ADVANCED OPTICAL MATERIALS

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Cover Picture

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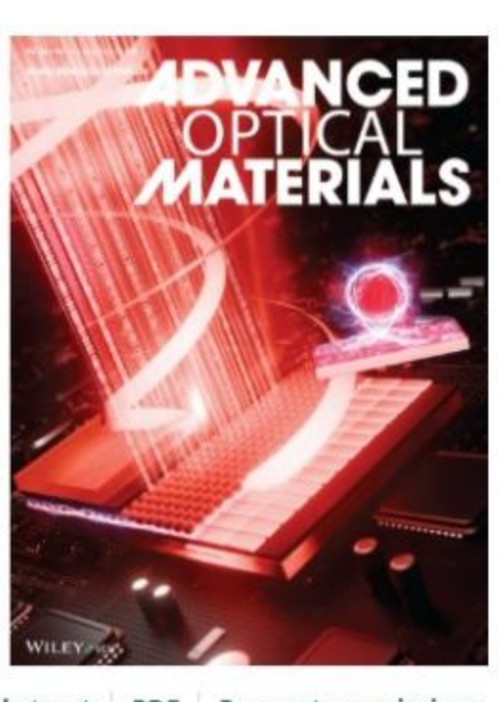
Solution-Processed Spin-Polarized Light-Emitting Diodes of Colloidal Quantum Wells and Magnetic Nanoparticles (Advanced Optical Materials 12/2026)

Savas Delikanli, Arinjoy Bhattacharya, Betul Canimkurbey, Chang Huai, Amani Almutairi, Arman Najafi, Hilal Korkut, Farzan Shabani, Furkan Isik, James Pientka, Ibrahim Sarpkaya, Hao Zeng, Richard D. Schaller, Athos Petrou, Hilmi Volkan Demir

e70983 | First Published: 24 March 2026

This article relates to:



Spin-Light Emitting Diodes
In the Research Article (DOI: 10.1002/adom.202502254), Savas Delikanli, Athos Petrou, Hilmi Volkan Demir, and co-workers introduce solution processed spin-LEDs based on colloidal magnetic Fe_3O_4 nanoparticles and CdSe/CdZnS core/shell CQWs to realize circularly polarized emission that can be modulated by magnetic field.

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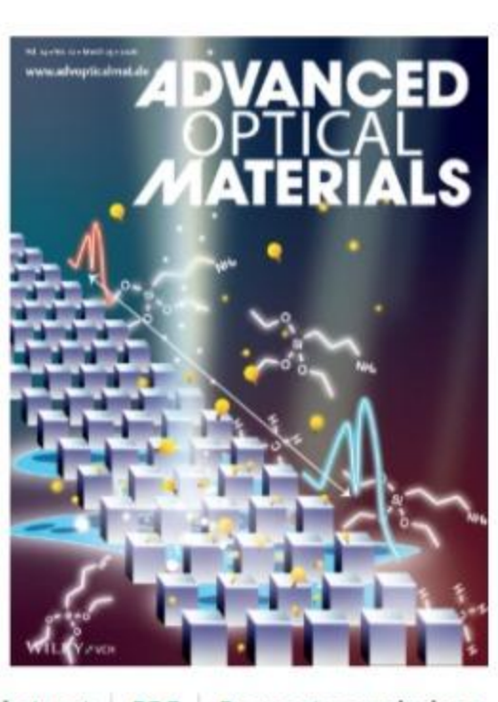
Responsive Visible-Wavelength Metasurfaces from Porous Silicon Based on Fano Guided-Mode Resonance (Advanced Optical Materials 12/2026)

Tomoshree Dash, Saddam Gafsi, Estevao Marques Dos Santos, Ivan Kravchenko, Judson D. Ryckman

e70989 | First Published: 24 March 2026

This article relates to:



Responsive Visible-Wavelength Metasurfaces
In the Research Article (DOI: 10.1002/adom.202502295), Judson D. Ryckman and co-workers demonstrate porous silicon metasurfaces operating on the principle of Fano guided mode resonance. The high surface area and subwavelength pore dimensions facilitates responsive and high sensitivity detection of small molecule surface interactions in a compact and low-cost form factor.

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Issue Information

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Issue Information

e70990 | First Published: 24 March 2026

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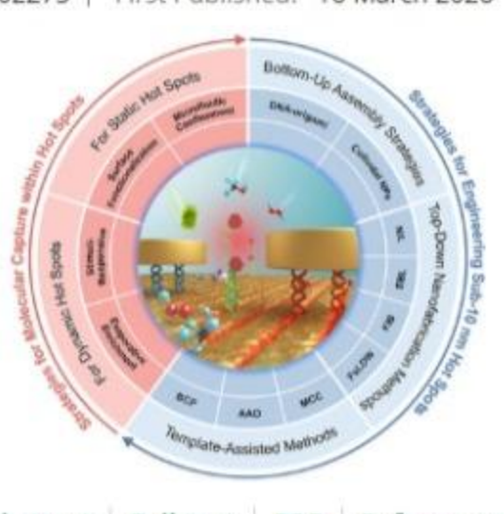
REVIEW

Full Access

Crucial Factors for Reproducible and Ultrasensitive Surface-Enhanced Raman Spectroscopy Detection: Hot Spot Engineering and Molecular Delivery

Sisi Yan, Haibin Tang, Liaoyong Wen, Nianqiang Wu, Guowen Meng

e02275 | First Published: 16 March 2026



This review highlights recent progress in the development of next-generation surface-enhanced Raman scattering (SERS) substrates through the strategic integration of plasmonic hot spot engineering and efficient molecular delivery. These advances aim to overcome long-standing challenges related to SERS sensitivity and reproducibility, thereby paving the way for reliable and practical applications in biosensing, clinical diagnostics, environmental monitoring, and related fields.

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Research Article

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Solution-Processed Spin-Polarized Light-Emitting Diodes of Colloidal Quantum Wells and Magnetic Nanoparticles

Savas Delikanli, Arinjoy Bhattacharya, Betul Canimkurbey, Chang Huai, Amani Almutairi, Arman Najafi, Hilal Korkut, Farzan Shabani, Furkan Isik, James Pientka, Ibrahim Sarpkaya, Hao Zeng, Richard D. Schaller, Athos Petrou, Hilmi Volkan Demir

e02254 | First Published: 17 December 2025

This article relates to:

All-solution-processed spin-LEDs based on colloidal Fe_3O_4 nanoparticles and CdSe/CdZnS core/shell CQWs that allows for polarization modulation of electroluminescence are fabricated. With these devices, electrical injection of spin-polarized carriers from the Fe_3O_4 nanoparticle layer into the CdSe/CdZnS CQWs is demonstrated, realizing circularly polarized emission that can be modulated by a magnetic field.

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Responsive Visible-Wavelength Metasurfaces from Porous Silicon Based on Fano Guided-Mode Resonance

Tomoshree Dash, Saddam Gafsi, Estevao Marques Dos Santos, Ivan Kravchenko, Judson D. Ryckman

e02295 | First Published: 21 December 2025

This article relates to:

The article introduces mesoporous silicon metasurfaces (pSi-MS) supporting Fano guided-mode resonances in the visible regime. By combining top-down lithographic patterning of 2D gratings with bottom-up electrochemical porosification, the approach realizes a new class of responsive metasurfaces, enabling highly sensitive and portable platforms for small molecule sensing, microfluidic applications, and image-based detection.

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RESEARCH ARTICLE

Editor's Choice

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Reverse Intersystem Crossing and Exciton Harvesting: A Pathway to Low Threshold in Multi-Resonant TADF Electrically Pumped Organic Semiconductor Lasers

Adam Bickerdike, Mahdiyar Nouri-Rezaie, Takuji Hatakeyama, Chris Groves, Chihaya Adachi, Mujeeb U. Chaudhry, Roderick C. I. MacKenzie

e01796 | First Published: 16 March 2026

Electrically pumped organic lasing thresholds are lowered by mitigating triplet accumulation through a tailored host-guest system. Integrating the multi-resonant TADF emitter DABNA-2 into a triplet-scavenging BSBCz host suppresses singlet-triplet annihilation. Numerical modeling and micro-OLED experiments quantify this mechanism, predicting a 50% reduction in threshold current density via efficient exciton harvesting.

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Exploration of Pyridyl Porphyrin as Ultrafast Hot Hole Extractor From Colloidal $CsPbI_3$ Quantum Dots

Sadashiv Wadepalli, Shekhar Mondal, Souvik Das, Naga Pranava Sree Kothoori, Pralok K. Samanta, Prakriti Ranjan Bangal, Abhijit Hazarika

e03615 | First Published: 16 March 2026

Ultrafast hot-hole extraction from $CsPbI_3$ QDs to TPyP molecules, probed using fs-transient absorption spectroscopy. The average hot hole extraction efficiency from all the excited states to TPyP under 2.58 eV excitation was estimated to be ~22%. Further analysis at the isosbestic point reveals that the hot hole extraction efficiency can reach a maximum up to ~36%, highlighting the potential of such systems for hot carrier solar cells.

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Optical Diversity and Nanostructural Organization in the Colored Scales of *Sternotomis*

Viola Bauernfeind, Viola V. Vogler-Neuling, Ilja Gunkel, Primož Pirih, Ullrich Steiner, Bodo D. Wilts

e03324 | First Published: 16 March 2026

Vivid colors in Sternotomis beetles originate from nanoscale photonic architectures embedded within individual scales. Here, we provide a comparative optical and structural analysis of 57 scale types that reveal how ordered, quasi-ordered, and disordered 3D networks tune color, saturation, and angular response. These findings establish a biological blueprint for designing advanced optical materials.

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Programmable Thermoresponsive Multicolor Afterglow Enabled by Pyrene-End-Capped Polyamides

Min Liu, Yan Yu, Yongjie Yuan, Hailiang Zhang

e03812 | First Published: 05 March 2026

A series of PA69 polymers with precisely controlled pyrene-1-carboxylic acid (PyCA) terminal modification was developed to construct a dual-emissive phosphorescent system. The time-resolved multicolor phosphorescence and temperature-responsive afterglow behaviors were systematically investigated. By correlating emission color evolution, lifetime variation, and thermal quenching characteristics, the cooperative and competitive phosphorescence mechanisms of the PA69 backbone and pyrene terminals were elucidated in detail.

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Achieving High Photoluminescence Quantum Yield in Sb-Doped Indium-Based Hybrid Halides for Single-Component Warm White LEDs

Yuyang He, Yuting Xu, Yuzhen Wang, Shuai Zhang, Zhiguo Xia

e00001 | First Published: 05 March 2026

$(Me_2NH_2)_4InCl_7{:}xSb^{3+}$ feature distorted $[SbCl_6]$ octahedra that enable efficient broadband self-trapped-exciton emission. Accordingly, it enables single-component warm-white LEDs with high brightness and excellent color quality, delivering robust performances while simplifying the device architecture for practical solid-state illumination.

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Unraveling Mechanism of Photoluminescence in Hybrid Indium Halide Materials

Aleksandra D. Valueva, Emily M. Chopra, Vladislav V. Klepov

e00007 | First Published: 05 March 2026

Halide substitution in isolated $[InHal_6]^{3-}$ octahedra reveals how bromide incorporation governs photoluminescence properties in hybrid indium halides. Ligand-to-metal charge transfer excitation followed by recombination produces a red-shift and steadily increasing photoluminescence efficiency with increasing Br content. These results establish halide identity as the key design parameter for efficient lead-free luminescent materials.

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High-Quality Free-Standing Diamond Micromembranes for Nanoscale Quantum Sensing

Alexander C Pakpour-Tabrizi, Artur Lozovoi, Sean Karg, Tecla Bottinelli Montandon, Melody Leung, Kai-Hung Cheng, Nathalie P. de Leon

e03864 | First Published: 16 March 2026

We report a procedure for fabricating low-damage free-standing diamond micromembranes, and we show that this fabrication scheme preserves the optical and spin properties of state-of-the-art shallow NV center quantum sensors, within nanometers of the diamond surface, while providing significant photonic enhancement. Furthermore, we demonstrate a pick-and-place transfer method, which enables integration with diverse sensing targets.

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$ZnCl_2$ Post-Treatment Enables High-Efficiency Violet $CsPbCl_3$ Quantum Dot LEDs

Po-Hsien Lai, Chien-Cheng Li, Tien-Lin Wu, Chih-Shan Tan

e03635 | First Published: 12 March 2026

Schematic illustration of $ZnCl_2$ post-treatment–induced doping in $CsPbCl_3$ quantum dots (QDs).

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Full Access

Advanced Multi-Objective Optimization of Nonlinear Metasurface Unlocks Quantum Light Generation

Alemayehu Getahun Kumela, Stéphane Lanteri, Francesco Papoff, John Jeffers, Giuseppe Leo, Célestin Lecasble, Jean-Michel Gérard, Mahmoud Elsawy

e03793 | First Published: 09 March 2026

Innovative inverse design framework incorporating quantum metrics into the optimization process is demonstrated. Using advanced multi objective optimization, both entanglement fidelity and spontaneous parametric down-conversion (SPDC) rate are simultaneously maximized, achieving high brightness and quantum purity. Numerical simulations predict a Bell-state fidelity of 0.989 and a collected SPDC rate of 55 Hz/mW, enabling compact, high-purity entangled photon sources.

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A Multi-Additive System With Superimposed Optimization Effects by Incorporating Additives With Tailored Mechanisms for Perovskite Solar Cells

Bangqi Jiang, Wen Yang, Yao Xiao, Ziyue Rao, Yugeng Hao, Ruijiang Hong

e03859 | First Published: 05 March 2026

A multi-additive system with superimposed optimization effects by incorporating additives with tailored mechanisms for perovskite solar cells.

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Ratiometric Temperature Sensing through Alternating Current Electroluminescence

Zhifeng Xing, Shuohan Li, Xin Zhang, Fengjun Chun, Yaxin Cao, Shengqiang Liu, Xiaohe Wei, Feng Wang

e03425 | First Published: 05 March 2026

Thermoresponsive alternating current electroluminescence (ACEL) is realized in ZnS microparticles with optimized Cu, Cl, and Co tri-doping concentrations, exhibiting a blue-to-green emission band shift along with increasing temperature. Based on this behavior, an ACEL-driven temperature sensing platform is developed for quantitative temperature detection and visualized surface temperature mapping.

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Efficient Deep Blue Luminescent Materials With Hybrid Local and Charge Transfer Characteristics for High-Performance OLEDs

Zhangshan Liu, Ting Guo, Ben Zhong Tang, Zujin Zhao

e71112 | First Published: 11 March 2026

Two efficient deep blue luminescent materials with hybrid local and charge transfer characteristics are developed, which radiate deep blue electroluminescence peaking at 420 and 450 nm with high external quantum efficiencies of 7.6% and 5.9% in non-doped OLEDs and 10.6% and 11.7% in doped OLEDs.

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Enabling Ion Milling Redeposition Nano-Templates for Scalable Nanofabrication of Chemical-Sensing Metamaterials with 10 nm-Feature Size

Mengcheng Wang, Hongbing Shi, Di Wu, Li Jiang, Zhijuan Su, Zhuoqing Yang, Guifu Ding, Faheng Zang

e00012 | First Published: 11 March 2026

This work introduces a novel fabrication process, the redeposition effect in ion milling, to create sub-10 nm nanogaps. This method enabled the production of gratings and nanoring structures incorporating metal nanogaps. Combined with the etching process, the smallest feature size of the metal mask is inherited on the silicon substrate. The resulting templates facilitated high-fidelity replication of diminutive structures via nanoimprinting.

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Elucidating the Mechanism behind the Enhancement of Persistent Luminescence in $ZnGa_2O_4$: Cr^{3+} Nanoparticles upon H_2O_2 Exposure

Celina Matuszewska, Izabel Mazon Anselmo, Mathilde Chaboud, Dimitri Mercier, Zied Ferjaoui, Cyrille Richard, Bruno Viana, Corinne Chaneac

e02409 | First Published: 11 March 2026

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