Multi-Terminal Junctions of Carbon Nanotubes: Architecture, Synthesis and Functionalities

Leonid A. Chernozatonskii *

Institute of Biochemical Physics, Russian Academy of Science, Kosygin st. 4 119991 Moscow, Russia

In recent time the building of âĂIJnanonetâĂİ from carbon nanotubes (CNTs) have been very important in nanoelectronics, and mechanical applications. Connecting different CNTs to form more than two terminal nanotube heterojunctions have been proposed as early in 1992 (L. Chernozatonskii, G. Scuseria). Between them high-yield fabrication of Y-junctions have been obtained by using template-based chemical vapor deposition (CVD), and pyrolis of organometallic precursor. Ii this report it will be considered: - architectonics of planar Y (âĂIJfolkâĂİ-, âĂIJslingshotâĂİ-, âĂIJboughâĂİ- types), T, and 3-dimentional junctions which require the presence of topological defects in the form of pentagons, heptagons and octagons, the relationship between the number of defect rings and number of branches; - energy optimization different types of Y-junctions (metal or semiconductor branches and stem, symmetric or asymmetric branches) and four-terminal junctions using the molecular-dynamic methods; - synthesis of junctions of single-walled and multi-walled nanotubes (CVD, template-based CVD, welding, pressure-temperature treatment, and procedure based on the decomposition of C in the presence of transition metals); - the growth mechanism of in developing template-based CVD and pyrolis techniques, and the mechanism of formation X-,Y- and T-types of junctions with covalent linked nanotubes and welding nanotube junction formation; - the effects of the switches and rectifications and other nonlinear I-V characteristics of Y-junctions, including covalent bonded CNT junctions; - mechanical properties of the Y-junctions: behavior of the carbon nanotube âĂIJforkâĂİ,T and âĂIJboughâĂİ junctions with a length of up to a few tens of nanometers and an acute angle between the branches under the action of an external load; - applications (the molecular switches can easily function as three-terminal bistable switches that are controlled by a control or âĂIJgateâĂİ voltage applied at a branch terminal, this effect can be used in logic circuits; the effects of spring, sticking and temperature opening of Y- junctions can be used in different nanomechanical and nanoelectromechanical devices).

* Corresponding author. Tel. 7 495 1378347. FAX 7 495 1374101.
Email address: cherno@sky.chph.ras.ru (Leonid A. Chernozatonskii).