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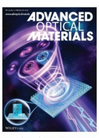
Compact Generation of Ultraviolet Structured Light via Low-Loss Dielectric Metasurfaces (Advanced Optical Materials 7/2026)

Huixian Zhou, Zhenyu Xing, Yuhui Hu, Hao Gao, Zhelin Lin, Niu Liu, Deqian Zheng, Xinliang Zhang, Cheng Zhang

e70947 | First Published: 15 February 2026

This article relates to:



UV Structured Light Generation via HfO_2 Metasurface

This cover showcases a low-loss hafnium oxide (HfO_2) metasurface for ultraviolet structured light generation. It supports polarization multiplexing and transforms incident Gaussian beams into outputs with tunable topological charge, radial index, and polarization order, offering a compact and versatile chip-scale solution. More details can be found in the Research Article by Cheng Zhang and co-workers (DOI: 10.1002/adom.202501940).

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Inside Front Cover

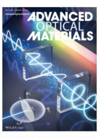
Free Access

Ultra-Small Birefringence Continuous-Tuning and Full-Band Zero-Order Waveplate Devices (Advanced Optical Materials 7/2026)

Feifei Guo, Lijuan Chen, Jie Yu, Yang Li, Youxuan Sun, Zeliang Gao

e70944 | First Published: 15 February 2026

This article relates to:



Zero-Order Waveplate

Waveplates have attracted increasing attention due to their irreplaceable role in polarization optics. For a long time, zero-order waveplates exhibited ultra-thin machining and application difficulties because the birefringence of the crystal was not small enough. Through non-principal axis cutting, even materials with large birefringence can achieve appropriate birefringence values by adjusting the incident direction, thereby expanding the selection range of waveplate materials and achieving precise phase control of light waves in a wide spectral range, breaking the limitations of the inherent birefringence and transmittance band of a single material. More details can be found in the Research Article by Lijuan Chen, Zeliang Gao, and co-workers (DOI: 10.1002/adom.202502910).

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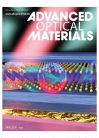
Temperature-Dependent Optical and Polaritonic Properties of Excitons in hBN-Encapsulated Monolayer TMDs (Advanced Optical Materials 7/2026)

Matan Meshulam, Anabel Atash Kahlon, Yonatan Gershuni, Thomas Poirier, James H. Edgar, Seth Ariel Tongay, Itai Epstein

e70946 | First Published: 15 February 2026

This article relates to:



TMD Optical and Polaritonic Properties Revealed

The temperature-dependent optical response of excitons in monolayer WS_2, MoS_2, WSe_2 and $MoSe_2$ TMDs is characterized in high-quality, hBN-encapsulated heterostructures, finding all four TMDs support surface-exciton-polaritons, with $MoSe_2$ demonstrating the strongest optical and polaritonic response. More details can be found in the Research Article by Itai Epstein and co-workers (DOI: 10.1002/adom.202502535).

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e70945 | First Published: 15 February 2026

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Review

All-Optical Modulated Bidirectional Responsive Synaptic Devices: Materials, Mechanisms, and Applications

Hao Chen, Dongyue Huang, Zhiruo Zhang, Song Wang, Yinghui Han, Hui Huang

e03737 | First Published: 24 January 2026

All-optical modulated bidirectional responsive synaptic (AOMBRS) devices, inspired by the human retina, bypass von Neumann bottlenecks. Based on organic, perovskite, 2D materials, and metal oxides with excellent optoelectronic properties, they leverage mechanisms like photogating and vacancy ionization to enable logic operations, associative learning, neuromorphic computing, and adaptive vision, while facing challenges in material stability, device performance, and large-scale integration.

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Research Article

Compact Generation of Ultraviolet Structured Light via Low-Loss Dielectric Metasurfaces

Huixian Zhou, Zhenyu Xing, Yuhui Hu, Hao Gao, Zhelin Lin, Niu Liu, Deqian Zheng, Xinliang Zhang, Cheng Zhang

e01940 | First Published: 18 September 2025

This article relates to:

High-efficiency, versatile UV structured light generation is achieved with low-loss hafnium oxide metasurfaces. The device reaches 72% operating efficiency at 360 nm and enables polarization multiplexing, allowing dynamic switching between radially and azimuthally polarized beams via incident polarization control. This compact platform offers a flexible and low-loss solution for chip-scale UV structured light sources.

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Ultra-Small Birefringence Continuous-Tuning and Full-Band Zero-Order Waveplate Devices

Feifei Guo, Lijuan Chen, Jie Yu, Yang Li, Youxuan Sun, Zeliang Gao

e02910 | First Published: 17 November 2025

This article relates to:

Through non-principal axis cutting, even materials with large birefringence can achieve appropriate birefringence values by adjusting the incident direction, thereby expanding the selection range of waveplate materials and achieving precise phase control of light waves in a wide spectral range, breaking the limitations of the inherent birefringence and transmittance band of a single material.

Abstract | Full text | PDF | References | Request permissions

Rising Stars

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Temperature-Dependent Optical and Polaritonic Properties of Excitons in hBN-Encapsulated Monolayer TMDs

Matan Meshulam, Anabel Atash Kahlon, Yonatan Gershuni, Thomas Poirier, James H. Edgar, Seth Ariel Tongay, Itai Epstein

e02535 | First Published: 27 November 2025

This article relates to:

A comparative study of the optical and polaritonic properties of excitons in hBN-encapsulated monolayer TMDs close to the homogeneous linewidth is presented. Reflection spectroscopy with transmission-line modeling enables extraction of the complex permittivities and demonstrate their ability to host surface-exciton-polaritons. It is found that under these conditions, MoSe2 shows the strongest optical and polaritonic response, in contrast to previous studies.

Abstract | Full text | PDF | References | Request permissions

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Influence of Platinum Thin Films on the Photophysical and Quantum Properties of Near-Surface NV Centers

Joachim P. Leibold, Lina M. Todenhagen, Matthias Althammer, Nikhita Khera, Sergej Levashov, Elke Neu, Martin S. Brandt, Hans Huebl, Dominik B. Bucher

e03544 | First Published: 09 February 2026

This work investigates the impact of platinum thin films on shallow nitrogen-vacancy (NV) centers in diamond for quantum sensing applications. Five samples are analyzed with varying nitrogen implantation energies (2.5–60 keV) and changes in optical properties, charge state, and coherence times are reported. The findings provide insights into NV–metal interactions and guide device designs integrating thin metal layers.

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Carrier Dynamics of β-Ga_2O_3 Single Crystal

Peng Lan, Minhui Dai, Fangming Zhao, Linlin Zeng, Rui Zhao, Weihua Tang, Meng Zhou

e02258 | First Published: 21 January 2026

This study employs transient absorption spectroscopy to comprehensively investigate carrier dynamics (particularly sub-picosecond processes) in β-Ga_2O_3 single crystals: (left) two-photon absorption dynamics; (right) hot carrier relaxation and carrier recombination. These findings elucidate the hierarchical dynamics spanning femtosecond to microsecond timescales in β-Ga_2O_3, offering insights into developing and optimizing β-Ga_2O_3-based optoelectronic devices.

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Terahertz Volume Plasmon-Polariton Modulation in All-Dielectric Hyperbolic Metamaterials

Stefano Campanaro, Luca Bursi, Stefano Curtarolo, Arrigo Calzolari

e02680 | First Published: 22 January 2026

THz volume plasmon-polariton (VPP) propagation through plasmon-based hyperbolic metamaterials, made of alternating layers of doped and undoped III-V semiconductors.

Abstract | Full text | PDF | References | Request permissions

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Ultrabroadband Excitation of Hot Carriers in Plasmonic Nanorods Revealed by Two-Dimensional Electronic Spectroscopy

Andrea Schirato, Mattia Russo, Luca Moretti, Alessandro Molinelli, Laura Polito, Filippo Rossi, Giulio Cerullo, Giuseppe Della Valle, Margherita Maiuri

e03283 | First Published: 28 January 2026

This work dissects the ultrafast response of polydisperse plasmonic nanorods using two-dimensional electronic spectroscopy, uniquely combining temporal and spectral resolution. Our ultrabroadband pulses cover both transverse and longitudinal nanorods' resonances, revealing sub-200-fs dynamics and distinct broadening mechanisms. Experiments are complemented with an original model of hot-carrier-mediated nonlinearities, advancing the understanding of plasmonic hot carriers in complex systems.

Abstract | Full text | PDF | References | Request permissions

Novel Interface Resonance-Enhanced Organic Photodetectors with High Stability and Detectivity for Health Monitoring

Guoqiang Liu, Jiaxin Luo, Congdi Xu, Kepian Miao, Dingming Lin, Weiyang Gong, Gang Song, Zhisheng Zhou, Ning Li, Min Chen, Qiao He, Zhicai He

e02767 | First Published: 20 January 2026

The ITO/PFN-Br/Au-based organic photodetector (OPD) exhibits high performance, enabling accurate monitoring of blood pressure, while the formation of a microcavity structure with a redshift in the absorption edge is particularly beneficial for blood oxygen monitoring.

Abstract | Full text | PDF | References | Request permissions

Laser-Induced Plasmonic Nanostructures for Optical Storage and Encryption in Disordered Crystals

Bo Wu, Han Zhu, Qingchuan Ye, Lingrui Chu, Lilong Pang, Saulius Juodkazis, Feng Chen

e03136 | First Published: 20 January 2026

A non-planar fabrication strategy that enables 3D directional migration and morphological reconstruction of Ag nanoparticles in laser crystals is presented. This allows precise rare-earth ion fluorescence control for optical information encryption. Achieved under ambient conditions, the method offers subwavelength, cross-scale processing on dielectric substrates, paving the way for scalable plasmonic device integration.

Abstract | Full text | PDF | References | Request permissions

Unveiling Photoluminescence Signatures of Magneto-Optical Coupling in Layered Hybrid Manganese Chloride Perovskites

Yaiza Asensio, Samuele Mattioni, Daniel Vaquero, Cédric A. Cordero-Silis, Houman Bahmani Jalali, Dorwal Marchelli, Marco Gobbi, Fèlix Casanova, Francesco Di Stasio, Marcos H. D. Guimarães, Luis E. Hueso, Beatriz Martín-García

e03123 | First Published: 22 January 2026

The relationship between magnetism and photoluminescence (PL) in two antiferromagnetic layered hybrid Mn-based perovskites with different lattice stiffness is investigated. Temperature-dependent PL excitation and emission reveal significant changes before reaching long-range magnetic order, whose magnitude and temperature vary between compounds. This originates from the interplay among the magnetic polarons, intrinsic magnetism, and crystal structure, providing new insights into spin-optoelectronics.

Abstract | Full text | PDF | References | Request permissions

Fabry-Pérot Microlaser Arrays Digitalized by Intra-Cavity Microlenses for Multiply Programmable Optical Encryption

Zifeng Xiao, Fengying Ji, Xuyang Zhao, Qi Wang, Hanxuan Huang, Yun Liu, Xiaoqin Wu, Xiang Wu, Yun-Lu Sun

e02719 | First Published: 19 January 2026

A programmable encryption platform is developed by integrating custom microlenses into Fabry–Pérot microcavities for controlling optical confinement. A microlens array, fabricated using two-photon lithography, together with the cavity length and pump energy, forms a triple-key for multi-attribute laser imaging encryption. This work provides a scalable tool for all-optical anti-counterfeiting and data encryption.

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Epitaxial Growth of Degenerately Doped Ga_2O_3 Films on GaN (0001) as a Deep Ultraviolet Transparent Electrode for Opto-Electronics Applications

Yue Yu, Xu Zhang, Wenjing Xu, Rongkun Chen, Cien Liu, Yiru Zhao, Yushuo Hu, Zhilai Fang, Ning Jia, Xiangyu Xu, Kelvin H. L. Zhang

e03337 | First Published: 20 January 2026

The degenerately Si-doped Ga_2O_3 (n^+-Ga_2O_3) epitaxial films are deposited on GaN (0001) substrates as a novel DUV transparent electrode. High-resolution X-ray photoemission spectroscopy (XPS) reveals the n^+-Ga_2O_3/GaN heterojunction with a small energy barrier height and narrow band bending. These results facilitate efficient carrier transport via quantum tunneling and explain the formation of excellent Ohmic contact behavior.

Abstract | Full text | PDF | References | Request permissions

VIS–IR Bilateral Modulation of All-Solid-State Electrochromic Devices Based on Two Principles: Localized Surface Plasmon Resonance and Ions-Electrons Dual Circulation

Jiaming Yang, Mengying Wang, Agnieszka Pawlicka, Ferial Benmahdi, Zheng Meng, Xungang Diao

e03552 | First Published: 22 January 2026

The electrochromic device(ECD) combines the plasmonic and traditional electrochromic processes together to gain VIS–IR dual band regulation. Ti-doped ITO instead of WO_3 modulates IR, the NiO_x modulates VIS. The $\Delta\varepsilon$ of the ECD in the range of 1.25–2.5, 3–5, 8–14 µm, are 0.50, 0.51and 0.48, respectively.

Abstract | Full text | PDF | References | Request permissions

Highly Photosensitive and Stable SiC/ZnO Nanowire Photoelectrochemical Ultraviolet Photodetector Based on Heterojunction Engineering for Reliable Complex Underwater Application

Zhiheng Liu, Hulin Wang, Runchao Dong, Jia Zhang, Hongxin Yin, Genqiang Liu, Weijun Li, Dongdong Zhang, Marko Gloginjić, Marko Erich, Weiyou Yang, Srdjan Petrović, Shanliang Chen

e03059 | First Published: 20 January 2026

A highly responsive and reliable photoelectrochemical ultraviolet photodetector based on a SiC/ZnO heterojunction nanowire photoelectrode is designed. The device exhibits excellent photodetection performance with rapid rise/decay times (186/454 ms), high responsivity (15.76 mA W^{-1}), high detectivity (1.827×10^{10} Jones), and excellent external quantum efficiency (5.21%) under 375-nm ultraviolet illumination.

Abstract | Full text | PDF | References | Request permissions

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Thickness Dependence of Linear and Nonlinear Optical Properties of Multilayer 3R-MoS_2

Fatemeh Abtahi, Alen Shaji, Gia Quyet Ngo, Benjamin Laudert, Hossein Esfandiar, Sebastian W. Schmitt, Falk Eilenberger

e03498 | First Published: 30 January 2026

Thickness as a key design parameter for optimizing the nonlinear optical response of layered transition metal dichalcogenides (TMDs) materials is established. The demonstrated correlation between thickness, linear spectra, and harmonic generation efficiency provides a powerful framework for tailoring nonlinear performance. This work highlights the central role of precise thickness control in advancing nonlinear and quantum applications based on TMDs.

Abstract | Full text | PDF | References | Request permissions

Hierarchical Metasurfaces with Significant Reductions in Aspect Ratio Based on Geometrically Compensated Phase

Wenbiao Liu, Bobo Du, Yuantong Yang, Yigang Ma, Hussain Ali, Jinxian Lu, Jingmin Zhou, Yaping Hou, Fu Liu, Yanpeng Zhang, Lei Zhang

e03231 | First Published: 20 January 2026

Hierarchical metasurfaces with nanoscale unit cells providing the phase gradient and microscale grating-shaped substrate offering a geometrically compensated phase are reported. Beam deflections and focusing are achieved with the aspect ratio significantly reduced from 30 to 8.7 by 71% compared with the metasurface without phase compensation. The concept can be generalized to other optical materials.

Abstract | Full text | PDF | References | Request permissions

High-Efficiency FWHM-Variable NIR II Phosphor $Mg_4Al_{4.5}Ga_{2.45}B_{1.05}O_{16}$: Cr^{3+} with Excellent Thermal Stability

Yang Wei, Han Gu, Yuanyuan Yi, Ye Jin, Fancheng Meng, Guotao Xiang, Jiahua Zhang, Li Ma, Xiao-Jun Wang, Haishen Ren

e03304 | First Published: 21 January 2026

A NIR phosphor $Mg_4Al_{4.5}Ga_{2.45}B_{1.05}O_{16}$:$Cr^{3+}$ with tunable FWHM (49–250 nm) is synthesized and Cr^{3+} locates in MgO_6, AlO_6, and GaO_6 forming three centers in $Mg_4Al_{4.5}Ga_{2.45}B_{1.05}O_{16}$. $Mg_4Al_{4.5}Ga_{2.45}B_{1.05}O_{16}$: $0.15Cr^{3+}$ has excellent thermal stability maintaining 87.5%@373 K and 73%@423 K and IQE of 95.7%. The fabricated NIR pc-LED achieves a photoelectric conversion efficiency of 15.8%, producing optical power of 120 mW@500 mA.

Abstract | Full text | PDF | References | Request permissions

Co-Catalyst Free Efficient Photocatalytic CO_2 Reduction Using Facet-Engineered Polyhedral $CsPbBr_3$ Perovskite Nanocrystals

Subarna Biswas, Rajashree P. Mishra, Jit Satra, Ram Sewak, Jyotisman Rath, Anirban Mondal, Yatendra S. Chaudhary, Nimai Mishra

e03043 | First Published: 20 January 2026

In this work, it is demonstrated that crystal morphology plays a more decisive role than size in governing CO_2 photoreduction over $CsPbBr_3$ perovskite nanocrystals. TOP-capped, amine-free 26-faceted rhombicuboctahedron polyhedral nanocrystals achieve a total CO evolution of 394 µmol g^{-1} with a rate of 35.81 µmol g^{-1} h^{-1}, significantly outperforming oleylamine-capped, 6-faceted cubic nanocrystals with an overall yield of only 34 µmol g^{-1}.

Abstract | Full text | PDF | References | Request permissions

Oxygen-Vacancy-Mediated Amorphous Ga_2O_3 for Neuromorphic Multicolor Image Sensor

Hao Yuan, Huili Liang, Rui Zhu, Haoran Mu, Yuantao Wang, Shenghuang Lin, Wei Zheng, Peng Song, Guangyu Zhang, Zengxia Mei

e03046 | First Published: 20 January 2026

Leveraging broadband photoresponse and distinct wavelength-dependent synaptic behavior of V_O-rich amorphous Ga_2O_3, a neuromorphic trichromatic image sensor is demonstrated. Under raster scanning of focused laser beams of 638, 520, and 405 nm, a 10×10 imaging array well identifies multicolor patterns enabled by the combination of distinguishable photocurrent levels and memorizing/fading time. This work opens new avenues for designing bio-inspired visual systems.

Abstract | Full text | PDF | References | Request permissions

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Polarization-Sensitive Au-TiO_2 Nanopillars for Tailored Plasmonic Enhanced Light-Driven Reaction Activity

Ning Lyu, Anjalie Edirisooriya, Zelio Fusco, Dawei Liu, Lan Fu, Fiona J. Beck, Christin David

e03650 | First Published: 20 January 2026

Manipulating the product generation yield is achieved on a model plasmonic resonance-driven reaction by tuning the nonthermal effects of localized surface plasmonic resonance on an elliptical Au-TiO_2 nanopillar metasurface. Asymmetric configuration of the elliptical nanopillar array governs the polarization-dependent optical properties redshifting the peak resonance, tailoring in absorption at the target photocatalytic wavelength.

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Donor-Substituted C(sp^3)-Bridged Phosphorus-Heterotriangulenes as Blue Thermally Activated Delayed Fluorescence Emitters

Maximilian Schöner, Angelina Jocic, Siegfried Harrer, Mahni Fatahi, Jonas Maurmann, Andrea Reule, Frank Rominger, Eli Zysman-Colman, Milan Kivala

e03851 | First Published: 22 January 2026

The newly developed regioselective strategy for the *para*-functionalization of C(sp^3)-bridged phosphorus-centered heterotriangulene delivers a series of donor-acceptor emitters exhibiting thermally activated delayed fluorescence. The carbazole-substituted compounds feature a unique combination of high photoluminescence quantum yields up to 75%, deep blue chromaticity, and narrow emission, outperforming known phosphine oxide-based systems.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Key Excitonic Processes Governing the Stability of Deep-Blue Phosphor-Sensitized Fluorescent Organic Light-Emitting Diodes

Kwangmo Yang, Joon-Gyu Oh, Joonghyuk Kim, Eunkyung Lee, Sungho Nam, Jaesang Lee

e03267 | First Published: 20 January 2026

By combining cryogenic photoluminescence spectroscopy with exciton-kinetic modeling, this study reveals the excitonic processes that govern the operational lifetime of deep-blue phosphor-sensitized fluorescent organic light-emitting diodes (OLEDs). A high activation energy for reverse intersystem crossing suppresses high-energy triplet-driven degradation, enabling record operational lifetimes with CIEy < 0.15 and establishing design principles for next-generation stable deep-blue OLEDs.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

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Excitonic Landscapes in Monolayer Lateral Heterostructures Revealed by Unsupervised Machine Learning

Maninder Kaur, Nicolas T. Sandino, Jason P. Terry, Mahdi Ghafariasl, Yohannes Abate

e03674 | First Published: 22 January 2026

Hyperspectral photoluminescence data from graded $Mo_xW_{1-x}S_2$ alloys and monolayer MoS_2–WS_2 lateral heterostructures are analyzed using unsupervised machine learning. The combined use of PCA, t-SNE, and DBSCAN uncovers distinct excitonic regions that trace how composition, strain, and defects modulate optical responses in these 2D materials.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

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Molecular Engineering for Enhanced Second-Order Nonlinear Response in Spontaneously-Oriented Evaporated Organic Films

Pierre-Luc Thériault, Heorhii V. Humeniuk, Zhechang He, Gabriel Juteau, Alexandre Malinge, Dmytro F. Perepichka, Stéphane Kéna-Cohen

e02212 | First Published: 23 January 2026

Intramolecular bridge-locking frustrates detrimental anti-parallel packing in evaporated organic films. This design enhances net polar orientation, leading to a twofold off-resonance increase in the second-order nonlinear susceptibility ($\chi^{(2)}$) without electric-field poling.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Dual-Exciplex Architecture: A Universal Route to Color-Tunable OLEDs

Zhongtao Shen, Zhaoyue Lü, Haichuan Mu, Jing Xiao

e03202 | First Published: 20 January 2026

A universal all-exciplex host-guest system is proposed for color-tunable OLEDs. The voltage-dependent emission originates from modulated energy transfer between host and guest exciplexes, whereby efficient transfer occurs at low bias and becomes suppressed at elevated voltages due to guest-state saturation. This dual-exciplex strategy enables continuous color tuning and demonstrates broad structural adaptability and material generality across diverse device architectures.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

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Enhancing Triplet Excitons Lifetime Through Controlled Intermolecular Interactions

Martin Richter, Muhammed Jeneesh Kariyottukuniyil, Zhiyun Xu, Philipp Ludwig, Pavel V. Kolesnichenko, Christian Huck, Uwe H. F. Bunz, Christof Wöll, Wolfgang Wenzel, Petra Tegeder

e02979 | First Published: 22 January 2026

Singlet fission (SF) is investigated in pentacene embedded in a surface-anchored metal–organic framework, enabling a molecular arrangement inaccessible in pure organic crystals. This architecture changes the singlet fission dynamics significantly and enhances the triplet lifetime by almost four orders of magnitude. This is an extremely promising improvement regarding the feasibility of SF materials.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Deep Learning-Powered Perovskite Paper Sensors for Ultrasensitive on-Site Mercury Detection

Jialong Xu, Yubiao Yue, Zhishan Chen, Hongqiang Zhu, Shaoan Zhang, Yiqing Chen, Huiwang Lian, Yuzhen Wang, Jia Xu, Linhai Li, Yang Li

e03205 | First Published: 20 January 2026

This work developed water-stable perovskite fluorescent materials and corresponding paper-based test kits, and combined a smartphone app with AI-based analysis to enable fast, accurate on-site detection of trace mercury ions.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Powder Atomic Layer Deposition–Enabled Stable Perovskite Phosphors for UV-Wavelength-Discriminable Luminescent Films

Dong Geon Shin, Seon Kyeong Kim, Min Kyu Jeon, Dante Ahn, Yusin Pak, Yoon Soo Han, Yeong Jae Kim, Hyeonghun Kim

e02641 | First Published: 20 January 2026

Al_2O_3-coated perovskite powders synthesized via powder atomic layer deposition (PALD) exhibited a 23.1% enhancement in photoluminescence quantum yield and remarkable structural and chemical stability under severe humidity and thermal stress. Furthermore, blending with PALD-coated $Cs_3Cu_2I_5$ enabled distinct green, sky-blue, and blue emissions under UVA, UVB, and UVC excitation, highlighting their potential for wavelength-selective UV sensing applications.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Editor's Choice

Low-Cost High-Performance VIS-NIR Snapshot Imager via Single-Exposure Patterning and Cumulative Attention Transformer Reconstruction

Shuaibo Feng, Jiaming Liang, Xuehui Wang, Junren Wen, Weiming Shi, Yipeng Chen, Haidong He, Linze Li, Lingfeng Zhang, Haiqi Gao, Mingzhong Pan, Yuchuan Shao, Weidong Shen, Chenying Yang

e03435 | First Published: 24 January 2026

A scalable solution for snapshot spectral imaging is presented, combining efficient hardware with advanced computation. The device utilizes single-exposure grayscale lithography to fabricate a 'weakly confined' cavity array. Coupled with a deep learning reconstruction network, this low-cost architecture restructures precise spectral information across the visible-to-near-infrared range.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Durable and Ultra-Black Superhydrophobic Coatings for High-Efficiency Photothermal Applications Under Harsh Conditions

Xiaolong Wu, Yan Wang, Jian Li, Wenqian Wang, Xiang Cheng, Chao Li, Zhi-Yan Zhao, Yaodong Liu, Xue-Qing Liu

e03714 | First Published: 20 January 2026

A robust, ultra-black CNTs/TiN@PDMS coating with a hierarchical micro/nanostructure is developed in this study. It combines exceptional superhydrophobicity with enhanced photothermal performance via plasmonic coupling near-field effect and light-trapping structure, enabling efficient anti-icing and de-icing under low-temperature and weak sunlight, demonstrating remarkable mechanical and chemical durability for practical outdoor applications.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Super-Encryption of Full-Color Fluorescent Hologram in Carbon Dot Assemblies

Shuo Zhang, Xin Ji, Haizhu Sun, Jingying Miao, Xiuping Qi, Zhihao Zhang, Shencheng Fu, Xintong Zhang, Yichun Liu

e03821 | First Published: 20 January 2026

Development of multi-dimensional optical encryption strategies is crucial for information protection. A dual-functional platform assembling full-color fluorescent carbon dots into TiO_2 scaffolds is proposed to integrate fluorescence display with polarization holography. Chromaticity information and polarized CGHs are integrated through interface charge transfer and spectral hole-burning effects. This work paves a promising way for high-security information protection.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

SolventMediated Hydrogen Bond-Driven Self-Assembly Materials for Tunable Phosphorescence

Ziyi Lu, Jiapeng He, Nabi Ahmad, Bin Li, Wensheng Xu, Jiang Liu, Run Wang, Ligong Chen, Bowei Wang

e03453 | First Published: 20 January 2026

Water and DMSO solvents dynamically steer the crystallization of melamine-cyanuric acid frameworks embedded with phosphors. Increasing water content transforms defect-rich nanocrystalline assemblies into ordered crystalline assemblies, boosting phosphorescence lifetime from 0.81 to 1.18 s. Vapor fumigation treatment reversibly changes between states, enabling applications in moisture sensors and anti-counterfeiting labels.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Asymmetric Electrode Engineering in p-Si/n-SnSSe Heterojunction Photodetectors for Enhanced Broadband Responsivity and Self-Powered Operation

Sukhendu Maity, Praveen Kumar

e03627 | First Published: 22 January 2026

A spray-coated vertical p-Si/n-SnSSe heterojunction photodetector with asymmetric Ag and graphene electrodes is demonstrated. Contact-induced built-in fields enable self-powered operation at zero bias and broadband photoresponse from visible to near-infrared wavelengths. The scalable architecture delivers low dark current, stable switching, and tunable responsivity, highlighting its potential for low-power optoelectronic applications.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Anisotropy-Driven Carrier Transport Modulation in Stacking-Engineered $Ta_2PdS_6/ReSe_2$ Van der Waals Heterostructures Photodetectors

Yan Han, Tao Zheng, Hongnan Luo, Jun Liu, Mengxue Wang, Xianchen Ke, Derek Hao, Li Chen, Xiaoyu Sun, Qi Huang, Jia Li, Dilshod Nematov, Hongchao Xie, Wei Gao, Xuechen Chen, Zuxin Chen

e02956 | First Published: 22 January 2026

Under the anisotropic-driven carrier transport modulation and the band alignment optimization, compared with the vertical-stacked structure, the parallel-stacked $Ta_2PdS_6/ReSe_2$ van der Waals heterostructures with a unilateral depletion region achieve superior self-powered polarization-sensitive photodetection with polarization ratio of 11.21. This significantly improved performance enables advanced polarization imaging and optical communication applications.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

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Improved Disorder Resilience in Small-Footprint Photonic Cavities with Periodicity Breaking

Nicoletta Granchi, Camilla Gonzini, Matteo Lodde, Gabriele Calusi, René P. J. van Veldhoven, Andrea Fiore, Guillermo Arregui, Francesca Intonti

e02531 | First Published: 24 January 2026

Compact photonic crystal cavities with engineered aperiodicity are demonstrated to sustain high quality factormodes and enhanced reproducibility within a minimal footprint. Combining numerical optimization and near-field measurements, the study reveals how controlled periodicity breaking improves disorder resilience, offering a robust and scalable route toward dense and stable photonic integration.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Intrinsic Low-Symmetry-Assisted Growth and Efficient Luminescence in Zero-Dimensional Hybrid Chloride Single Crystals

Xiangyan Yun, Zexiang Liu, Denghui Xu, Yumeng Shi

e03404 | First Published: 20 January 2026

A sustainable single-heat-source recrystallization strategy is developed for growing high-quality 0D $MA_4InCl_7{:}Sb^{3+}$ single crystals. An intrinsic axial temperature gradient induces continuous Ostwald ripening, while intrinsic low lattice symmetry is associated with selective nucleation behavior. This synergistic regulation enables transparent crystals with highly efficient STE-based yellow emission.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Achieving Near-Theoretical Transparency in Alumina Ceramics by Refining Nanograins

Yueming Kang, Hongbing Yang, Yanteng Wei, Zhengjun Pei, Yupeng Wang, Bing Shen, Jishan Feng, Herbert Gleiter, Yanhao Dong, Lei Duan, Jiangong Li

e02109 | First Published: 21 January 2026

This work reduced the grain size of alumina ceramics to an ultrafine nanoscale of 13 nm. The resulting ultrafine nanograined alumina nanocrystalline ceramics exhibit 82% in-line transmittance, surpassing the reported values for alumina ceramics and approaching that of sapphire. The high density and ultrafine, and narrow-size-distribution grains may contribute to the high transmittance.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

A Lead-Free Transparent Hybrid Manganese(II) Metal Halide Flexible Scintillator for Large-Area and High-Resolution X-Ray Imaging

Xueyan Chen, Xue Zhao, Liping Feng, Jie Su, Hui Peng, Fei Chen, Zhou Yang, Xing Guo, Zhenhua Lin, Jingjing Chang, Jincheng Zhang, Yue Hao

e03834 | First Published: 21 January 2026

A lead-free 0D scintillator $(C_{25}H_{30}P)_2MnBr_4$ is developed, exhibiting a high LY of 85 000 photons MeV^{-1}, a near-unity PLQY of 99.2%, a broad linear response range, an ultra-low detection limit of 25 $nGy_{air}\ s^{-1}$. A large-area $(C_{25}H_{30}P)_2MnBr_4$-TPU composite film is prepared, enabling high-quality X-ray imaging with a spatial resolution of 13.4 lp mm^{-1} for both planar and curved objects.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

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Enhanced Scintillation with Uncorrelated TL and OSL Signals in $LiCaAlF_6$:Eu Nanoparticles Enables Unprecedented Multimodal Radiation Dosimetry

Nancy Gabriela Chicango Arcos, João Victor Viera Lessa, Hayra do Prado Labaki, Éder José Guidelli

e02226 | First Published: 20 January 2026

The graphical abstract illustrates the coexistence of independent OSL and TL signals, demonstrating that the material preserves TL information even after complete OSL zeroing, enabling a dual dosimetric readout within the same material.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

Comparison of Electroluminescence and Photoluminescence Imaging of Mixed-Cation Mixed-Halide Perovskite Solar Cells at Low Temperatures

Hurriyet Yuce-Cakir, Haoran Chen, Isaac Ogunniranye, Susanna M. Thon, Yanfa Yan, Zhaoning Song, Behrang H. Hamadani

e03522 | First Published: 29 January 2026

A detailed study of low-temperature device performance in mixed-cation mixed-halide perovskite solar cells using electroluminescence and photoluminescence hyperspectral imaging reveals key insights into charge-carrier dynamics, external radiative efficiency spatial distribution, and defect behavior, paving the way for their use in space-based and other low temperature applications.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

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Selective Crystal Growth and Optical Responses of 2H and 3R Polytypes in van der Waals Polar Insulator α-In_2Se_3

Ryoga Murata, Takao Sasagawa

e03485 | First Published: 28 January 2026

Selective growth protocols are established to obtain high-quality bulk single crystals of the 2H and 3R polytypes of the vdW polar insulator α-In_2Se_3, together with rapid, non-destructive phase-identification methods. Combined optical transmission and absolute reflectivity measurements, supported by DFT calculations, reveal distinct polytype-dependent electronic structures and van Hove singularities beyond simple band-gap differences.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

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Mechanistic Origin of Photodegradation and Impurity Effects in Donor–Acceptor Luminescent Radicals

Takuya Hosokai, Wataru Ota, Kenshiro Matsuda, Hikaru Ishii, Amane Niwa, Yasuo Nakayama, Keisuke Nakamura, Daiki Asakawa, Emiko Fujiwara, Tohru Sato, Ken Albrecht

e03832 | First Published: 30 January 2026

Purification-dependent impurities distort the apparent optical and analytical data of TTM-based radicals without altering their intrinsic photophysical properties. Carbazole attachment elevates the activation barrier of the photodegradation pathway, offering design principles for achieving more robust luminescent radical materials.

Abstract | **Full text** | **PDF** | **References** | **Request permissions**

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