

Small is beautiful: layers of diamond-like carbon increase the data capacity of devices like the iPod



COURTESY OF APPLE
nanotubes are used in F1 cars and high-performance tennis rackets. "In terms of electronics, carbon nanotubes are the way forward in making our electronic circuits smaller and faster," explains Professor Rebecca Cheung of Edinburgh University.

SMALL SOUNDS

Every hard drive in our computers, iPods and Palm Pilots is coated with a layer of microscopic diamond-like carbon, which imitates its sparkling relative in its hardness,

smoothness, and durability. The thinner this layer the more data can be stored on the disk. "The first hard drives had a layer of about 50 nanometers, which was a mixture of carbon and hydrogen", says Dr Andrea Ferrari, an electrical engineer at Cambridge University. "In recent years this has got thinner and thinner and ideally we will reduce this to one or two nanometers of pure carbon."

HEALTH BOOSTERS

Nano-particles may one day be used to clinically target malign cells and tumours in the body. Using organic materials, silicon, and carbon nanotubes, engineers and cell biologists are working to perfect microscopic localised drug delivery and sensor systems.

Cell biologist Professor McFadden, working with nano-engineer Professor Silva at Surrey University says: "We have had some success in the lab in attaching cancer drugs and targeted antibodies to carbon nanotubes, which can deliver anti-cancer drugs to cells."

This technology will allow more concentrated doses of drugs to be delivered to the site of the disease. Finding ways to power these nano-devices and to prevent the body from forming tissues around them is a major challenge for engineers, but in the future these nano-particles may play key roles in the fight against cancer and diabetes.

NANO KNOWLEDGE

IT TAKES BIG TALENT TO WORK ON A TINY SCALE, SAYS **ADAM RAMSAY**

There's huge demand for microchips, and there are engineers who do nothing but work on components the size of a postage stamp. We look at the work of those for whom a magnifying glass is a crucial piece of kit:

SPEEDY CIRCUITS

Carbon nanotubes are rolls of graphite too small to be seen by

the naked eye. Yet, according to Dr Milo Shaffer, an expert in nanomaterials at Imperial College, London, these materials, which look a bit like tiny rolls of chicken wire under the microscope, have the greatest strength of any material we know.

The tubes can change their properties depending on how the "chicken wire" structure is folded, so the material can behave like a metal or a semi-conductor like silicon. Composite carbon