'Revolutionary' Nanotube Growth Method Devised

CAMBRIDGE, England, Aug. 21, 2006 -- A new method of growing carbon nanotubes is predicted to revolutionize the implementation of nanotechnology and the future of electronics. Researchers at the University of Cambridge have successfully grown carbon nanotubes at a temperature that permits their full integration into present CMOS technology (350 ºC).

Carbon nanotubes are the driving force for current advances in nanotechnology. They have excellent mechanical and electronic properties, which make them extremely attractive for next-generation electronics. Increasing efficiency through smaller components is key for the miniaturization of technology. The use of carbon nanotubes could find uses from sophisticated, niche applications to everyday electronics, such as mobile phones and computers.

Until now, the growth of nanotubes has been carried out at very high temperatures, and growth below 500 ºC was believed impossible -- making the direct implementation of nanotubes into electronic devices unthinkable. Trying to integrate nanotubes above 400–450 ºC would in fact damage the intermetal dielectrics commonly employed in CMOS device fabrication.

A group of researchers at the University of Cambridge's engineering department, led by Mirco Cantoro, Stephan Hofmann, Andrea Ferrari and John Robertson, in collaboration with colleagues at the Cambridge Hitachi Laboratory and the Department of Materials Science, University of Cambridge, succeeded in growing single-wall carbon nanotubes at temperatures as low as 350 ºC. These nanotubes, grown by thermal chemical vapor deposition (a chemical process often used in the semiconductor industry), are promising candidates for integration into existing nanoelectronic devices.

This result also sheds new light on the possible mechanisms that occur during carbon nanotube growth. Previously, the assumption that the catalyst has to be liquid often dominated carbon nanotube growth model considerations; but at these lower temperatures, evidence has been found of a solid catalyst. The findings extend to the catalytic growth of other nanostructures in general.

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