



Method of Growth of Branched Carbon Nanotubes and Devices Produced from the Branched Nanotubes

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This invention is a method of producing Y-junction carbon nanotubes. An alumina template with branched growth channels is produced after which individual Y-junction carbon nanotubes are grown directly by pyrolysis of acetylene using cobalt catalysis. The use of a branched growth channel allows the natural simultaneous formation of a very large number of individual but well-aligned three-port Y-junction carbon nanotubes with excellent uniformity and control over the length and diameter of the "stem" and "branches" separately. These Y-junctions offer the nanoelectronics community a new base material for molecular scale electronic devices including, for example, transistors and rectifiers.

TECHNOLOGY

Carbon nanotubes have emerged as promising candidates for nanoelectric devices because of their unique electronic properties. They exhibit either metallic or semiconducting behavior depending on the diameter and helicity of the tubes and can conduct current ballistically with little heat dissipation.

These properties have recently gained great interest in forming nanotube two-way or three-way heterojunctions between different tubes for use as building blocks in nanoelectric devices. However, this will be difficult to achieve using conventional carbon nanotube growth methods since the straight tube structure cannot be controllably altered along its length. Ideas for post-growth modifications have been advanced in the literature, but are hard to implement in practice and are prone to defects.

The ability to create devices on the scale of nanometers is a goal sought by many. One class of nanostructures, which hold great promise for molecular scale devices are carbon nanotubes. In order to form electron devices based on these structures, mainly theoretical proposals have been advanced on ways to obtain heterojunctions between different nanotubes. However, this is difficult to achieve with conventional nanotube fabrication methods, all of which produce simple straight tubes.

This invention provides a method for growing branched carbon nanotubes. An advantage to this method is that it allows for the production of a very large number of individual but well-aligned three-port Y-junction carbon nanotubes with excellent uniformity and control over the dimensions of the tube.

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