Chemical vapor deposition of single-walled carbon nanotubes using ethanol and water as carbon feedstock

Technology #m06-003

“Lead Inventor: Stephen O’Brien

Carbon nanotube production without carbon monoxide or external electric field: Carbon nanotubes (CNTs) have unique structural, electronic and optical properties applicable to a range of applications. Single-walled carbon nanotubes (SWNTs) have important electrical properties not found in multi-walled carbon nanotubes (MWNTs). Both metallic and semiconducting SWNTs have electrical characteristics comparable to the best electronic materials available. But manufacturability issues have been an obstacle to the widespread commercialization of CNT technology. Affordable synthesis techniques compatible with existing semiconductor manufacturing processes are needed. These techniques must produce high quality SWNTs and have good control over the placement, orientation, length and direction of the nanotubes. This invention addresses all of these issues.

Growth of carbon nanotubes using heated lithographically patterned metal catalyst film: This invention details a method for growing high purity single-walled carbon nanotubes by chemical vapor deposition. The process is simple, cheap, clean and precise. Unlike another technique, this process does not use an external electric field during growth, which can be very complicated for large-scale manufacturing. Unlike the “fast heating” technique which uses carbon monoxide as the carbon feedstock, this process uses ethanol and water to produce clean CNTs. This process can produce long, well defined SWNTs with good size uniformity. The tube length, orientation and location can be controlled. This is accomplished by growing the nanotubes from nanoparticles obtained from heating a lithographically patterned metal catalyst film.

Applications: This technology can be used in the production of nanotube-based devices such as field effect transistors (FETs), sensors, optoelectronic devices, field emission devices and biomedical devices. It can also be used to produce CNTs for conductive nanocomposite polymers, SWNT thin films for displays, solar cells, batteries and fuel cells.

Advantages: • High quality, low cost SWNTs • Ability to produce long CNTs • Precise placement • Length, radius, orientation and direction control • Compatible with any substrate (for example: silicon, silicon nitride, quartz) • Compatible with existing semiconductor processes • CNTs can be suspended across posts and slits.

Opportunity: STV is actively seeking licensing partner(s) who will develop and/or market the proposed technology.

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Licensing Status: Available for Licensing and Sponsored Research Support”
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