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Brief Report

A Report on Carbon Nanotubes

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BRIEF REPORT

Carbon nanotubes (CNTs) are carbon tubes with diameters that are typically measured in nanometers. Carbon nanotubes often refer to single-walled carbon nanotubes (SWCNTs) with a diameter in the nanometer range. Although not manufactured this way, single-walled carbon nanotubes are wound along one of the Bravais lattice vectors of a hexagonal lattice as a section of a two-dimensional hexagonal lattice of carbon atoms that forms a hollow column. It can be idealized. This design imposes periodic boundary conditions along the length of this curling vector, producing a spiral lattice of carbon atoms seamlessly connected to the surface of the cylinder.

Carbon nanotubes often refer to multi-walled carbon nanotubes (MWCNTs). It consists of nested single-walled carbon nanotubes that are weakly coupled by van der Waals interactions in an annual ring-like structure. These tubes, if not identical, are very similar to the long, straight, parallel carbon sheets of Oberlin, Endo, and Koyama, arranged cylindrically around a hollow tube. Multi-walled carbon nanotubes are sometimes used to refer to double-walled and triple-walled carbon nanotubes. Carbon nanotubes may refer to tubes with an undetermined carbon wall structure and a diameter of less than 100 nanometers. Such a tube was discovered in 1952 by Radushkevich and Lukyanovich.

While there are nanotubes of other composition, most studies focus on carbon nanotubes. Therefore, the modifier "carbon" is often left implicit in the acronym, and the names are abbreviated as NT, SWNT, and MWNT. The length of carbon nanotubes manufactured by common manufacturing methods is often unspecified, but is usually much longer than their diameter. Therefore, for many purposes, the final effect is ignored and the length of carbon nanotubes is assumed to be infinite. Carbon nanotubes can show remarkable electrical conductivity, while other carbon nanotubes are semiconductors. Due to their nano-strength, they also have extraordinary tensile strength and thermal conductivity. These properties are expected to be valuable in many technical areas such as electronics, optics, composites (carbon fiber replacement or supplementation), nanotechnology, and other materials science applications.

When a hexagonal lattice is expanded along various directions into various infinitely long single-walled carbon nanotubes, all these tubes have translational symmetry as well as spiral symmetry along the tube axis, and of this axis. You can see that there is also a non-trivial rotational symmetry around it. In addition, most are chiral. That is, the tube and its mirror image do not overlap. This structure also allows single-walled carbon nanotubes to be tagged with a pair of integers. Certain groups of achiral single-walled carbon nanotubes are metals, while all other groups are semiconductors with small or medium bandgap. However, these electrical properties are the same for the tube and its mirror image, as it does not depend on whether the hexagonal grid is rolled from back to front or from front to back.

The ideal (infinitely long) single-walled carbon nanotube structure is a regular hexagonal lattice structure drawn on an infinite cylindrical surface, the apex of which is the position of the carbon atom. The length of the carbon-carbon bond is fairly fixed, limiting the diameter of the cylinder and the placement of atoms above it. Zigzag and armchair configuration When studying nanotubes, a zigzag path on a grid like graphene is defined as a path that alternates between left and right by 60 degrees after passing through each bond. It is also common to define a chair pass as a pass that makes two 60-degree left turns and then two right turns every four steps. Some carbon nanotubes have a closed zigzag path that wraps around the tube. Tubes are said to be zigzag type or configuration, or simply zigzag nanotubes. Instead, if the tube is surrounded by a closed chair path, it is called a chair type or chair nanotube.

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