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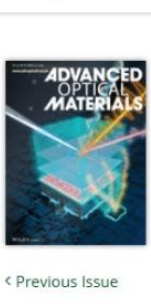

Advanced Optical Materials: Volume 13, Issue 8

March 13, 2025

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Cover Picture

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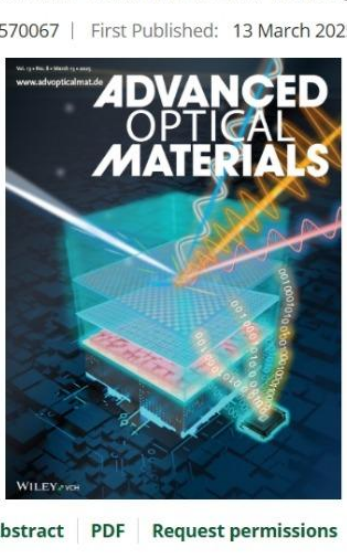
Prephase-Based Reconfigurable Joint Amplitude-Phase Control Metasurface for Multifunctional Scattering Manipulation (Advanced Optical Materials 8/2025)

Kun Duan, Chenxi Fan, Ke Chen, Tian Jiang, Junming Zhao, Yijun Feng

2570067 | First Published: 13 March 2025



Reconfigurable Metasurface for Multifunctional Scattering Manipulation

The cover image illustrates a reconfigurable metasurface for multifunctional scattering manipulation. Each unit cell integrates p-i-n diodes with tunable equivalent resistance, enabling the metasurface to fully leverage the combined advantages of pre-phased configuration, continuous amplitude tuning, and 1-bit phase control by adjusting the coding sequences. This allows for versatile control over scattering characteristics, paving the way for new opportunities in scattering manipulation and inspiring advanced concepts for next-generation multifunctional devices. For further details, see article number 2402664 by Tian Jiang, Junming Zhao, and co-workers.

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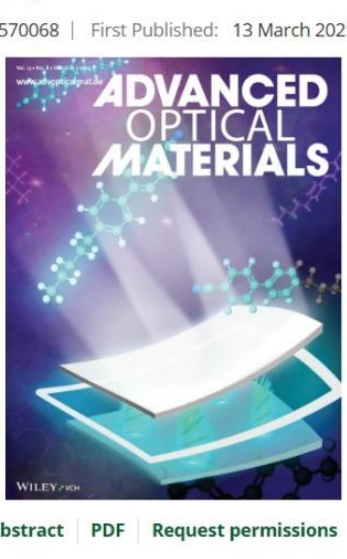
Inside Front Cover

Free Access

Stimuli-Responsive Smart Glass with Switchable Unidirectional Light Source for Enhanced Privacy/Indoor Illumination (Advanced Optical Materials 8/2025)

Chun-Ting Wu, Pravinraj Selvaraj, Yuan-Chang Tsai, Chi-Tang Huang, Ching-Cherng Sun, Ko-Ting Cheng

2570068 | First Published: 13 March 2025



Unidirectional Light Source

The cover of the article 2403088 by Ko-Ting Cheng and co-workers shows a smart window fabricated using advanced liquid crystal technology, offering privacy protection and a unidirectional light source. It emphasizes the unidirectional light functionality, where light enters the liquid crystal cell and exits exclusively through one side of the smart windows, showcasing its distinctive characteristic for enhanced privacy and control.

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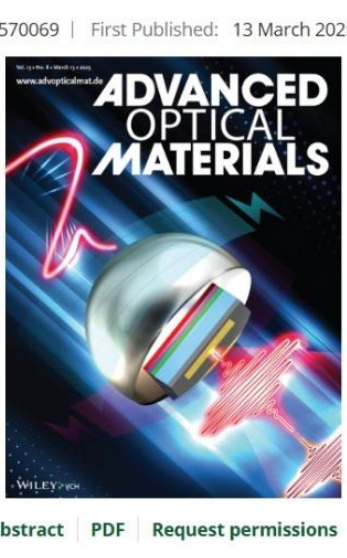
Back Cover

Free Access

Hybrid Terahertz Emitter for Pulse Shaping and Chirality Control (Advanced Optical Materials 8/2025)

Weipeng Wu, Wilder Acuna, Zhixiang Huang, Xi Wang, Lars Gundlach, Matthew F. Doty, Joshua M. O. Zide, M. Benjamin Jungfleisch

2570069 | First Published: 13 March 2025



Terahertz Engineering

Terahertz (THz) technology has applications in many fields. However, the full potential of these applications is often hindered by the need for external THz modulators. The article 2402374, Matthew F. Doty, Joshua M. O. Zide, M. Benjamin Jungfleisch, and co-workers demonstrate a hybrid THz source that overcomes this limitation by integrating two THz emitters into a single device to enable pulse shaping and chirality control of the emitted radiation without external components. Cover image created by Kelly Walker.

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Issue Information

2570070 | First Published: 13 March 2025

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Correction

Free Access

Correction to Vertically-Stacked Discrete Plasmonic Meta-Gratings for Broadband Space-Variant Metasurfaces

Amir Hassanfiroozi, Zih-Syuan Huang, Wen-Hui Cheng, Yuzhi Shi, Pin Chieh Wu

2402785 | First Published: 21 November 2024

This article corrects the following:

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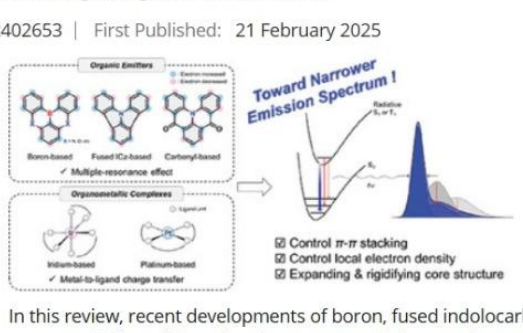
Review

Full Access

Recent Advances in Narrow Emission Bandwidth Materials for Application in Organic Light-Emitting Diodes

Jihoon Kang, Dong Jin Shin, Jun Yeob Lee

2402653 | First Published: 21 February 2025


Organic Emitters
Boron-based
Fused-ICz-based
Carbonyl-based
✓ Multiple-resonance effect
Organometallic Complexes
Iridium-based
Platinum-based
✓ Metal-to-ligand charge transfer
Toward Narrower Emission Spectrum !
☑ Control π–π stacking
☑ Control local electron density
☑ Expanding & rigidifying core structure

In this review, recent developments of boron, fused indolocarbazole, carbonyl, phosphine oxide, and organometallic emitters showing narrow emission spectrum are described and future directions to advance the device performances are suggested.

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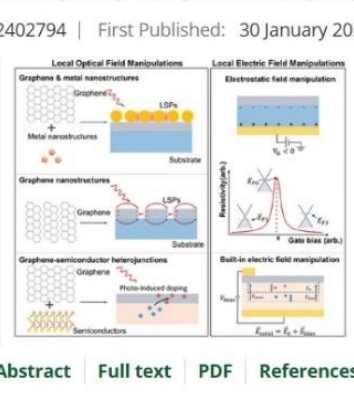
Recent Progress on Local Field Manipulations of Graphene Photodetectors

Xianning Zhang, Changbin Nie, Xilong Jiang, Lei Zhu, Xingzhan Wei

2402794 | First Published: 30 January 2025


Local Optical Field Manipulations
Local Electric Field Manipulations

This review focuses on how local fields manipulate graphene photodetectors, highlighting the role of local optical fields and local electric fields in influencing the absorption of light, the Fermi level of graphene, and carrier transport behavior in photodetectors. It also introduces functional graphene optoelectronic devices and discusses the future development of graphene photodetectors.

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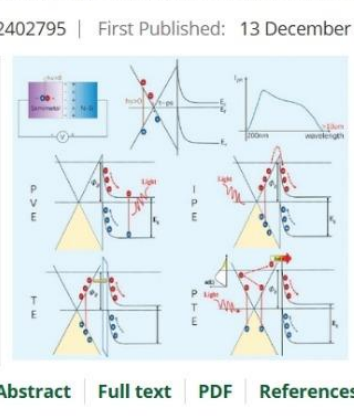
Dirac Semimetal Heterojunction Photodetectors: Status and Prospects

Xilong Jiang, Changbin Nie, Feiying Sun, Xianning Zhang, Xingzhan Wei

2402795 | First Published: 13 December 2024



This review focuses on 2D Dirac semimetal/semiconductor heterojunction photodetectors (DSSHP), highlighting the unique properties of Dirac semimetals, photoresponse mechanisms across wavelength ranges, and performance enhancement strategies. It also summarizes key challenges and discusses potential future advancements in Dirac semimetal-based photodetectors.

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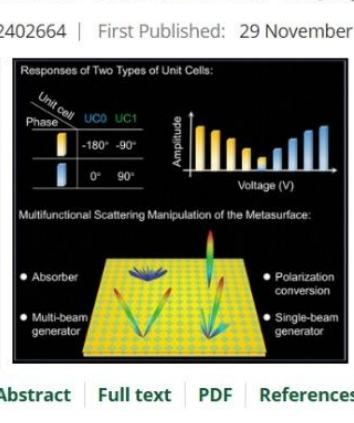
Research Article

Full Access

Prephase-Based Reconfigurable Joint Amplitude-Phase Control Metasurface for Multifunctional Scattering Manipulation

Kun Duan, Chenxi Fan, Ke Chen, Tian Jiang, Junming Zhao, Yijun Feng

2402664 | First Published: 29 November 2024


Responses of Two Types of Unit Cells:
Multifunctional Scattering Manipulation of the Metasurface:
Absorber
Polarization conversion
Multi-beam generator
Single-beam generator

A dual-polarization independently reconfigurable joint amplitude-phase control metasurface is proposed, incorporating two types of pre-phased unit cells. By leveraging the combined factors of continuous amplitude tuning, 1-bit phase control, and pre-phased configurations, this metasurface enables enhanced scattering manipulation, including polarization conversion, single- and multi-beam generation, and intensity modulation of scattered beams.

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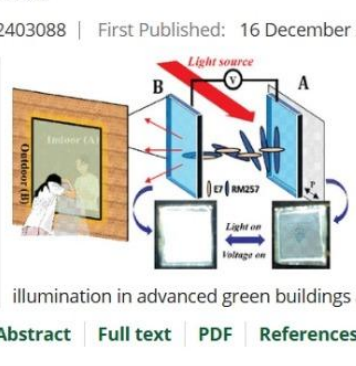
Stimuli-Responsive Smart Glass with Switchable Unidirectional Light Source for Enhanced Privacy/Indoor Illumination

Chun-Ting Wu, Pravinraj Selvaraj, Yuan-Chang Tsai, Chi-Tang Huang, Ching-Cherng Sun, Ko-Ting Cheng

2403088 | First Published: 16 December 2024



A groundbreaking class of stimuli-responsive smart glasses features a switchable unidirectional light source through 2,2-dimethoxy-2-phenylacetophenone DMPAP-doped twisted hybrid polymer network liquid crystals (TH-PNLCs). This innovative technology delivers enhanced light scattering, superior polarization control, and unidirectional light emission with rapid switching capabilities and exceptional stability. The glasses are ideal for privacy protection and energy-efficient illumination in advanced green buildings and automobiles.

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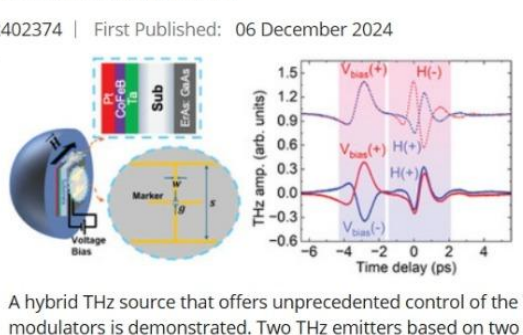
Hybrid Terahertz Emitter for Pulse Shaping and Chirality Control

Weipeng Wu, Wilder Acuna, Zhixiang Huang, Xi Wang, Lars Gundlach, Matthew F. Doty, Joshua M. O. Zide, M. Benjamin Jungfleisch

2402374 | First Published: 06 December 2024



A hybrid THz source that offers unprecedented control of the THz chirality without external modulators is demonstrated. Two THz emitters based on two different material platforms are integrated to create a single hybrid material device that enables pulse shaping and chirality control of the emitted radiation. The material constituents of this hybrid are a spintronic emitter and a photoconductive antenna.

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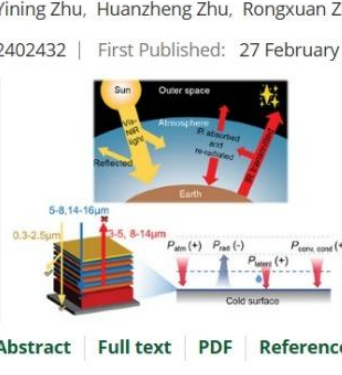
Photon-Engineered All-Day Radiative Warming Utilizing Solar and Atmospheric Energy

Yining Zhu, Huanzheng Zhu, Rongxuan Zhu, Yiwei Zhou, Min Qiu, Qiang Li

2402432 | First Published: 27 February 2025



A photon-engineered flexible film for all-day radiative warming is proposed, integrating spectral control to maximize solar and atmospheric energy absorption ($\alpha_{0.3\text{-}2.5\mu m} = 0.95$, $\alpha_{5\text{-}8\mu m} = 0.75$, $\alpha_{14\text{-}16\mu m} = 0.84$) while minimizing outward radiation ($\varepsilon_{8\text{-}14\mu m} = 0.13$). Experiments show it outperforms traditional warming blankets (9.4°C higher daytime, 1.4°C nighttime) and offers significant potential for anti-condensation applications.

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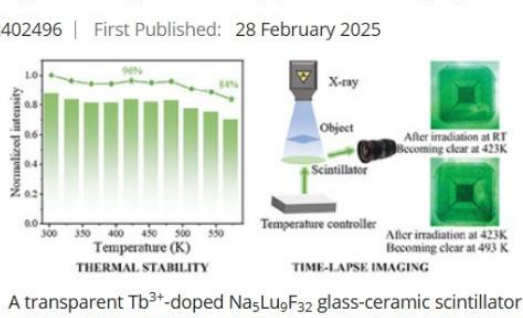
High-temperature X-ray Time-lapse Imaging Based on the Improved Scintillating Performance of $Na_5Lu_9F_{32}$:Tb^{3+} Glass Ceramics

Rongfei Wei, Ying Chen, Li Wang, Junwei Pan, Xiangling Tian, Fangfang Hu, Hai Guo

2402496 | First Published: 28 February 2025



A transparent Tb^{3+}-doped $Na_5Lu_9F_{32}$ glass-ceramic scintillator is developed, which demonstrates exceptional scintillating performance, X-ray-induced persistent luminescence, robust irradiation resistance, and excellent thermal stability. Additionally, the scintillator can be used for both real-time and high-temperature time-lapse X-ray imaging with spatial resolutions of 18 and 14 lp mm^{-1}, respectively.

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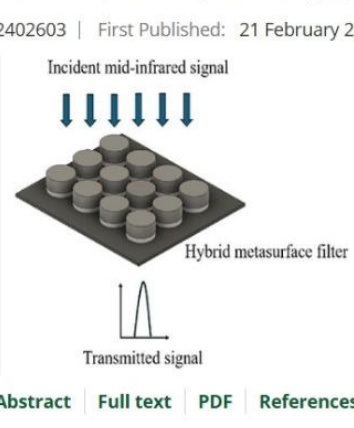
High-Transmission Mid-Infrared Bandpass Filters using Hybrid Metal-Dielectric Metasurfaces for CO_2 Sensing

Amr Soliman, C Williams, Richard Hopper, Florin Udrea, Haider Butt, Timothy D. Wilkinson

2402603 | First Published: 21 February 2025



This article presents a hybrid metal-dielectric metasurface in transmission mode for mid-infrared (MIR) spectroscopy. Composed of germanium on aluminium cylinders atop a calcium fluoride substrate, the metasurface achieves 80% transmission efficiency at λ = 2.6 μm with a narrow full-width-half-maximum of 0.4 μm. Numerical simulations, straightforward fabrication method, characterization, and implementation for CO_2 gas detection are presented.

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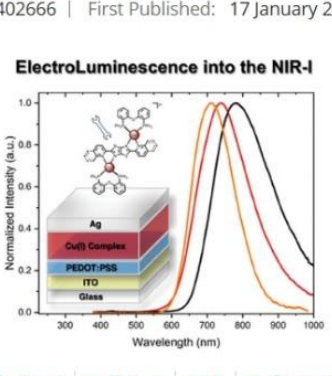
Tuning the Electroluminescence of Binuclear Copper(I) Emitters Into the NIR-I Region

Abdelaziz Jouaiti, Lavinia Ballerini, Wei-Min Zhang, Federico Polo, Christophe Gourlaouen, Hai-Ching Su, Matteo Mauro

2402666 | First Published: 17 January 2025



A novel series of photoactive binuclear copper(I) complexes is presented and their structural, optical, and redox properties are investigated.
Their electroluminescence performances are evaluated in light-emitting electrochemical cells. Electronic properties are further elucidated by means of computational methods and compared to mononuclear counterparts. Remarkably, the complexes display photo- and electroluminescence squarely falling into the NIR region.

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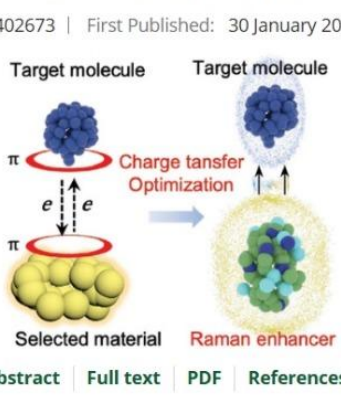
Rational Design and Engineering of Conducting Polymers for Chemical Enhancement in Raman Scattering

Huanhuan Zhang, Jun-Yu Dong, Xuke Tang, Naoki Kishimoto, Yunjie Deng, Hongqian Zhang, Xingxing Yu, Yuta Nakagawa, Shi-Tong Zhang, Yuji Kagotani, Motoyasu Adachi, Yuqi Zhou, Yasutaka Kitahama, Machiko Marumi, Laura Kacenauskaite, Pablo Martinez Pancorbo, Yasuteru Shigeta, Atsushi Iwasaki, Yuguang Ma, Ting-Hui Xiao, Keisuke Goda

2402673 | First Published: 30 January 2025



This work presents a systematic approach to rationally design and engineer the charge transfer process in chemical enhancement of Raman scattering. By optimizing the composition and morphology of the selected Raman enhancer, this work demonstrates surface-enhanced Raman spectroscopy with a highly reproducible enhancement factor up to 10^6, as well as enhanced Raman lasing with a remarkable 40-fold improvement in energy conversion efficiency.

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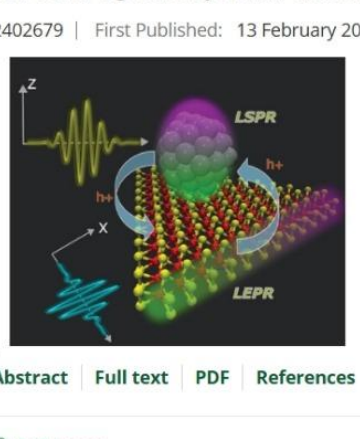
Plasmon Induced Charge Transfer Dynamics in Metallic Nanoparticle-$MoSe_2$ Nanoflake Heterostructures

P. K. Verma, Vignesh Balaji Kumar, Varadharajan Srinivasan

2402679 | First Published: 13 February 2025



A bi-plasmonic heterostructure of two nanoparticles containing localized surface (LSPR) and edge plasmon resonances (LEPR) at either end is introduced. First-principles simulations reveal that exciting the interface through either mode leads to plasmon-induced charge transfer primarily through direct hot-hole transfer. The novel platform with many tunable features holds promise for various applications including photocatalysis and photodetection.

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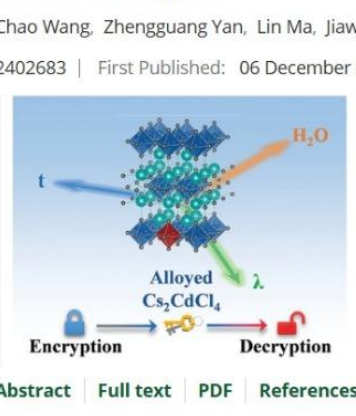
Multicolor and Hydrochromic Luminescence of Alloyed Cs_2CdCl_4 for Advanced Information Encryption

Chao Wang, Zhengguang Yan, Lin Ma, Jiawen Xiao

2402683 | First Published: 06 December 2024



A series of polychromatic and hydrochromic alloyed Cs_2CdCl_4 is demonstrated. Water exposure induces a structural transformation of the host into 3D cubic $CsCdCl_3$, which exhibits obvious afterglow luminescence, originating from triplet excitons of Cd^{2+}. A high confidentiality and adjustable 3D encryption strategy is displayed only through the Cs_2CdCl_4 system.

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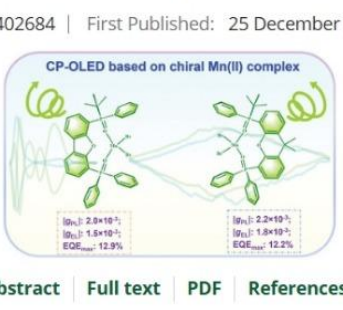
Circularly Polarized Electroluminescence From Chiral Manganese(II) Complexes

Zhong-Zhong Huo, Yu Wang, Bo Yang, Jia-Qi Liang, Xian-Fang Hong, Qi An, Li Yuan, Huili Ma, Jing-Lin Zuo, You-Xuan Zheng

2402684 | First Published: 25 December 2024



Based on chiral phosphine oxide ligands, two chiral manganese(II) enantiomers are obtained based on chiral phosphine oxide ligands, exhibiting pronounced circularly polarized luminescence characteristics, with dissymmetry factors (|g_{PL}|) aound 2.0× 10^{-3}. Accordingly, circularly polarized organic light-emitting diodes demonstrate external quantum efficiencies of up to 12.9% and |g_{EL}| factors of up to 1.8 × 10^{-3}.

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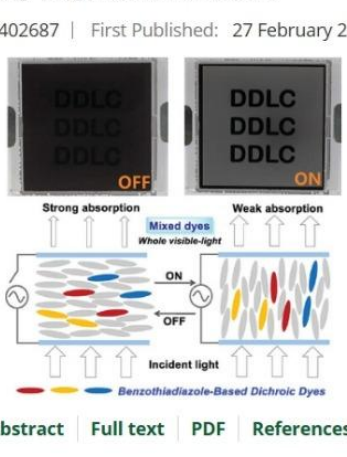
Benzothiadiazole-Based Dichroic Dyes: Novel Approaches for Electrically Tunable Liquid Crystal Smart Windows

Danyang Wan, Yongchi Ma, Juanli Li, Minggang Hu, Lexuan Liang, Lingchao Mo, Zhaoyi Che, Chen Tang, Kang Zhao, Hua Jiao, Jian Li

2402687 | First Published: 27 February 2025



A series of benzothiadiazole (BT)-based dichroic dyes with donor–acceptor–donor (D–A–D) molecular frameworks are designed and synthesized. Their performance in liquid crystal smart windows is evaluated, demonstrating transmittance modulation under dynamic electric fields. By combining complementary absorption dyes, full visible-light transmittance control is achieved, demonstrating their potential for smart window applications.

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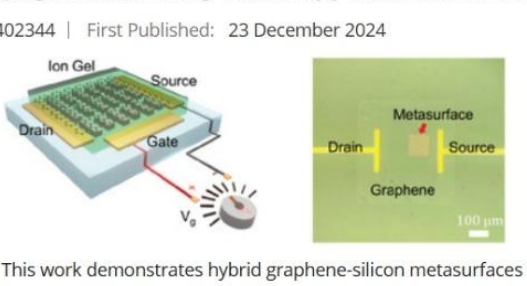
Electrically Tuning Quasi-Bound States in the Continuum with Hybrid Graphene-Silicon Metasurfaces

Ziqiang Cai, Xianzhe Zhang, Tushar Sanjay Karnik, Yihao Xu, Taeyoon Kim, Juejun Hu, Yongmin Liu

2402344 | First Published: 23 December 2024



This work demonstrates hybrid graphene-silicon metasurfaces for the electrical tuning of quasi-bound states in the continuum (quasi-BIC). The interaction between graphene and light is enhanced under the critical coupling condition. The transmittance spectra of the quasi-BIC metasurface can be effectively modulated even with a small resonance wavelength shift, thanks to the relatively high quality factor of quasi-BIC.

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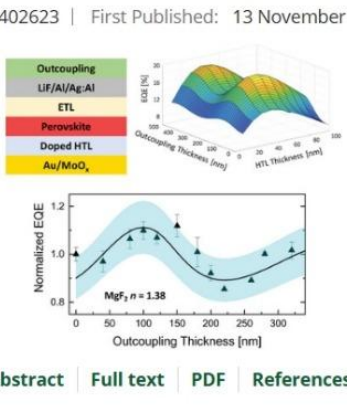
Influence of Outcoupling Layers on Top-Emitting Perovskite Light-Emitting Diodes

James C. Loy, Weiming Qiu, Diane Yang, Jack Scherlag, Jonathan Scott, Barry P. Rand

2402623 | First Published: 13 November 2024



Top-emitting perovskite LEDs offer benefits over typical bottom-emitting architectures, toward lasing, improved thermal management, and on-chip fabrication compatibility. Outcoupling layers offer a strategy uniquely applicable to top-emitting LEDs to optimize EQE by improving optical outcoupling. Experimental resolution of the wave-like dependent EQE with outcoupling layer thickness uncovers the influence this layer has on perovskite LED performance.

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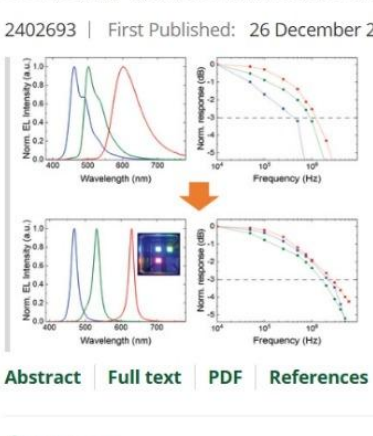
Fast-Response and High-Color-Purity RGB Fluorescent Organic Light-Emitting Diodes for Visible Light Communication System

Seo-Hee Jung, Kyumi Lee, Hanbeen Lee, Rino Choi, Jeong-Hwan Lee

2402693 | First Published: 26 December 2024



Fluorescent RGB top-emitting organic light-emitting diodes (OLEDs) are developed for visible light communication systems. The fluorescent OLEDs achieved bandwidths exceeding 1 MHz for all RGB colors within a single substrate, underscoring its potential for high-speed communication.

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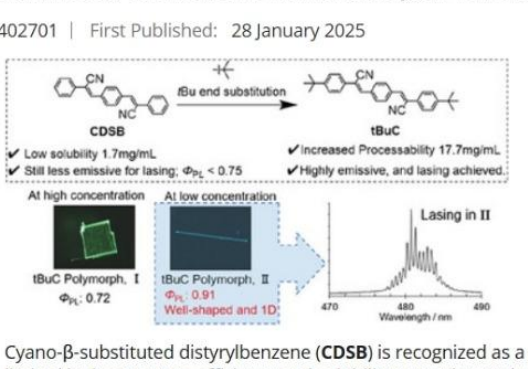
Cyano-Substituted Distyrylbenzene Derivative for Laser Media: High Solid-State Luminescence and Processabilities by *Tert-Butyl* Appending Design

Takumi Matsuo, Soichiro Azuma, Mahiro Nakabayashi, Fumio Sasaki, Shotaro Hayashi

2402701 | First Published: 28 January 2025


tBu end substitution
CDSB
tBuC
✔ Low solubility 1.7mg/mL
✔ Still less emissive for lasing
✔ Increased Processability 17.7mg/mL
✔ Highly emissive, and lasing achieved
At high concentration
At low concentration
Lasing in II

Cyano-β-substituted distyrylbenzene (**CDSB**) is recognized as a potential solid-luminogen but is limited by its quantum efficiency and solubility toward crystal resonator processability. The rational design for high solid-state luminescence and processability is demonstrated by designing a tertiary-butyl (*t*Bu)-appended approach. The *t*Bu-appended **CDSB** is highly luminescent; thus, lasing is first achieved in the **CDSB** series.

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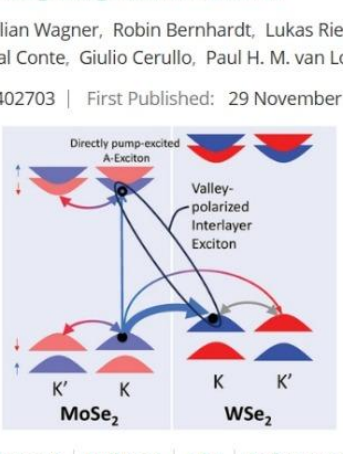
Unveiling Ultrafast Spin-Valley Dynamics and Phonon-Mediated Charge Transfer in $MoSe_2/WSe_2$ Heterostructures

Julian Wagner, Robin Bernhardt, Lukas Rieland, Omar Abdul-Aziz, Qiuyang Li, Xiaoyang Zhu, Stefano Dal Conte, Giulio Cerullo, Paul H. M. van Loosdrecht, Hamoon Hedayat

2402703 | First Published: 29 November 2024


Directly pump-excited A-Exciton
Valley-polarized Interlayer Exciton
K′
K
K
K′
$MoSe_2$
WSe_2

This study reveals the potential to manipulate spin-valley polarization dynamics in $MoSe_2/WSe_2$ heterostructures by quantifying different scattering processes following selective photoexcitation. The results show that these heterostructures enable ultrafast valley-selective charge transfer, with phonon scattering playing a significant role in the process. After charge transfer, the signatures of interlayer excitons can be observed in the transient absorption response.

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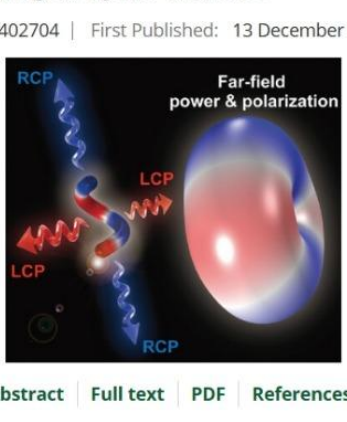
Mode-dependent Far-field Radiation of Circularly Polarized Light by a Single Plasmonic Nanohelix

Yiou Cui, Yilin Chen, Jing Li, Shengyan Wang, Ruiqian Zhang, Zhongyi Chen, Huan Liu, Ximin Cui, Xihang Shi, Biye Xie, Xiaolu Zhuo

2402704 | First Published: 13 December 2024



The numerical simulations explored the chiroptical response and far-field radiation behaviors of single plasmonic nanoantennas transitioning into helical structures. This study highlights the ability of these plasmonic nanohelices to regulate the far-field directionality of radiation power and circular polarization in plasmon-exciton coupled systems.

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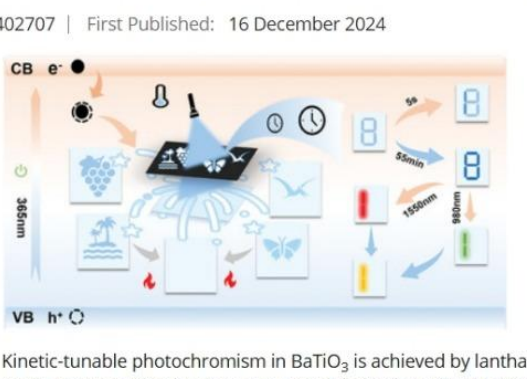
Kinetics-Tunable Photochromism and Dual-Mode Luminescence Modulation in $BaTiO_3$-Based Phosphors for Dynamic Anti-Counterfeiting Application

Shasha Fu, Anjun Huang, Heping Zhao, Yingzhu Zi, Xue Bai, Ziwen Gao, Asif Ali Haider, Yue Liu, Yangke Cun, Zhiguo Song, Jianbei Qiu, Cherkasova Tatiana, Zhengwen Yang

2402707 | First Published: 16 December 2024



Kinetic-tunable photochromism in $BaTiO_3$ is achieved by lanthanides doping strategy, and the dual-mode upconversion luminescence modulation is realized relying on the re-absorption effect, demonstrating that it is a promising dynamic anti-counterfeiting agent.

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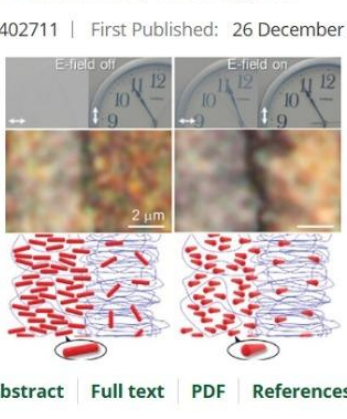
Stimuli-Responsive Light-Diffusing Polarizers Self-Assembled of Liquid Crystals and Polymers

Hiroshi Kakiuchida, Akifumi Ogiwara

2402711 | First Published: 26 December 2024



Light-diffusing polarizers, which are self-assembled through photopolymerization-induced phase separation, are electro-responsively switchable. Microscopically, electric fields change liquid-crystal orientation in different manners depending on polymer network density. The fields induce liquid crystals in polymer-poor (or -rich) domains to reversibly flip from uni- (or multi-)directionally homogenous alignment to collective homeotropic alignment.

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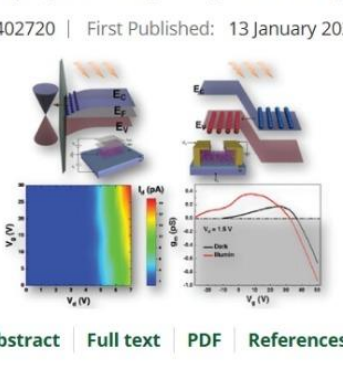
Efficient Optical Control of Quantum Tunneling Devices Based on Layered Violet Phosphorus

Yanyong Li, Haolong Wu, Lyuchao Zhuang, Wai Kin Lai, Shenghuang Lin, Shu Ping Lau

2402720 | First Published: 13 January 2025



Strong light–matter interaction in violet phosphorus generates photoinduced carriers under visible light illumination. Through investigating the carriers' transport characteristics in violet phosphorus (VP)-based tunneling diodes and tunneling field-effect transistors, light tunability is demonstrated as an efficient method for tunneling modulation, opening new avenues for designing future multifunctional devices at the 2D limit.

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Disrupting J-Aggregation in Triazatruxene Dimers to Develop Responsive Luminescent Inks for Anti-Counterfeiting Applications

Raúl Martín, Marcelo Echeverri, Francisco González, Alicia de Andrés, M. Carmen Ruiz Delgado, Alberto Concellón, José Luis Serrano, Berta Gómez-Lor

2400965 | First Published: 05 November 2024

This study investigates the stimulus-responsive behavior of trialkylated triazatruxene dimers for third-generation luminescent security inks. In particular, the derivative with flexible dodecyl chains displays high-contrast, reversible color changes upon heating or shear, driven by liquid crystalline phase transitions and involving J-aggregationbreakdown. This reversible behavior makes it a promising tool in anti-counterfeiting efforts through dynamic color shifts.

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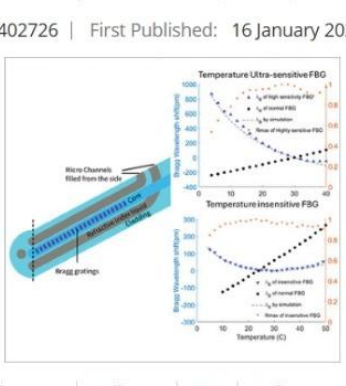
Fiber Bragg Gratings with Micro-Engineered Temperature Coefficients

Zipei Song, Mohan Wang, Frank P. Payne, Patrick S. Salter, Tongyu Liu, Steve J. Elston, Martin J. Booth, Stephen M. Morris, Julian A. J. Fells

2402726 | First Published: 16 January 2025



Fiber Bragg gratings (FBGs) are intrinsically responsive to temperature and strain simultaneously. In this research, low-loss FBGs with micro-engineered temperature coefficients are fabricated, utilizing refractive index liquid-filled microchannels in the cladding. Large negative coefficient FBGs may enable strain-temperature separation and tunable components, while temperature-insensitive FBGs may enable temperature-independent strain sensing. The microfabrication process also offers potential for new sensors and tunable optical devices.

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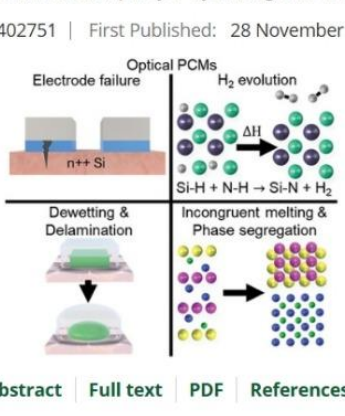
Understanding and Circumventing Failure Mechanisms in Chalcogenide Optical Phase Change Material $Ge_2Sb_2Se_4Te$

Cosmin Constantin Popescu, Kiumars Aryana, Brian Mills, Tae Woo Lee, Louis Martin-Monier, Luigi Ranno, Jia Xu Brian Sia, Khoi Phuong Dao, Hyung-Bin Bae, Vladimir Liberman, Steven A. Vitale, Myungkoo Kang, Kathleen A. Richardson, Carlos A. Ríos Ocampo, Dennis Calahan, Yifei Zhang, William M. Humphreys, Hyun Jung Kim, Tian Gu, Juejun Hu

2402751 | First Published: 28 November 2024



Chalcogenide optical PCMs have gathered interest for their potential in compact, non-volatile optics and photonics. Free-space PCM metasurfaces require new considerations from phase change memory that need to be addressed for reliable scale-up. Several failure mechanisms pertaining to free-space PCM devices and layout methods are isolated to prevent them.

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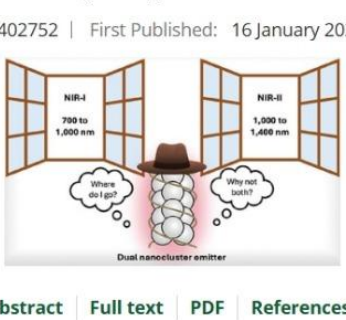
A Dual-Emissive DNA-Templated Silver Nanocluster with Near-Infrared I and II Emission

Anna Gonzàlez-Rosell, Vanessa Rück, Mikkel B. Liisberg, Cecilia Cerretani, Villads R. M. Nielsen, Tom Vosch, Stacy M. Copp

2402752 | First Published: 16 January 2025



This study presents a dual-emissive DNA-stabilized silver nanocluster with a nanosecond-lived NIR-I emission band and a microsecond-lived NIR-II emission band. Mass spectrometry establishes that the nanocluster has molecular formula $(DNA)_2[Ag_{17}]^{11+}$. DNA sequence variations reveal critical nucleobases for stabilization, and modifications at the DNA 5′ -end preserve nanocluster properties, offering the potential for biomolecule conjugation in bioimaging applications.

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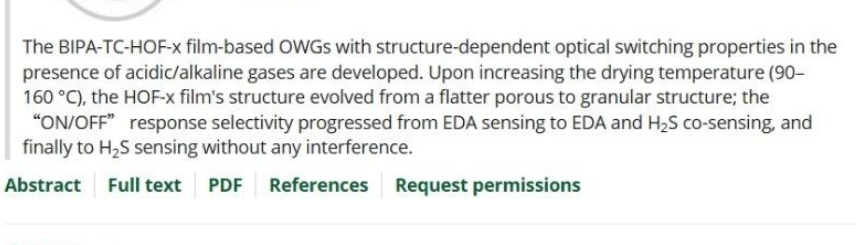
Development of an Optical Switching BIPA-TC-HOF Film-Based Optical Waveguide and Evaluation of Its ON-OFF Gas Sensing Characteristics

Patima Nizamidin, Yanmei Li, Xiangdi Du, Reziwanguli Abulimiti

2402757 | First Published: 14 December 2024



The BIPA-TC-HOF-x film-based OWGs with structure-dependent optical switching properties in the presence of acidic/alkaline gases are developed. Upon increasing the drying temperature (90–160 °C), the HOF-x film's structure evolved from a flatter porous to granular structure; the "ON/OFF" response selectivity progressed from EDA sensing to EDA and H_2S co-sensing, and finally to H_2S sensing without any interference.

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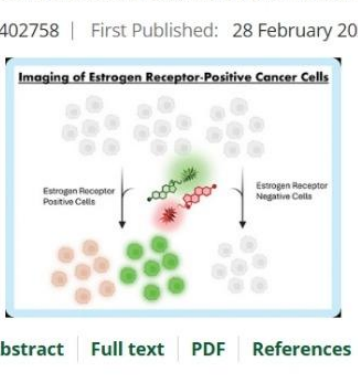
Targeted Imaging of Estrogen Receptor-Positive Cancer Cells Using Fluorescent Estradiol Probes

Shabnam Mansuri, Subhadra Ojha, Sriram Kanvah

2402758 | First Published: 28 February 2025


Imaging of Estrogen Receptor-Positive Cancer Cells
Estrogen Receptor Positive Cells
Estrogen Receptor Negative Cells

Fluorescent estradiol derivatives selectively target ER-positive breast cancer cells via clathrin-mediated endocytosis and demonstrate mitochondrial localization.

Abstract | Full text | PDF | References | Request permissions

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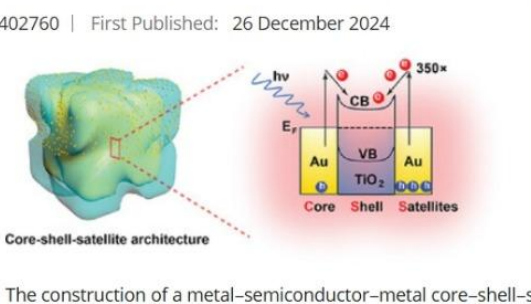
Constructing Chiral Core–Shell–Satellite Superstructures for Highly Efficient Antenna–Reactor Hot Electron Generation

Le Wang, Tiepei Geng, Ningneng Hu, Hao Li, Kaiyu Wang, Lishuai Hao, Weihai Ni

2402760 | First Published: 26 December 2024



The construction of a metal–semiconductor–metal core–shell–satellite (CSS) superstructure is demonstrated, where a mesoporous TiO_2 shell spatially separates the Au nanohelicoid (AuNH) antenna core and Au nanocluster reactor satellites. Hot electron (HE) and circular differential HE photocurrent responses of the CSS-superstructures exhibit 12.4- and 8.3-fold enhancements with respect to those of the AuNHs respectively.

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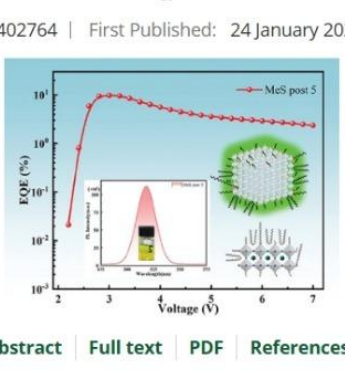
Sulfonic Acid Ligands Promote Surface Reconstruction of Perovskite Quantum Dots for High-Performance Light-Emitting Diodes

Jiaxiang Wang, Zunxian Yang, Ye Chen, Hui Zhang, Yue Chen, Yuting Bai, Xudong Jiang, Benfang Liu, Jiajie Hong, Zhezhou Fang, Jinzhu Gao, Zheyu Zhou, Runsen Yu, Xuanyao Song, Zhiyu Yuan, Tailiang Guo, Fushan Li, Yongyi Chen, Zhenzhen Weng

2402764 | First Published: 24 January 2025



This study investigates the effects of post-processing strategies, including OA, DDAB, and their combination, on PQD performance. A synergistic DDAB-NaMeS strategy for ligand reconstruction during purification significantly enhances quantum dot stability and performance. The resulting QLEDs achieved a maximum external quantum efficiency of 9.82%, 1.91 times higher than standard devices, with stability over one month.

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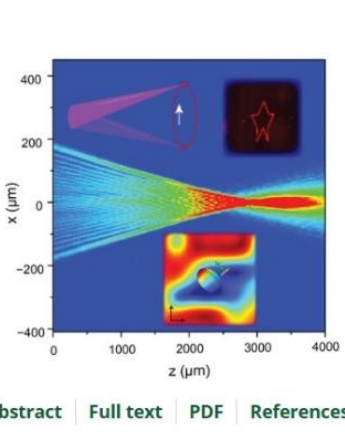
Active Luminous Quantum Dot Self-Assembled Microsphere Volumetric Display

Guihai Li, Ruixiang Liu, Lei Wang, Leilei Zhao, Xiaoting Yang, Huaibin Shen, Fengjia Fan

2402766 | First Published: 06 February 2025



This paper presents an active luminous volumetric display based on red-emitting and green-emitting colloidal quantum dot (CQD) self-assembled microspheres. Meanwhile, the performance of the photophoretic-trap-based volumetric display is explored in this research. The authors also investigate the effect of the thermal parameters and morphology of the CQD self-assembled microsphere on the photophoretic force experienced by the microsphere.

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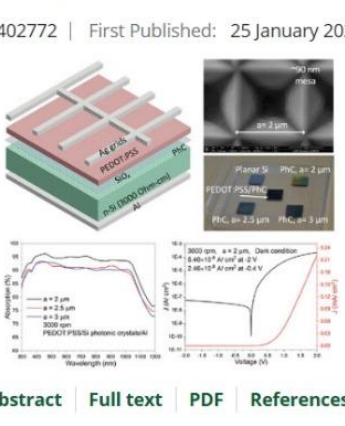
Wave-Interference Photonic Crystals and Space Charge Engineering Enable Efficient Broadband Faint Light Detection in Organic/Inorganic Hybrid Photodetectors

Yibo Zhang, Sara Almenabawy, Gloria Vytas, Moein Shayegannia, Jiabao Shen, Haozhe Wang, Nazir P. Kherani

2402772 | First Published: 25 January 2025



This work demonstrates superior performance of organic–inorganic heterojunction photodetectors to sense broadband faint light. Wave-interference photonic crystals are integrated into the Si substrate to improve optical absorption. A deep depletion region design matches the photogeneration profile, enabling drift-dominated photocarrier transport. Low noise, high broadband external quantum efficiency, high specific detectivity, and fast speed are achieved for the photodetector.

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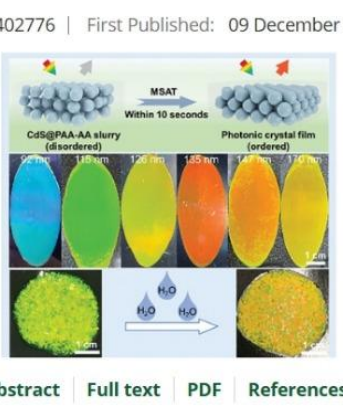
Ultra-Bright Stimuli-Responsive Photonic Crystals for High-Performance Anticounterfeiting Coatings

Ziqiang Tian, Jinyao Zhu, Qilin Guo, Lulu Chen, Jia Guo, Changchun Wang

2402776 | First Published: 09 December 2024


MSAT
Within 10 seconds
CdS@PAA-AA slurry (disordered)
Photonic crystal film (ordered)

Ultra-bright photonic crystal (PC) film with excellent optical performance is prepared by molecule-mediated shearing-induced assembly technique (MAST), the relative reflectance of the film is up to 130% compared with the standard aluminum mirror, exceeding four times reflectance of that constructed by polystyrene (PS) core nanoparticles. The PC coating prepared by alkali-treated ultra-bright PC pigments possesses good water response ability and antifcounterfeiting effect.

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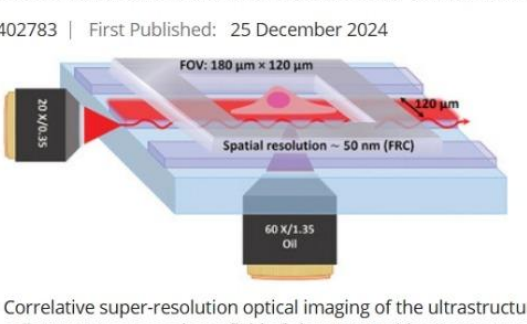
Correlative Super-Resolution Imaging of Cellular Nanopores Facilitated by Transparent Polymer Waveguide Chips

Surjendu Bikash Dutta, Jasmin Celine Schürstedt-Seher, Anders Kokkvoll Engdahl, Wolfgang Hübner, Stefan Belle, Karolina Szafranska, Peter McCourt, Ralf Hellmann, Mark Schüttpelz, Thomas Huser

2402783 | First Published: 25 December 2024



Correlative super-resolution optical imaging of the ultrastructure of rat liver sinusoidal endothelial cells (LSECs) across a large field of view (FOV) with 3D structured illumination microscopy (3D-SIM) and single-molecule localization microscopy (SMLM), facilitated by a transparent polymer photonic waveguide chip, is presented. The waveguide chip provides a high throughput method (FOV of ≈180 μm × 120 μm) to analyze the structural morphology of LSECs with high spatial resolution (≈50 nm).

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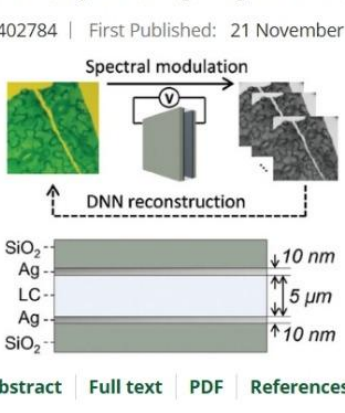
A Multi-Resonant Tunable Fabry-Pérot Cavity for High Throughput Spectral Imaging

Xiao Wu, Zijian Lin, Shige Tang, Xiao Chen, Tingbiao Guo, Sailing He

2402784 | First Published: 21 November 2024



This study introduces a multi-resonant tunable Fabry-Pérot filter for high throughput spectral imaging. With a spectral resolution of 10 nm and a switching time of 23 ms, this compact and low-cost device possesses better spectral imaging accuracy in poor light conditions while maintaining over six times higher optical throughput than standard liquid crystal tunable filters (LCTFs).

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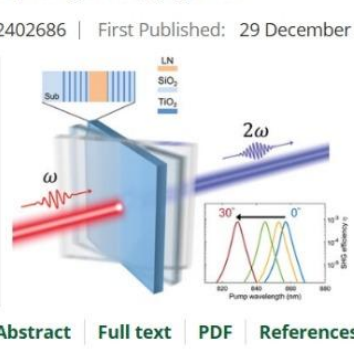
Wavelength Tunable Second Harmonic Generation from Photonic Crystal Vertical Cavities

Lu Bai, Lun Qu, Wei Wu, Zhidong Gu, Weiye Liu, Xueqian Zhao, Lishuan Wang, Wei Cai, Huasong Liu, Mengxin Ren, Jingjun Xu

2402686 | First Published: 29 December 2024



Tuning second harmonic generation in photonic crystal vertical cavities by adjusting the incident light angle, enabling a 30 nm spectral shift in SHG efficiency and advancing wavelength tunability in nanoscale beyond traditional phase-matching techniques.

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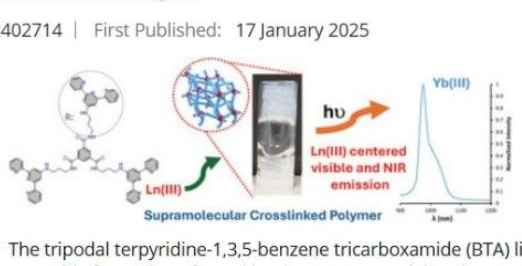
Self-Assembly of a Tripodal Terpyridine Based Ligand with Luminescent Lanthanide Ions in Solution and Soft Material

Jason M. Delente, Oxana Kotova, Niamh Willis-Fox, John E. O'Brien, Brendan Twamley, Ronan Daly, Thorfinnur Gunnlaugsson

2402714 | First Published: 17 January 2025


Ln(III)
hυ
Ln(III) centered visible and NIR emission
Yb(III)
Supramolecular Crosslinked Polymer

The tripodal terpyridine-1,3,5-benzene tricarboxamide (BTA) ligand **1** is employed in the self-assembly formation of novel luminescent materials using a range of lanthanide ions. In the polar protic solution, the results from the photophysical measurements are assessed using nonlinear regression analysis, while the functional material properties of the cross-linking supramolecular (hydrogels) metallogels, is demonstrated by probing their photophysical, rheological, and morphological properties.

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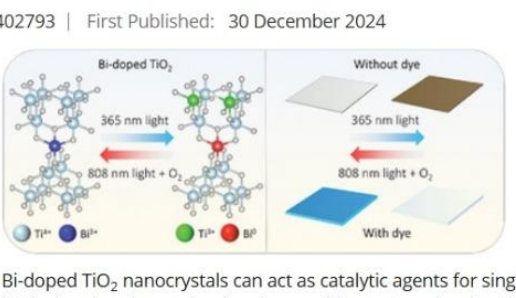
Photo-Sensitive Bi-Doped TiO_2 Nanocrystals with Reversible Single and Multimode Color Transformations for Rewritable Printing

Zeyulong Wen, Xiaoli Yang, Daniel K. Macharia, Qingyang Feng, Hanhan Lv, Mei Wen, Nuo Yu, Zhigang Chen

2402793 | First Published: 30 December 2024



Bi-doped TiO_2 nanocrystals can act as catalytic agents for single/multimode color switching, where intrinsic coloration and redox-dye sensitive system decoloration are driven by 365 nm light. Conversely, the restoration of original states is induced by 808 nm light in the air for accelerated self-catalyzed oxidization.

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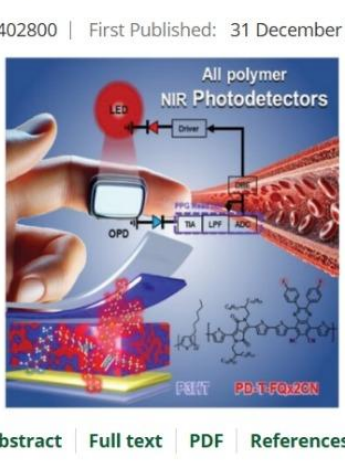
Strategic Design of A_1–π–A_2-Type Polymer Acceptors for Highly Sensitive Near-Infrared All-Polymer Photodetectors

Seok Woo Lee, Gyeong Uk Seo, Ji Yeon Son, Juan Anthony Prayogo, Dong Ryeol Whang, Ah Young Lee, Jae-Hyun Kim, Mingi Seo, Dong Hyun Lee, Junseok Heo, Sungjun Park, Jong H. Kim, Dong Wook Chang

2402800 | First Published: 31 December 2024



This study highlights the development of polymeric acceptors for all-polymer near-infrared photodetectors that demonstrate excellent detectivity at 860 nm, making them highly promising for skin photoplethysmography (PPG) sensors. The molecular design strategy used in this study efficiently enhances the overall performance of all-polymer photodetectors, thereby contributing to the rapid advancements of noninvasive health monitoring technologies.

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