

General Applications

What is Nanotechnology?

The United States National Nanotechnology Initiative (USNNI) defines *nanoscience* and *nanotechnology* as “the study and application of extremely small things and can be used across all the other science fields, such as chemistry, biology, physics, materials science, and engineering.”

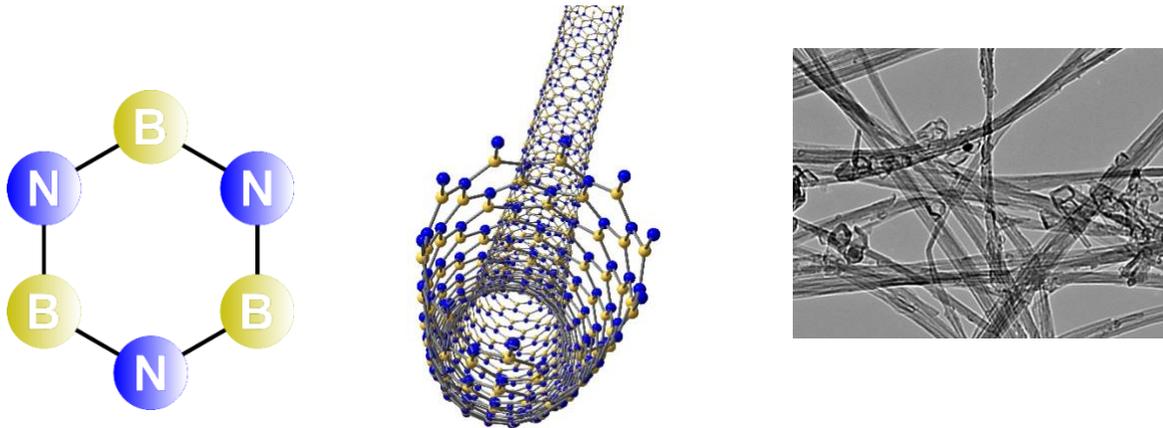
The USNNI traces the idea of nanotechnology to a presentation given in 1959 by famed American physicist, Richard Feynman. During his presentation Feynman proposed that in the future scientists would be able to manipulate and control individual atoms and molecules. Some ten years later Professor Norio Taniguchi coined the term nanotechnology. Modern nanoscience began in the 1980s when newly developed scanning tunneling microscopes could image individual atoms.

What are Boron Nitride Nanotubes?

Boron Nitride is a chemical compound made with equal numbers of Boron and nitrogen atoms at very high temperatures which forms a hexagonal crystalline. The six-sided molecule of Boron Nitride is similar to graphite which is comprised solely of carbon atoms.

The atomic bonds between the Boron and nitrogen atoms in Boron Nitride are very strong, giving the molecule outstanding chemical stability even when subjected to very high temperatures, high stiffness and thermal conductivity. Boron Nitride also exhibits high electrical resistivity, and super hydrophobicity (resistance to dissolving in liquids).

Nanotubes are small hollow cylinders with diameters of 2 to 20 nanometers and lengths generally in the 10's of microns range. At the individual tube level, these unique structures exhibit exceptional properties, including high thermal stability, high thermal conductivity, electrical resistivity, very high strength and stiffness, and super hydrophobicity (resists combining with or dissolving in water).



Left to right: the hexagonal Boron Nitride molecule, Boron Nitride molecules shaped in an ideal nanotube, TEM image of actual Boron Nitride nanotubes

Applications of Boron Nitride Nanotubes

The unique combination of Boron Nitride Nanotubes properties makes it an attractive material for use in wide-ranging domains from aerospace to automotive and defense to medtech.

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| <p>Lubrication</p> <p>Boron Nitride Nanotubes act as an effective dry, high temperature (850°C) lubricant. When added to oil Boron Nitride Nanotubes reduce both friction and wear.</p> | <p>Heat Transfer</p> <p>The high thermal conductivity of Boron Nitride Nanotubes improves the performance of conventional heat sinks and liquid coolants to help improve product performance and life.</p> | <p>Strength</p> <p>Added to other materials, from metal and plastic to textiles, Boron Nitride Nanotubes significantly improve strength and stiffness of the host material allowing for significant weight reduction.</p> |
| <p>Radiation Protection</p> <p>Boron Nitride Nanotubes absorb neutron radiation protecting avionics, sensitive electronics and living tissues.</p> | <p>Anticorrosion</p> <p>Boron Nitride Nanotubes are naturally resistant to reacting with other materials and can help protect the destructive effects of corrosion.</p> | <p>Electrical Insulation</p> <p>High dielectric breakdown strength and volume resistivity make Boron Nitride Nanotubes an effective electrical insulator.</p> |