

MATERIALS AND STRUCTURES SYMPOSIUM (C2)  
Specialised Technologies, Including Nanotechnology (8)

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ROBUST CNT FIELD EMITTERS FOR HARSH ENVIRONMENT ELECTRONICS

**Abstract**

Methods to root carbon nanotubes (CNTs) on conductive substrates were developed to enable robust diode and triode operation at high temperatures. The present method that shows the most promise involves flipping CNTs grown on optically flat silicon, anchoring them onto a new substrate upside-down, and transfer from the silicon. Multiple methods of attaching the CNTs to the new substrate were investigated, including copper tape, conductive epoxies, and metals, each method with its own benefits. Transfers using adhesives and epoxies are easy to reproduce and give high yields, however these materials are limited in the desired vacuum and high temperature applications. Room temperature field emission properties of these samples are impressive, with both low threshold fields and high values of . While the processes are the most challenging to develop reliably for metal-based transfers, these are the materials that would enable the highest temperature operation. Furthermore, several of the flipped-CNT samples onto titanium dies coated in copper show incredible field emission properties, displaying ultra-low threshold fields and extremely high values of . With the development of these robust cathodes, they were assembled and packaged into fully functioning CNT-based diodes and triodes.