SYNTHESIS OF EUROPIUM HALIDE PEROVSKITE IN SOLUTION PHASE

Tech ID: 30210 / UC Case 2019-110-0

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,884,855	01/30/2024	2019-110

BRIEF DESCRIPTION

High-performance optoelectronic materials, such as rare earth perovskites, are highly sought after for next-generation digital displays, solar energy harvesting, and advanced lighting technologies. However, synthesizing these complex materials with precise control over their crystalline structure at the nanoscale is often exceptionally difficult and expensive. To overcome this limitation, researchers at UC Berkeley have developed a scalable, solution-phase synthesis process specifically designed to fabricate europium halide perovskite nanocrystals. The method utilizes a multi-step liquid reaction where an alkali metal material is first combined with a specialized surfactant ligand in a non-coordinating solvent to create a primary precursor solution. Separately, a rare earth metal halide is mixed with a second surfactant ligand to form a complementary precursor. When these two precursor complexes are precisely reacted together in a third solvent mixture, they cleanly precipitate out into highly uniform rare earth perovskite nanocrystals. This colloidal approach bypasses the need for costly high-vacuum deposition equipment, enabling affordable, large-scale manufacturing of pristine, light-emitting nanomaterials.

SUGGESTED USES

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Advanced Displays and Light-Emitting Diodes: Utilizing the narrow and sharp color emission lines of europium-based nanocrystals to create ultra-high-definition television screens and energy-efficient lighting.

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Solar Cells and Photovoltaics: Integrating the rare earth perovskite nanomaterials as light-harvesting layers or down-conversion coatings to boost the overall energy conversion efficiency of solar panels.

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Quantum Dot Inks: Formulating stable colloidal inks for printable electronics, flexible electronic displays, and high-security anti-counterfeiting tagging applications.

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Scintillators and Radiation Detectors: Leveraging the dense crystal structure and luminescent properties of europium halides to detect high-energy radiation in medical imaging and security screening infrastructure.

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Optical Amplifiers: Applying the nanocrystals in telecommunication systems to amplify optical signals traveling through fiber-optic networks.

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OTHER INFORMATION

CATEGORIZED AS

» **Optics and Photonics**

» All Optics and Photonics

» **Energy**

» Other

» **Materials & Chemicals**

» Chemicals

» Other

RELATED CASES

2019-110-0

ADVANTAGES

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Scalable Colloidal Processing: The liquid-phase synthesis operates at accessible temperatures and atmospheric pressures, making it far cheaper and easier to scale than traditional vapor-phase deposition methods.

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Precise Nanoscale Uniformity: The strategic use of three distinct surfactant ligands limits uncontrolled crystal growth, ensuring the resulting perovskites maintain a highly uniform nanocrystal size distribution.

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Enhanced Luminescent Efficiency: The utilization of non-coordinating solvents eliminates unwanted chemical interference during the reaction, leading to fewer structural defects and superior optical brightness.

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Robust Solution Stability: The surfactant coating securely wraps around the resulting nanocrystals, keeping them stably suspended in liquid form and preventing unwanted clumping during downstream manufacturing processes.

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Versatile Material Composition: The modular formulation allows for fine-tuning of the structural and chemical components, paving the way for a broader library of customized rare earth nanomaterials.

RELATED MATERIALS

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Methods to Produce Ultra-Thin Copper Nanowires for Transparent Conductors
- CO2 Upgrading into C2 Oxygenates with a CuAg Tandem Electrocatalyst
- Semiconductor-Based Photo Redox Catalysts For Sustainable Dehydrogenation Reactions
- Stable Lead Halide Perovskite RGB Emitters

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