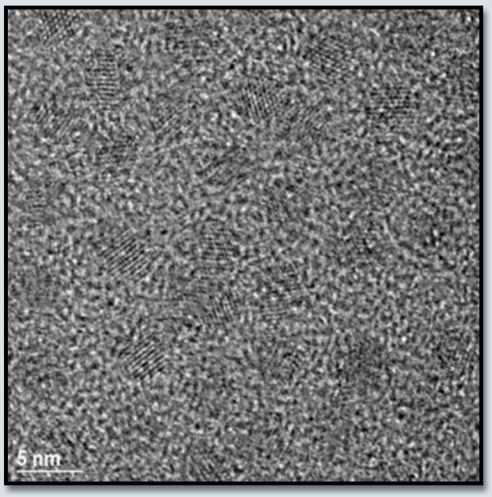
Fluorescent Nanoparticles for Radiation Detection

UT-B ID 200201145

High resolution TEM image of mondisperse, highly crystalline, 4-nm CdS0.05Se0.95 NCs



Technology Summary

Researchers at ORNL invented a promising material for more efficient nanoscale scintillators, or radiation detectors. The new material, which can detect most kinds of radiation, consists of fluorescent nanoparticles embedded in a transparent matrix. The invention addresses needs in research, security, and industry for detectors with improved light output and higher detection efficiency. The technology offers high count rate capability and better time resolution.

Scintillators emit light upon absorbing ionizing radiation. The ORNL invention uses nanoparticles to produce fluorescence on exposure to radiation. These particles are placed in a transparent matrix to maximize the fraction of light they emit. The scintillator can be customized for specific applications by tailoring the nanoparticles for particular wavelengths, quantum yields, and fluorescence decay times. Multiple layers of matrix and nanoparticles can be structured for different functions.

The nanoparticles are made from materials that include lithium oxide, lithium carbonate, lithium phosphate, lithium silicates, lithium aluminates, and lithium zirconates. For gamma ray spectroscopy, materials of high atomic number can be doped in the matrix.

Advantages

- Superior light emission intensity, emission decay times, high count rate capabilities, emission wavelengths, and counting efficiency for scintillators
- Offers a competitive edge over existing survey instruments used at reactors, hospitals, and research facilities

Potential Applications

- Neutron scattering research
- Gamma ray spectroscopy in nuclear medicine imaging techniques
- Neutron and gamma detection of concealed nuclear materials
- Survey instruments at reactors, reactor facilities, and hospitals

Patent

Sheng Dai, Andrew C. Stephan, Steven A. Wallace, Suree Saengkerdsub, and Hee-Jung Im, *Composite Nanoparticle/Transparent Matrix Structures for Radiation Detection*, U.S. Patent Application 10/940,054, filed September 14, 2004.

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