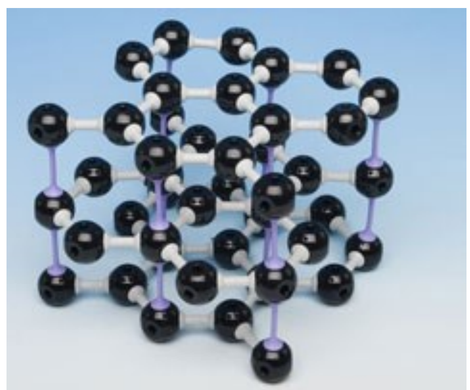
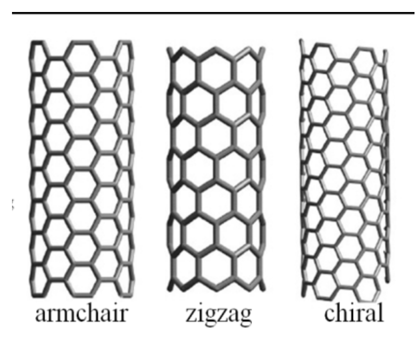
NNCI—Nanoscale Science and Engineering
Exploring Allotropes of Carbon

Explore!

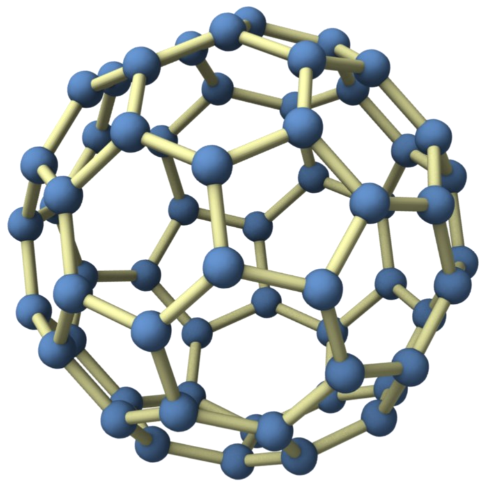
1. Look at the models of diamond and graphite (both are made of carbon atoms) How do they differ?
    A. Does shape explain how each functions?
2. Now look at the buckyball and the carbon nanotube. How do they differ?
3. Can you roll the graphene models to form the three forms of CNTs?
    A. armchair, zigzag, and chiral





What is an allotrope of carbon?
An allotrope is a different physical form of the same material—in this case carbon. All of the models you observed are pure forms of carbons but notice how different their forms are. Carbon can have several different physical forms with the most common ones being diamond and graphite. Scientists have determined that there are other forms of pure carbon in particular buckyballs or fullerenes and carbon nanotubes (CNT). A buckyball consists of 60 carbon atoms and has a diameter of ~1.1nm while a CNT can be several nm wide and up to several mm long. These nanoscale materials have unique properties — CNTs have extraordinary mechanical, electrical, thermal, optical and chemical properties. A single CNT is 200X stronger, 5X more elastic, and 5X more conductive than steel.

NNCI—Nanoscale Science and Engineering
Exploring Allotropes of Carbon

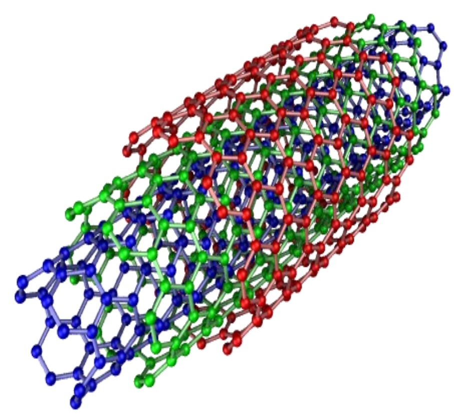


Possible applications of buckyballs include:

1. Used as a storage device for hydrogen in fuel cells.
2. Treat HIV by attaching them on to the HIV molecule section that binds to proteins thereby inhibiting the virus.
3. Their antioxidant properties may be able to fight motor deterioration caused by multiple sclerosis.
4. May be used to trap and deliver cancer drugs.

Possible applications of CNTs

1. Lighter but stronger including materials for airplane wings, co-axial cables, fiber composites in engines.
2. Clean up oils spills. CNTs with boron act like sponges that are able to absorb many times their weight in oil.
3. Create transistors that will be even smaller than current transistors.
4. Create artificial muscles composed of a CNT yarn filled with wax. The artificial one can lift 200X more than natural muscles.
5. Develop sensors of CNTs and gold nanoparticles to detect oral cancer.
6. Attach to cancer tumors and by absorbing infrared light—burn the tumor.



Information found at understandingnano.com