon nanotubes (SWNT) together with the ability to deposit them from solution onto plastic and other unusual device substrates make them well suited for use in large area distributed electronics. These systems have potential applications in structural health monitors, flexible displays, steerable antennas and other devices. Large scale, horizontally aligned arrays of pristine SWNTs can provide high quality effective thin film semiconductors for devices such as thin film transistors (TFTs). The two main challenges for an approach are to (1) generate large quantities of semiconducting SWNTs without any metallic SWNTs and (2) create horizontally aligned, close packed arrays of SWNTs. Our research in the last year produced solutions to both of these problems.<sup>1-3</sup> Here we highlight a simple procedure for generating, over large areas, well aligned arrays of pristine SWNTs. The technique relies on guided chemical vapor deposition of tubes onto single crystal quartz substrates that have some degree of miscut. Figure 1 shows images of arrays grown in this manner.

The format of these arrays allows easy integration into devices; we demonstrated this capability through the fabrication of high performance TFTs, as illustrated in Fig. 1. These arrays will be valuable for a range of emerging applications that use large collections of SWNTs as thin film type electronic materials.

#### References:

- [1] For further information about this project email jrogers@uiuc.edu
- [2] C. Kocabas, S.-H. Hur, A. Gaur, M. Meitl, M. Shim and J.A. Rogers, "Guided Growth of Large Scale, Horizontally Aligned Single Walled Carbon Nanotubes and Their Use in Thin Film Transistors," *Small* 1(11), 1110-1116 (2005).
- [3] C.J. Wang, Q. Cao, T. Ozel, A. Gaur, J.A. Rogers and M. Shim, "Electronically Selective Chemical Functionalization of Carbon Nanotubes: Correlation Between Raman Spectral and Electrical Responses," *Journal of the American Chemical Society* 127(32), 11460-11468 (2005).



**Figure 1.** Large scale, horizontally aligned arrays of carbon nanotubes (top images) represent a high performance type of effective thin film semiconductor for applications in electronic devices such as transistors (bottom images and graphs).