Formation pathway and transport properties of carbon nanotube T-junctions

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The carbon nanotube junctions have recently emerged as excellent candidates for use as building blocks in the formation of nanoscale electronic devices. In particular, in a three-terminal junction, the third terminal could be used for controlling the switching mechanism, power gain, or other transisting applications that are needed in any molecular electronic circuit. Recent experimental works have demonstrated the feasibility of using controlled electron irradiation in tailoring the junction geometry to create desired multiterminal junctions of nanotubes [1].

Using tight-binding molecular dynamics simulations we illustrate the formation of single wall carbon nanotube T-junctions through an energetically efficient pathway in which all atoms maintain the sp^2 arrangement throughout. Different combinations of nanotubes (metallic and semiconducting) are considered. We further report I-V characteristics of the thus formed junctions. For example, when we chose stem as semiconductor and crossbar as metal this T-junction show asymmetric I-V behavior.

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[1] M. Terrones et. al., Phys. Rev. Lett., Vol. 89, 075505 (2002).