Press Releases

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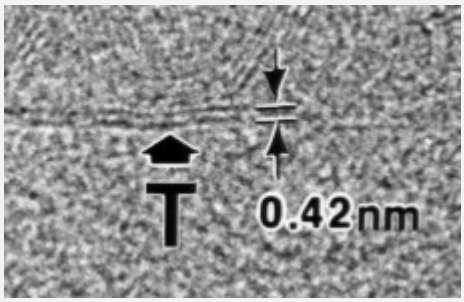
HKUST Develops the World's Smallest Single-Walled Carbon Nanotubes

Scientists from the Hong Kong University of Science and Technology (HKUST) have succeeded in fabricating the smallest single-walled carbon nanotube in the world, of which diameter is only 0.4nm (nanometer). This discovery has not only provided novel samples for forefront research on carbon nanotubes, but has also opened up new applications in various hi-tech areas such as electronics, information technology and biology.

Using microporous zeolite single crystals as hosts, Dr Zikang Tang and Dr Ning Wang from the Physics Department succeeded in fabricating the world's smallest single-walled carbon nanotubes (SWNTs) that are periodically aligned in the crystal channels. In recognition of their achievement, Nature, a leading international science journal, published their research today (2 November).

Hi-res image Dr Ning Wang (left) examines carbon nanotubes under an electron microscope while Dr Zikang Tang looks on.

A unit for measuring length, one nanometer equals to one-billionth of a meter. When materials are measured in nanometers, they display extraordinary physical properties, opening up new research areas, and leading to novel applications. Nanomaterials have been regarded as revolutionary new materials for the 21st century.



Hi-res image Electron microscopic examination of carbon nanotubes (indicated by arrows).

Carbon nanotubes are long, thin cylinders of carbon. Single-walled carbon nanotubes are formed by rolling single-atomic graphite layer into a cylinder. They are extremely small in size-a bundle of 1,000,000 carbon nanotubes equals to the size of a hair. Their unique physical structures, electronic properties, and their intriguing potentials for wide applications have sparked an explosion of research into their understanding since they were discovered in 1991. Leading edge research on carbon nanotubes has become one of the fastest-growing and the most competitive area all over the world.

Carbon nanotubes do not exist in nature. They can only be formed under special circumstances. The carbon nanotubes that are produced by traditional techniques are usually larger in size, and contain a mixture of various kinds of carbon specimens structured in a disorderly manner. The challenge for scientists is to produce smaller-sized, mono-dispersed and regularly arrayed carbon nanotubes.

"The fabrication technology that we developed is very unique, and the nanotubes that we produced are unprecedented," said Dr Tang. "We make an important step towards the research of carbon nanotube by pushing its size to its theoretical limit."

"The carbon nanotube that we discover is an ideal one-dimensional conductor, and its novel properties are yet to be explored," he said.

"Electron microscopic observation shows that our nanotubes are extraordinarily small with uniform diameters. This discovery will provide new samples for further research on nanotubes," said Dr Wang.

Nanotubes make it possible to control materials at the molecular level, providing wide applications in many hi-tech areas. For instance, the development of hydrogen-driven electric cars becomes a reality. Although hydrogen can be used as a cost-effective fuel, liquefying the gas is very expensive, and compressing can be potentially dangerous. Carbon nanotubes can serve as an ideal cylinder for storing hydrogen as their diameter is close to that of the hydrogen atom. The smaller the nanotube, the higher the density of hydrogen storage. When the nanotube is heated, hydrogen will be released, and burned, providing pollution-free fuel for the car.

Nanotubes are also useful in producing micro-computers and ultra-thin TVs. They can be used to fabricate nano-scaled semiconductor devices and nano-conducting wires to increase the integration density in electric circles. They are useful as a field-emission source to replace cathode ray tubes, reducing the size of TVs but improving the display quality.