SELF-ASSEMBLED CONCENTRIC NANOPARTICLE RINGS TO GENERATE ORBITAL ANGULAR MOMENTUM

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PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20240052111	02/15/2024	2024-006

BRIEF DESCRIPTION

Traditional ring-shaped nanostructures are vital for manipulating electromagnetic waves, yet they remain difficult to integrate into scalable devices due to the limitations of standard nanofabrication techniques. UC Berkeley researchers have developed a straightforward approach to generate ring-shaped nanoparticle assemblies in thin films using supramolecular nanocomposites. By employing directed self-assembly (DSA), the system guides the formation of concentric rings with precise radii ranging from 150 to 1150 nm and widths between 30 and 60 nm. When plasmonic nanoparticles are utilized, these completed nanodevice arrays can be fabricated in a single step, producing high-quality orbital angular momentum (OAM). Unlike traditional methods that rely on polymer-pattern incommensurability, this supramolecular system self-regulates the spatial distribution of its components, providing a level of flexibility and material selection previously unavailable in block copolymer DSA.

SUGGESTED USES

» Optical Communications: Generating and manipulating orbital angular momentum (OAM) for high-capacity data transmission and optical multiplexing.

» Plasmonic Nanodevices: Fabricating high-density arrays for enhanced light-matter interactions in sensing and spectroscopy.

» Optical Vortex Generation: Developing compact components for microscopy and particle trapping that require precise control over the phase and wavefront of light.

» Advanced Lithography: Utilizing the self-assembled rings as high-resolution masks for secondary etching or deposition processes.

» Quantum Information Processing: Implementing OAM-based photonic states in nanophotonic circuits for quantum computing and secure communications.

ADVANTAGES

» One-Step Fabrication: Enables the direct production of metal nanostructures without the need for traditional, multi-step etching or deposition sequences.

» Self-Regulating Assembly: The supramolecular system naturally adjusts to its environment, overcoming the rigid constraints and defects often found in standard block copolymer self-assembly.

» New Design Dimensions: Introduces inter-particle coupling as a tunable design axis, allowing for the fine-tuning of electromagnetic responses within the ring arrays.

» Broad Scalability: Successfully produces concentric rings across a wide range of radii and widths, offering versatility for different wavelength requirements.

» Streamlined Integration: Simplifies the incorporation of complex plasmonic architectures into functional devices by utilizing thin-film processing.

RELATED MATERIALS

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OTHER INFORMATION

CATEGORIZED AS

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

RELATED CASES

2024-006-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Bioactive Plastics With Programmable Degradation And Microplastic Elimination
- Near Complete Depolymerization Of Polyesters With Nano-Dispersed Enzymes
- Synergistic Enzyme Mixtures to Realize Near-Complete Depolymerization in Blends
- Thermal Stabilization Of Embedded Proteins
- Population-Based Heteropolymer Design To Mimic Protein Mixtures In Biological Fluids
- Preserving Protein Function Via Statistically Random Heteropolymers

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