The Royal Academy of Engineering

Research Fellows

Next Generation Electronics using Carbon Nanotubes

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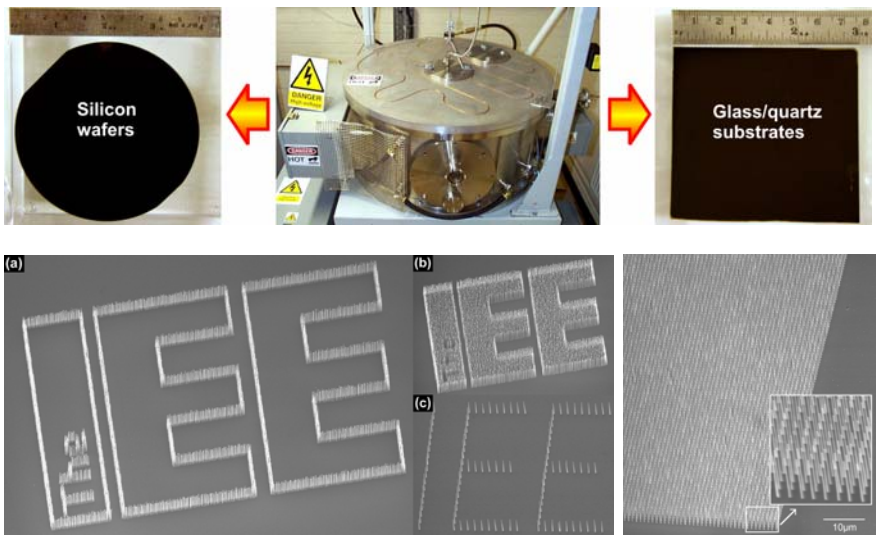
Introduction

Carbon nanotubes (CNT) are a building block for the 'nano-electronics' age. CNT have high electrical conductivity ($10^{-6}\Omega$m), thermal conductivity (1750-5800W/mK), mechanical strength (60GPa), are chemically inert, and can be semi-conducting (for single wall nanotubes) or semi-metallic.

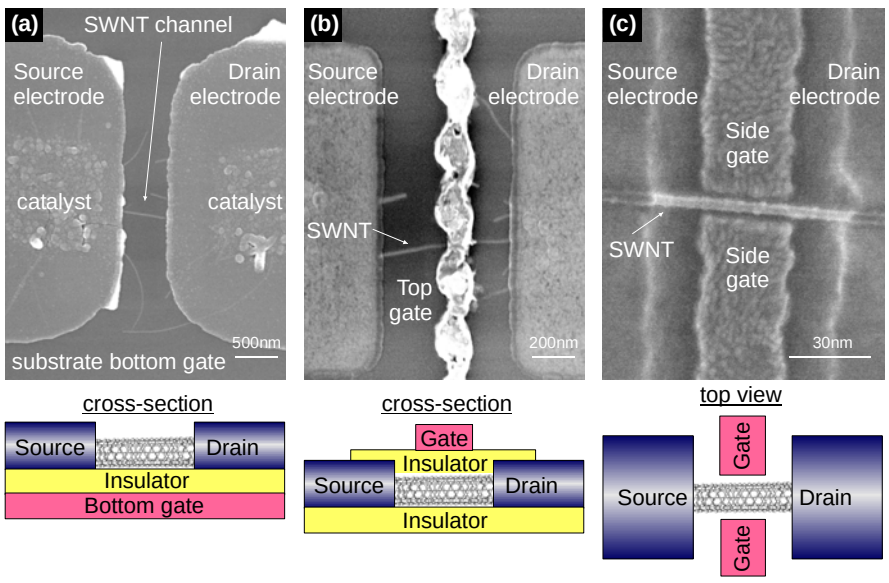
Wafer-scale Production of CNT

A tool has been developed which is capable of controlled deposition of CNT of different morphologies, including single and multiwall CNT, horizontal and vertical, with controlled length and diameter.



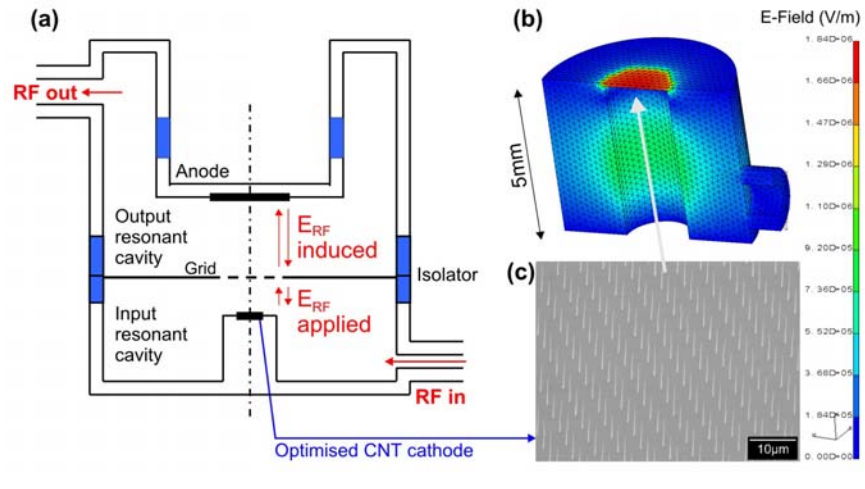
Solid State CNT FET Devices

Three important configurations of CNT Field Effect Transistors have been demonstrated – bottom gate, top gate and side gate. These devices have excellent on-off ratio (10^5-10^6), high on current densities (10^8-10^9A/cm^2) and sub-threshold slope (60-70mV/dec).



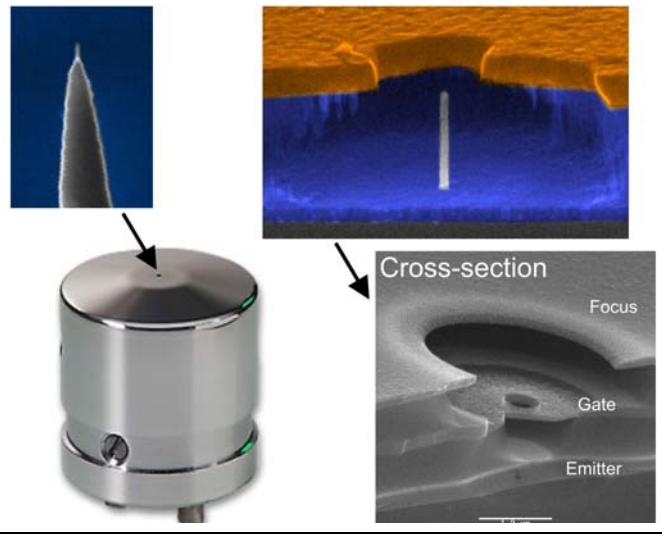
Microwave CNT Diode/Triode

CNT cold field emitters can be directly modulated at GHz frequencies. A 1.5GHz diode and 32GHz triode have been demonstrated. This technology increases the efficiency and enables the miniaturisation of microwave tubes used today for telecommunications and radar.



CNT Electron Gun

CNT electron sources have low energy spread (0.2-0.35eV), good stability (0.5%), low noise (0.2%) and high brightness (10^9A/srm^{2}V). The electron gun can be made using a CNT grown at the end of a tungsten needle or microfabricated on a silicon wafer.



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