Multicolor Photonic Pigments From Magnetically Assembled Nanorod Arrays

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PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20230305322	09/28/2023	2021-840

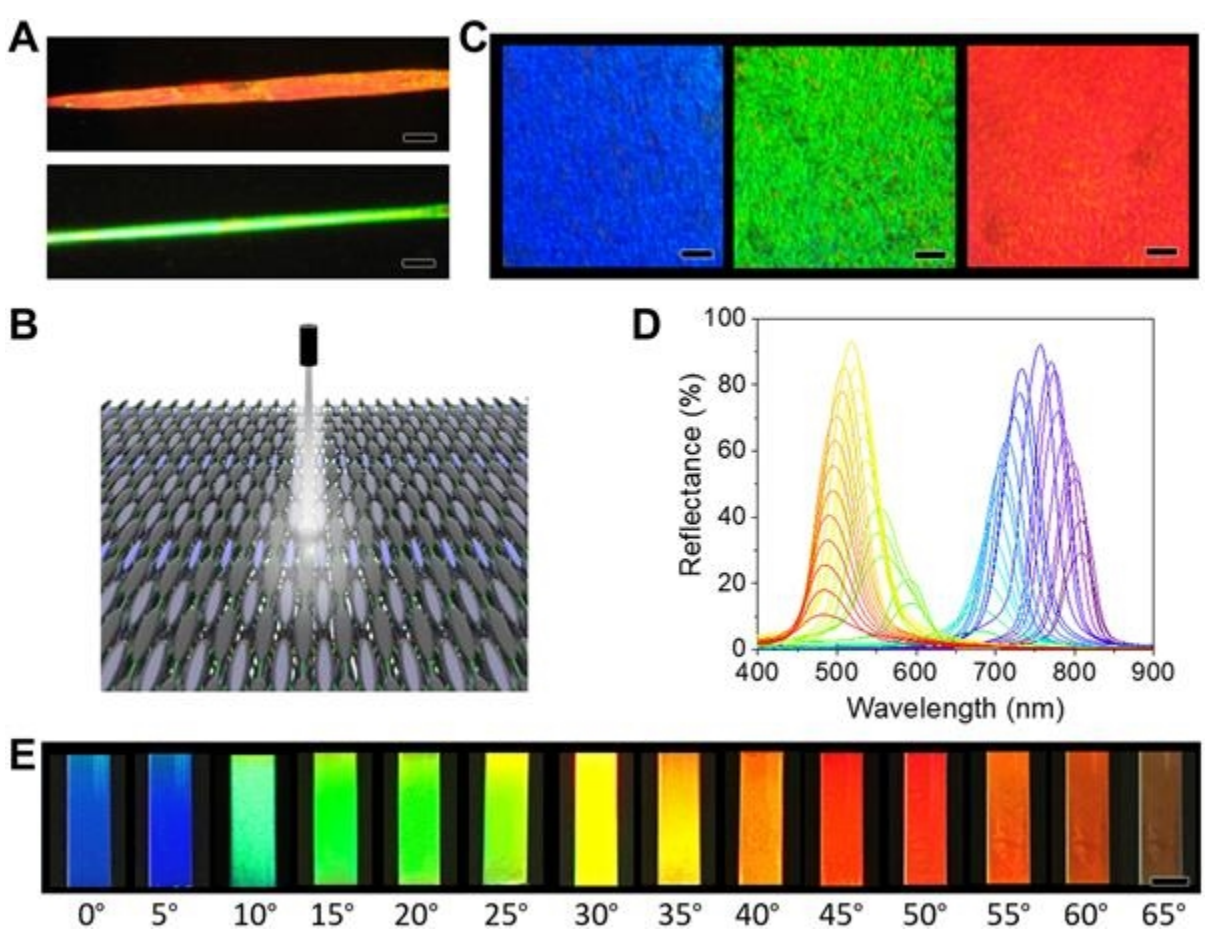
FULL DESCRIPTION

Background

Colloidal crystals are ordered superstructures of colloidal particles whose repeating subunits are much larger than their analogous atomic and molecular crystals. The spatial configuration of matter and surface ligands in colloidal crystals, which control many physical and chemical properties, can be tailored in a nanometer precision by adjusting the subunit composites, size, shape and crystal structures. The colloidal assembly has become an effective strategy in producing many functional materials.

Current Invention

Prof. Yadong Yin and his research team have developed a novel magnetic assembly of magnetite nanorods into tetragonal colloidal clusters where the magnetic nanorods assemble along a size dependent critical angle rather than a simple end-on attachment. The coupled shape and magnetic anisotropy in nanorods is responsible for the unconventional assembly manner and leads to the non-close-packed and hard phase.



Optical properties of the assembled bct photonic crystals. (**A**) Optical microscopy images of a bct crystal under different orientations. (**B**) Schematic illustration of measuring the crystal optical properties. Light was incident along the surface normal, and a horizontal (0°) magnetic field was applied. (**C**) Optical microscopy images of the bct crystals under different magnetic field directions: blue at 0°, green at 20°, and red at

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OTHER INFORMATION

KEYWORDS

Bio-sensors, Catalysis, Chemical sensors, Color displays, Optical devices, Drug delivery, Electronics, Medical diagnostics, Solar energy conversion, Electrochromic coatings

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Energy**
  - Solar
  - Storage/Battery
- **Materials & Chemicals**
  - Biological
  - Chemicals
  - Composites
  - Nanomaterials
  - Polymers
  - Textiles
  - Thin Films
- **Medical**
  - Delivery Systems
  - Diagnostics
  - Imaging
- **Nanotechnology**
  - Electronics
  - Materials
  - NanoBio
- **Sensors & Instrumentation**
  - Biosensors
  - Environmental Sensors

RELATED CASES

2021-840-0

45°. (**D**) Measured reflection spectra of rod dispersion under different magnetic fields. Increasing the field direction from 0° to 65° leads to a gradual red shift of the reflection peaks. (**E**) Structural colors of rods dispersion under different magnetic fields. Scale bars, 20 m m (A and C) and 5 mm (E).

ADVANTAGES

The significant aspects of their invention are:

- The unique 3D tetragonal architectures and tunable interconnected porosity provide a unique platform to modulate chemical transformations in energy conversion and optical devices.
- Breaks the technical limitation of the dense packing phase in the conventional entropy-dominated colloidal assembly systems, thereby opening the door to creating many complex colloidal crystals.
- A simple extension of the nanoscale magnetic assembly to different nanorods yields body centered tetragonal (bct) crystals with tunable lattice constants, tailorable physical properties, readily accessible surfaces and interconnected nanochannels.
- The silica shell can be replaced by other materials such as Titanium Dioxide (TiO2) and polymers.
- Magnetic nanorods prepared by different methods can also be used as building blocks. Examples include Nickel (Ni) nanorods, NiFe2O4 nanorods, y-Fe2O3 nanorods and Cobalt nanorods for various applications such as data storage, electrochromic coatings, catalysis, biosensing, etc.

SUGGESTED USES

A wide variety of applications could benefit from this invention:

- Electro-chromic coatings
- Electronics
- Color displays and optical devices
- Drug delivery and bio-sensing
- Medical diagnostics
- Chemical sensors
- Solar energy conversion

RELATED MATERIALS

- Coupling morphological and magnetic anisotropy for assembling tetragonal colloidal crystals

USER DEFINED 1

Please see all inventions by Prof. Yadong Yin and his team at UCR

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