

Carbon Dots Newest Member of Brightly Luminescent Nanoparticle Family

June 5 2006

Chemists at Clemson University have developed a new type of quantum dot that is the first to be made from carbon. Like their metal-based counterparts, these nanoscale "carbon dots" glow brightly when exposed to light and show promise for a broad range of applications, including improved biological sensors and medical imaging devices. The carbon-based quantum dots may be less toxic and less expensive than metal-based quantum dots. This work appears in the *Journal of the American Chemical Society*.

"Carbon is hardly considered to be a semiconductor, so luminescent carbon nanoparticles are very interesting both fundamentally and practically," says study leader Ya-Ping Sun, Ph.D. "It represents a new platform for the development of luminescent nanomaterials for a wide range of applications."

Quantum dots have generated much interest in recent years, especially for potential applications in biology and medicine. These tiny particles have been developed from compounds composed of lead, cadmium and, more recently, silicon. But these materials have raised concerns over potential toxicity and environmental harm, though investigators have developed a variety of approaches for encapsulating these semiconductor nanoparticles in polymers to render them inert. Nevertheless, scientists continue searching for more benign compounds for making quantum dots.

Researchers have known for some time that carbon nanoparticles, due

partly to their enormous surface area, have unusual chemical and physical properties quite different from their bulk form. Using nanoparticles produced from graphite, the Clemson investigators demonstrated that when these carbon nanoparticles are covered with special polymers, they glow brightly when exposed to light. The dots glow continuously as long as a light source is present.

The scientists believe that this photoluminescence may be due to the presence of "pockets," or holes, on the surface of the carbon dots that trap energy. The polymer coating acts as a "molecular band-aid," enabling light emission from the inside of the polymer casing, the investigators note. Scientists believe that metal-based quantum dots emit light by a different mechanism.

The polymer coating also allowed the investigators to attach antibodies and other labeling materials to the carbon dot, opening the door to the development of sensors that light up in the presence of tumors or even precancerous cells. In lab studies, the researchers successfully labeled anthrax-like spores with luminescent carbon dots, resulting in glowing spores that were easily viewed under a microscope.

This work is detailed in a paper titled, "Quantum-sized carbon dots for bright and colorful photoluminescence." This paper was published online in advance of print publication. An abstract is available at the [journal's website](#).

Source: National Cancer Institute

Citation: Carbon Dots Newest Member of Brightly Luminescent Nanoparticle Family (2006, June 5) retrieved 24 April 2024 from <https://phys.org/news/2006-06-carbon-dots-member-brightly-luminescent.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.