

# 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
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## CONTACT

Michael M. Mueller  
[mmmueller@ucdavis.edu](mailto: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](#)
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**University of California, Davis****Technology Transfer Office**

1 Shields Avenue, Mrak Hall 4th Floor,  
Davis, CA 95616

Tel:

530.754.8649

[techtransfer@ucdavis.edu](mailto:techtransfer@ucdavis.edu)<https://research.ucdavis.edu/technology-transfer/>

Fax:

530.754.7620

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