Electronic Properties of Carbon Nanotubes

oudjertli salah

Abstract : Theoretical calculations predicted that carbon nanotubes were to present a metal behavior or semiconductor following their diameter and their chirality, these properties of conduction have inherited the structure of a particular band of graphite. Consequently, a limited number of wave vectors are allowed in this direction, It depends on the diameter and the winding of the graphene sheet on itself. If the edge conditions include the corners of the Brillouin zone, the behavior of the nanotube is metallic, this is the case for all “chair” type nanotubes and a third of “chiral” and “zig-zag” nanotubes. In other cases, the band structure has a bandgap, as a first approximation, inversely proportional at the radius of the nanotube. In addition, STM makes it possible to image the atomic structure of nanotubes and therefore to determine their chirality and their diameter. The transport properties can thus be correlated with the structure of the nanotube, the nanotube would be thus a quantum prototype of wire to a dimension. The various measurements carried out by AFM and STM on nanotubes monofeuillets showed that they behave indeed like such. The possible applications of these properties come within the province of nanoelectronic, not only the use of the nanotube like a molecular discussion thread but also like an active electronic element.

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