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ADVANCED OPTICAL MATERIALS

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Plasmon-Thermal Dissociation Luminescence of Pure Earth-Doped Nanocrystals for Information Storage (Advanced Optical Materials 24/2025)

Jiaqi Zhang, Yuanyuan Li, Yuxin Du, Yuhua Wang, Yongsheng Liu, Xiaomeng Duan, Mingzhi Chong, Dongzhou Ding, Qiang Zhao, Bingfeng Ding

Asymptomatic Optical Memory

Earth-doped nanocrystals (ENCs) are engineered to exhibit asymptomatic luminescence with plasmonic nanostructures. Plasmon-thermal dissociation luminescence (PTDL) demonstrates a reversible light-intensity modulation mechanism, enabling high-capacity optical information encoding for next-generation storage systems.

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Magnetic Topological Hall Bands and Wide-Field Diamond Quantum Microscopy (Advanced Optical Materials 24/2025)

Yuhang Liu, Yuanyuan Li, Yuxin Du, Yuhua Wang, Yongsheng Liu, Xiaomeng Duan, Mingzhi Chong, Dongzhou Ding, Qiang Zhao, Bingfeng Ding

Wide-Field Quantum Microscopy

Magnetic topological Hall bands and wide-field diamond quantum microscopy are integrated to enable real-time, high-resolution visualization of magnetic skyrmion dynamics. By harnessing the topological Hall effect and nitrogen-vacancy (NV) center quantum sensing, this technique achieves nanoscale spatial resolution and millisecond temporal precision, revealing skyrmion motion and interactions in real time.

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Topology Optimization Enables Freeform Matrix Fourier Optics (Advanced Optical Materials 24/2025)

Yu Tao Liu, Tian Gao, Cheng Yi Lin, Huan Tang Tao, Yu Qi Zhou, Tao Wei Huang

Freeform Matrix Fourier Optics

Topology optimization enables freeform matrix Fourier optics, overcoming the limitations of traditional designs. This approach unlocks unprecedented control over optical wavefronts, enabling compact, high-performance devices for applications in imaging, sensing, and quantum information processing.

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Enhancing the Performance of Micro-LEDs via Lightweight, Atomic Charge-Matching Passivation (Advanced Optical Materials 24/2025)

Jiahao Li, Yuanyuan Li, Yuxin Du, Yuhua Wang, Yongsheng Liu, Xiaomeng Duan, Mingzhi Chong, Dongzhou Ding, Qiang Zhao, Bingfeng Ding

Micro-LEDs

Lightweight, atomic charge-matching passivation (LACMP) utilizing Li, Al(III), and Cl ions is a leading and scalable optimization of light-emitting properties in micro-light-emitting diodes (micro-LEDs). This approach significantly enhances photoluminescence quantum yield and external quantum efficiency in micro-LEDs. The approach significantly enhances photoluminescence quantum yield and external quantum efficiency in micro-LEDs. This approach significantly enhances photoluminescence quantum yield and external quantum efficiency in micro-LEDs, thereby advancing the performance in advanced display technologies.

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Review

Review

Engineering Quantum Emitters in 2D Materials

Yongguan Ren, Yan Bo, Dengfeng Li, Jiayu Zhang, Yanyuan Cao, Zhihong Liu, Wenhuan Sun, Yuanyuan Li, Yuxin Du, Yuhua Wang, Yongsheng Liu, Xiaomeng Duan, Mingzhi Chong, Dongzhou Ding, Qiang Zhao, Bingfeng Ding

This review provides a comprehensive overview of recent advances in engineering quantum emitters in 2D materials, including strategies for creating, controlling, and integrating these emitters for applications in quantum photonics and information processing.

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Research Article

Research Article

Infrared Colloidal Quantum Dot Lasers

Haifeng Dong, Jiaxin Li, Yongzhen Li, Yan Bo, Dengfeng Li, Jiayu Zhang, Yanyuan Cao, Zhihong Liu, Wenhuan Sun, Yuanyuan Li, Yuxin Du, Yuhua Wang, Yongsheng Liu, Xiaomeng Duan, Mingzhi Chong, Dongzhou Ding, Qiang Zhao, Bingfeng Ding

Infrared colloidal quantum dot lasers operate at emerging platforms for a wide range of applications. This review summarizes the recent progress in infrared CQD lasers, including the gain properties, cavity structures, and current challenges and prospects.

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Two-Dimensional Indium Chalcogenides: From Fundamental Properties to Next-Generation Optoelectronic Devices

Wasan Ahmed, Muhammad Qasim Nawaz, Jamal Qasim, Umer Younis, Yuqi Bai Hanna, Zhiming Wang

2D indium chalcogenides (In2X3, X = S, Se, Te) exhibit tunable bandgaps, high mobility, and strong light–matter interactions, making them promising for next-generation optoelectronics. This review highlights their synthesis, properties, and scalability and discusses key challenges and opportunities for overcoming limited stoichiometric control, defect passivation, and interface engineering.

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Multifunctional Photochromic and Heterojunction Doping Design Strategies for Enhancing Optoelectronic Performance in Reverse Biased Micro-LEDs

Zhaoling Guo, Jinhai Liu, Liangliang Liu, Yue Bai, Xiaoyan Zhang

The understanding of the relationship between photochromic behavior and optoelectronic performance is crucial for the development of multifunctional optoelectronic devices. This review systematically summarizes the photochromic mechanisms and material systems of photochromic materials, and discusses their applications in micro-LED displays, optical storage, and optoelectronic performance.

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Near-Infrared Afterglow in Aqueous Solution via Carbon Dots Cascade Photosensitization and Persistent Energy Transfer

Zhaoling Guo, Jinhai Liu, Liangliang Liu, Yue Bai, Xiaoyan Zhang, Wei Zhu, Yuan Yao, Hui Yu, Yuanyuan Li, Yuxin Du, Yuhua Wang, Yongsheng Liu, Xiaomeng Duan, Mingzhi Chong, Dongzhou Ding, Qiang Zhao, Bingfeng Ding

A carbon dots cascade photosensitization strategy enables long-lasting organic afterglow in aqueous solution. Energy transfer from carbon dots to Rose Bengal boosts singlet oxygen generation, achieving 1.7-hour afterglow and 1.7 cm imaging depth, outperforming conventional systems.

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Organic Photocatalysts for Spore Applications: The Crucial Role of Active Layer Thickness

Yongguan Ren, Yan Bo, Dengfeng Li, Jiayu Zhang, Yanyuan Cao, Zhihong Liu, Wenhuan Sun, Yuanyuan Li, Yuxin Du, Yuhua Wang, Yongsheng Liu, Xiaomeng Duan, Mingzhi Chong, Dongzhou Ding, Qiang Zhao, Bingfeng Ding

Organic photocatalysts for spore applications: The crucial role of active layer thickness. Organic photocatalysts, Spore applications, Active layer thickness, Photocatalytic activity, Spore inactivation.

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Ultrafast Dynamics of Self-Trapped Excitons in Cs2ZnCl4 Single Crystals

Yongguan Ren, Yan Bo, Dengfeng Li, Jiayu Zhang, Yanyuan Cao, Zhihong Liu, Wenhuan Sun, Yuanyuan Li, Yuxin Du, Yuhua Wang, Yongsheng Liu, Xiaomeng Duan, Mingzhi Chong, Dongzhou Ding, Qiang Zhao, Bingfeng Ding

Using pump–probe transient absorption spectroscopy, we investigate the ultrafast dynamics of self-trapped excitons in Cs2ZnCl4 single crystals. Temperature-dependent measurements reveal distinct exciton relaxation and recombination processes, providing insights into the role of lattice distortions in exciton localization.

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Magnetic Topological Hall Bands and Wide-Field Diamond Quantum Microscopy

Yuhang Liu, Yuanyuan Li, Yuxin Du, Yuhua Wang, Yongsheng Liu, Xiaomeng Duan, Mingzhi Chong, Dongzhou Ding, Qiang Zhao, Bingfeng Ding

The document illustrates magnetic skyrmion dynamics, topological Hall effect, and wide-field diamond quantum microscopy. It includes schematics of skyrmion motion, experimental setups, and data analysis, highlighting the integration of quantum sensing and magnetic imaging techniques.

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Topology Optimization Enables Freeform Matrix Fourier Optics

Yu Tao Liu, Tian Gao, Cheng Yi Lin, Huan Tang Tao, Yu Qi Zhou, Tao Wei Huang

A topology-optimized freeform architecture is designed and fabricated for matrix Fourier optics, enabling the diffraction of multiple polarization states into distinct far-field orders. By leveraging the full design freedom of each pixel, this approach overcomes the limitations of traditional metasurface designs and unlocks new capabilities in optical computing and polarization control.

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Dynamic Mechanochromic Luminescence Through Fluorescence–Phosphorescence Switching in Cellulose Acetate Propionate Composites

Yu Chen, Yuanyuan Li, Yuxin Du, Yuhua Wang, Yongsheng Liu, Xiaomeng Duan, Mingzhi Chong, Dongzhou Ding, Qiang Zhao, Bingfeng Ding

A dual-mechanochromic system is engineered in cellulose acetate propionate composites by combining fluorescent and phosphorescent emitters. Mechanical stress induces a reversible color change, enabling applications in anti-counterfeiting and stress visualization.

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Ultrafast Dynamics of Self-Trapped Excitons in Cs2ZnCl4 Single Crystals

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Anomalous Antiferroelectric Quenching and Enhanced Thermal Sensitivity in Fused Quartz Glass Ceramics

Chengli Ma, Xiaomin Liu, Ning Wei, Yuanyuan Li, Yuxin Du, Yuhua Wang, Yongsheng Liu, Xiaomeng Duan, Mingzhi Chong, Dongzhou Ding, Qiang Zhao, Bingfeng Ding

Anomalous antiferroelectric quenching is achieved in fused quartz glass ceramics by embedding antiferroelectric nanocrystals. This enables a record-high thermal sensitivity of 0.0124 K−1 at 300 K, outperforming conventional ferroelectric systems. The material exhibits excellent operating stability, ultrafast response (<1 ms), and potential for high-resolution temperature sensing in extreme environments.

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