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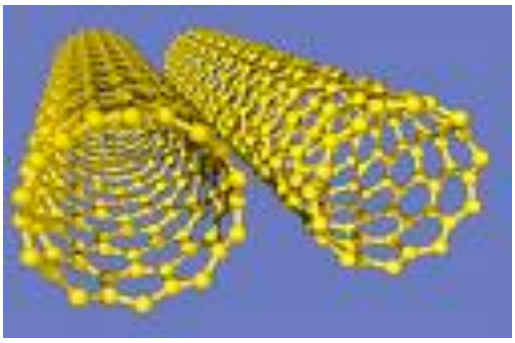
Carbon Nanotubes: Bone Growth

Carbon Nanotubes are a fairly recent technological advance in both the chemical and biomedical fields as well as many other fields because of their strength, size, abundance, and various properties. Carbon Nanotubes can be defined as "cylindrical carbon molecules with properties that make them potentially useful in extremely small scale electronic and mechanical applications." It is important to know how they are made and then we can discuss their applications.

Carbon Nanotubes are made in a fairly simple procedure in which they are synthesized from two graphite electrodes in an atmosphere of helium gas. When a 50 amp current is passed through the graphite, it begins to vaporize and then condense on both the reaction vessel and on the cathode (the electrode with a negative charge). Carbon Nanotubes will then begin to accumulate on the cathode. They can be collected with simple methods of extraction even by a syringe and are usually housed in water or a water solution.



So why are these Nanotubes so useful? The sp2 bonds of the carbon give the Nanotubes amazing strength and are as high as 1000GPa (for change of stress with applied strain) which is about 5x higher than steel and the tensile strength can be up to 63GPa which as about 50x higher than steel. Accompanied with the small size of these tubes, about 10-20 nm, and the organic makeup, they can perform many useful qualities.

The main application I'm focusing on in this report is the growth of bones. As we've already established, the Nanotubes are very small, are completely organic, and are extremely strong. These are all ideals when thinking about healing bones. It has been found that, when these carbon tubes are inserted into a bone fracture, they can act as scaffolds upon which the new bone can grow (almost like a framework). Also, because the Nanotubes are organic, the body does not reject them and there are no problems. The principle bone salt, Hydroxyapatite, can then grow up and around the framework of the carbon Nanotubes making the healing time much faster.

In the clinical tests of this application it was also found that the bone would grow back almost 3x as dense as a normal bone would which would prevent future fractures. They are also extremely easy to give to patients because they are just injected into the spot with a regular needle.

Because of their strength and size, they also have other applications in places such as circuits (they are a very good conductor of heat) in aerospace engineering, and in applications with the military. The strength and denseness of the material (as hard as a diamond) would make an excellent bullet proof material.

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