

Sensing Individual Carbon Nanotube Emissions

Probe for mapping field emission from individual vertically aligned carbon nanofibers and nanotubes

Carbon nanofibers (CNFs) and nanotubes (CNTs) have been shown in many studies to be candidates for use as cold cathodes for electron field emission (FE) applications. During the past few years, prototype microelectronic devices based upon these materials also have been demonstrated. Vertically oriented CNFs and CNTs grown on a substrate are potentially promising FE materials due to the modest FE turn-on field that should result from a high geometric field enhancement factor.

FE studies performed by other researchers of films containing closely, but randomly, spaced vertically oriented CNFs and CNTs fail to elucidate the FE properties of individual emitters due to their close

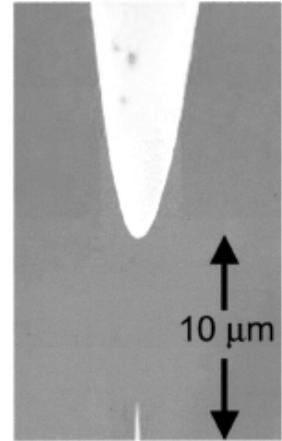
proximity to each other in these films. A moveable probe $\sim 2 \mu\text{m}$ in diameter was developed to enable measuring the FE properties of individual vertically aligned carbon nanofibers (VACNFs) provided that they are separated sufficiently from each other such that the electric field from the probe (anode) is negligibly weak at neighboring nanofibers, thus providing data that are not available from large nonimaging flat-plate anodes typically used by others. More details may be found in the following reference: Baylor, L. R., et al., J. Appl. Phys., **91** (7), 4602-4606 (2002)

Features:

- **Individual carbon nanostructure measured for field emission**
- **First of a kind measurements**
- **Diagnostic and research tool**

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Separate SEM images of the moveable probe and a VACNF combined with proper scaling to show the configuration for the measurements, with the probe at a height of 10 mm above the substrate surface.

