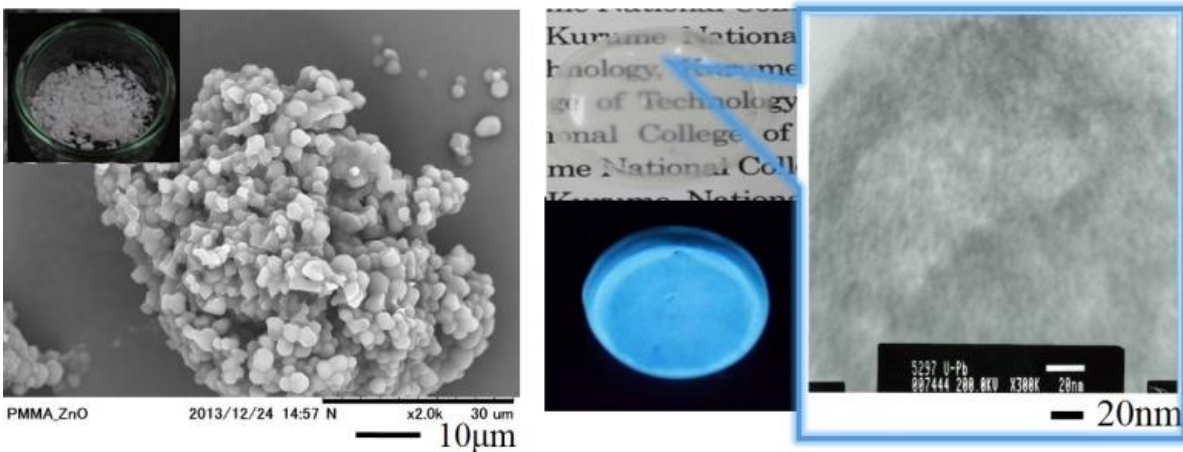


# Semiconductor nanoparticles show high luminescence in a polymer matrix

October 1 2015



Polymer-ZnO nanoparticle QDs by dispersion polymerization in supercritical CO<sub>2</sub> are shown. Credit: Copyright (C) 2015 Toyohashi University Of Technology.

Semiconductor nanocrystals known as quantum dots (QDs) are increasingly being used as photoluminescent materials in bio-imaging, photonics, and optoelectronic applications. However, these QDs must have stable photoluminescence properties to be used in these applications. Photoluminescence stability of QDs is achieved by chemically modifying the surface of the QDs.

However, chemical modification of the surface typically requires large

amounts of organic solvents that are harmful to the environment. To solve this problem, many researchers have attempted to synthesize polymer-nanoparticle composites by using supercritical fluid (SCF)-based technology. Supercritical CO<sub>2</sub> has emerged as the most extensively studied SCF medium, because it is readily available, inexpensive, nonflammable, and environmentally benign.

Toyohashi Tech researchers in cooperation with researchers at the National Institute of Technology, Kurume College have investigated the formation of nanostructured material using supercritical CO<sub>2</sub>. They have demonstrated the formation of composite nanoparticles of luminescent ZnO QDs and polymer by dispersion polymerization in supercritical CO<sub>2</sub>. As a result of the supercritical-CO<sub>2</sub>-assisted surface modification of QDs, the QDs were well dispersed in the polymer matrix and showed high luminescence.

"Unfortunately, the photoluminescence properties of pristine luminescent QDs were quenched in supercritical CO<sub>2</sub>. The surface structure of the QDs was destroyed by supercritical CO<sub>2</sub>.", explains associate professor Kiyoshi Matsuyama at the National Institute of Technology, Kurume College, "We found that the quenching of ZnO QDs could be prevented by coating with silica to obtain PMMA-ZnO composite QDs with high luminescence using a supercritical-CO<sub>2</sub>-assisted [surface](#) modification with polymer."

Our research shows that the supercritical-fluid-assisted process provides an environmentally benign route for producing stabilized luminescent materials.

**More information:** Kiyoshi Matsuyama, Yu-ki Maeda, Takaaki Matsuda, Tetsuya Okuyama, Hiroyuki Muto (2015) Formation of poly(methyl methacrylate)-ZnO nanoparticle quantum dot composites by dispersion polymerization in supercritical CO<sub>2</sub>, *The Journal of*

*Supercritical Fluids*, 103, 83-89. [DOI: 10.1016/j.supflu.2015.04.025](https://doi.org/10.1016/j.supflu.2015.04.025)

Provided by Toyohashi University of Technology

Citation: Semiconductor nanoparticles show high luminescence in a polymer matrix (2015, October 1) retrieved 16 July 2024 from <https://phys.org/news/2015-10-semiconductor-nanoparticles-high-luminescence-polymer.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.