Batch Fabrication of Nanotube Transducers

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Abstract

Relative displacements between the atomically smooth, nested shells in multiwalled carbon nanotubes (MWNTs) can be used as a robust nanoscale motion enabling mechanism for transduction applications such as bearings, switches, GHz-oscillators, shuttles, memories, syringes and actuators. Here we report on a batch fabrication paradigm suited for structuring large arrays of MWNTs into such devices in a parallel fashion. This effort is enabled by the synergistic integration of several key processes that include dielectrophoretic assembly of individual nanotubes onto nanoelectrodes, site selective shell engineering using electric breakdown with heat dissipation modulation using nanomachined heat sinks, and on-chip characterization. We anticipate this approach to enable the manufacturability of future nanoelectromechanical systems (NEMS) with sophisticated architectures.

Keywords

Carbon nanotubes, transducers, nanofabrication, nanoassembly, NEMS