Nanoparticle Capsules for Magnetically Controlled Color-Changing Materials

Tech ID: 24828 / UC Case 2013-943-0

ABSTRACT

Researchers at the University of California, Davis have developed composite photonic materials that encapsulate magnetic nanoparticles inside hollow shells. When exposed to a magnetic field, these materials change their optical properties, producing visible color shifts. This capability enables applications in dynamic displays, sensors, and smart coatings, offering a novel approach to magnetically controlled color modulation.

FULL DESCRIPTION

The technology centers on creating hollow shells that contain magnetic nanoparticles. In the absence of a magnetic field, the nanoparticles are randomly oriented, and the material appears transparent or a base color. When a magnetic field is applied, the nanoparticles align rapidly, forming photonic crystal-like structures that alter how light is reflected and transmitted, resulting in a distinct color change.

This reversible color change occurs within milliseconds and can be tuned by adjusting particle size, shell dimensions, and magnetic field strength. The invention provides a scalable method for synthesizing these capsules using template-assisted processes and controlled polymerization, followed by oxide shell formation and core removal. Potential uses span consumer electronics, security features, and biomedical visualization tools.

APPLICATIONS

- Dynamic color-changing coatings for consumer products Magnetically controlled photonic displays and signage.
- Security and anti-counterfeiting features in packaging.
- Sensors for detecting magnetic fields or mechanical impact.
- Biomedical imaging and diagnostic markers.
- Smart textiles and wearable devices with tunable appearance.

FEATURES/BENEFITS

- Rapid and reversible color change under magnetic stimulus.
- Customizable optical response through particle and shell design.
- Scalable synthesis using established chemical processes.
- Non-toxic, biocompatible materials suitable for medical use.
- Integration into paints, polymers, and composite surfaces.
- Energy-efficient operation without electronic components.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,161,747	11/02/2021	2013-943

CONTACT

Michael M. Mueller

mmmueller@ucdavis.edu

tel: .



INVENTORS

- Guo, Ting

OTHER INFORMATION

KEYWORDS

color-changing materials, dynamic display technology, encapsulation, hollow silica shells, magnetic nanoparticles, magnetically responsive coatings, nanocomposite synthesis, optical sensors, photonic crystals, smart pigments

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Materials & Chemicals**
  - Nanomaterials
  - Polymers
- **Nanotechnology**
  - Materials
  - Tools and Devices

RELATED CASES

2013-943-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Formation of Polymers on Nanostructures Under X-ray Irradiation
- Enhancement of X-Ray Radiation Using Nanomaterials
- X-Ray-Triggered Release of Drugs from Nanoscale Drug Carriers
- Measurement of Nanoscale Physical Enhancement by Materials under X-ray Irradiation
- Combined Individual Nanomaterial Enhancements for Total X-Ray Enhancement

University of California, Davis
Technology Transfer Office
1 Shields Avenue, Mrak Hall 4th Floor,
Davis,CA 95616

Tel: 530.754.8649
techtransfer@ucdavis.edu
https://research.ucdavis.edu/technology-transfer/
Fax: 530.754.7620

© 2015 - 2026, The Regents of the University of California
Terms of use
Privacy Notice