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Featured

Article
02 April 2026 | Open Access

Internal field tailoring enables low noise high speed colloidal quantum dot photodetectors beyond 1500 nm

Park et al. report a field-tailoring strategy by using n-type InAs as the absorber and p-type InAs as the hole transport layer to suppress leakage current for colloidal quantum dot photodetectors, enabling a low dark current of 9.7E-7 A cm2 and fast response time of 24 ns at 1,500 nm.

Youngsang Park, Seongmin Park & Sohee Jeong

Article
02 April 2026 | Open Access

Machine-learning enhanced simulations predict graphene is hydrophobic and microscopically not wetting transparent

This study demonstrates that pristine graphene is intrinsically hydrophobic, regardless of the underlying substrate. The apparent hydrophilicity observed experimentally is shown to arise from signal cancellation by intercalated water molecules.

Dianwei Hou, Yevhen Horbatenko & Minhaeng Cho

Article
01 April 2026 | Open Access

Pillar[*5*]arene-catalyzed anti-Markovnikov halogenations through cationic intermediates stabilization in confined spaces

Here the authors report that the π-basic cavity of pillar[n]arenes can effectively stabilize bromiranium intermediates generated during olefin halogenation, confining them in a controlled microenvironment. This strategy overrides the intrinsic Markovnikov preference, enabling highly selective anti-Markovnikov halogenation.

Tianyue Xu, Shengtian Lai & Ying-Yeung Yeung

Article
01 April 2026 | Open Access

Synthesis of atomically dispersed catalysts via hydrogen embrittlement-like assisted thermal activation for acidic oxygen reduction

Stabilizing 4d/5d metals as single atoms for catalysis is challenging due to their strong tendency to cluster. Here, the authors develop a hydrogen embrittlement-like assisted thermal activation strategy that prepares Ru-based single-atom catalysts, which achieve high performance in fuel cells.

Pan Guo, Yunkun Dai & Zhenbo Wang

Article
01 April 2026 | Open Access

Light-induced bimerons in a chiral magnet

Bimerons are magnetic solitons that are topologically equivalent to skyrmions in in-plane magnetized systems. This study demonstrates the room-temperature creation of bimerons in $Co_8Zn_8Mn_4$ via femtosecond laser pulse excitation, revealing dynamic topological control and morphological transitions of these solitons.

Kaixin Zhu, Filipp N. Rybakov & Jianqi Li

Article
01 April 2026 | Open Access

Topological non-Abelian gauge structures in Cayley-Schreier lattices

Cayley-Schreier lattices have been shown to enable the inclusion of non-commutative translations into Abelian systems. Here, authors theoretically demonstrate that these crystalline systems can also bring to the emergence of non-Abelian gauge structures, providing a perspective on realistic experimental implementations.

Zoltán Guba, Robert-Jan Slager & Tomáš Bzdušek

Article
01 April 2026 | Open Access

Atomic-scale reconstruction of sapphire induced by selective tribochemical removal of surface atoms

Nanostructure fragility limits applications. The authors develop a tribochemical surface reconstruction strategy to build single-crystal nanostructures on sapphire, which retain bulk-level wear resistance and improve triboelectric device performance.

Jinhao Zhang, Chunhong Li & Hui Deng

Article
01 April 2026 | Open Access

An ultrathin ionic thermoelectric cell design utilizing near body heat for self-powered wearable electronics

Ionic thermoelectric cells suffer from compromised performance upon miniaturization due to reduced thermal gradients. Here, the authors propose an ultrathin asymmetric architecture that couples ionic modulation with pseudocapacitive storage, enabling high power density for self-powered wearables.

Haofei Meng, Wei Gao & Yongping Chen

Article
01 April 2026 | Open Access

Reentrant superconductivity in a naturally occurring Josephson junction array tuned by radio-frequency power

The authors observe re-entrant superconductivity beyond a superconductor-to-insulator transition in a granular aluminum thin-film nanobridge, which they demonstrate functions as naturally occurring Josephson junction array. They argue that the re-entrant behavior is induced by the screening of electron charge, a many-body correlation effect.

S. Avraham, S. Sankar & Y. Dagan

Article
01 April 2026 | Open Access

Disulfide modification and thiol protection via tris(trimethylsilyl)silane-mediated hydrosilylation of disulfides

Here, the authors report that tris(trimethylsilyl)silane (TTMSS), a unique trisilyl-substituted reagent, efficiently enables the rapid hydrosilylation of disulfides under exceptionally mild conditions.

Ying Zhang, Kejun Lin & Tingshun Zhu

Article
01 April 2026 | Open Access

High-quality perovskite crystal for efficient and bright pure-blue light-emitting diodes with narrow emission

Chen et al. report a crystal regulation strategy for 3D perovskites by using functional molecule to adsorb to specific perovskite facets and diminish random crystal facet-correlated defects, yielding pure-blue LEDs with emission peak at 473 nm, linewidth of only 14 nm, and efficiency of 14%.

Hua Chen, Zhenwei Ren & Yu Chen

Article
01 April 2026 | Open Access

Wavelength-responsive in situ redox chemistry enables stable CO_2 photocatalysis

The authors report a wavelength-gated regeneration strategy, where specific wavelength photogenerated carriers drive the reversible cycling of active sites, enabling highly stable photocatalytic CO_2 reduction to C_2H_4.

Zixiang Huang, Yide Zhu & Xusheng Zheng

Article
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Path entropy-driven design of solid-state electrolytes

Researchers introduce path entropy to quantify how ions travel through solid-state electrolytes, linking pathway diversity to ionic conduction and enabling efficient screening for high-performance solid-state electrolytes.

Qiye Guan, Kaiyang Wang & Yongqing Cai

Review Article
01 April 2026 | Open Access

Architecture and regulation of nanoscale chromatin domains

Conserved 50-200 nm chromatin domains add a new layer to genome organization beyond loops. This Review integrates imaging and biophysics to show how epigenetic activity and transcription shape these domains to regulate cell identity.

Vinayak Vinayak, Melike Lakadamyali & Vivek B. Shenoy

Article
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Spontaneous crack healing in calcite reveals the influence of dynamic strain evolution and surface chemistry

Time-resolved, high-resolution elastic strain mapping using microfocused synchrotron Laue X-ray diffraction paired with infrared spectroscopy reveal the dynamic nature of spontaneous crack healing in a slide of calcite.

Michelle Devoe, Harrison P. Lisabeth & Hans-Rudolf Wenk

Article
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Human-like cognitive generalization for large models via mental representation-guided supervision

It remains unclear how best to equip large models with human-like conceptual understanding. Here, the authors demonstrate that guiding networks learning with human mental representations can effectively transfer conceptual structures to networks, leading to improvements on diverse tasks.

Jiaxuan Chen, Yu Qi & Gang Pan

Article
01 April 2026 | Open Access

The origins of patchy aurora at Jupiter

At Jupiter, isolated auroral patches have long been linked to particle injections from the magnetosphere. Here, the authors show that plasma waves can also scatter electrons into the atmosphere, triggering precipitation and producing aurora.

A. Daly, W. Li & S. J. Bolton

Article
01 April 2026 | Open Access

Reversible color switching of bright phosphorescence in purely organic materials for advanced data encryption

Purely organic room temperature phosphorescent materials are of interest for a range of applications, but phosphorescence colour switching is hard to achieve. Here, the authors report the use of a single-component organic crystal with reversible phosphorescence colour switching.

Jung-Moo Heo, Hochul Woo & Jinsang Kim

Article
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Accelerated drug development using a digital formulator and a self-driving tableting data factory

Drug development is slowed down by manual formulation and testing. Here, the authors present an integrated digital formulator and self-driving tableting system that rapidly designs and manufactures tablets, thereby reducing material consumption and development time.

Faisal Abbas, Mohammad Salehian & Daniel Markl

Article
01 April 2026 | Open Access

Single-event fast neutron time-of-flight spectrometry with a petawatt-laser-driven neutron source

Laser-driven neutron sources offer unique advantages for fundamental physics and applications. Here, authors present an experiment at the DRACO PW laser where they achieved for the first time single neutron detection of fast neutrons, establishing LDNSs as a promising, scalable platform for future fast neutron-induced reaction studies.

M. A. Millán-Callado, S. Scheuren & C. Guerrero

Article
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Dawn-dusk Asymmetrical Distribution of Saturn's Cusp

The magnetospheric cusp is a key solar wind– magnetic field interface. Here, the authors show that Saturn's cusp has a pronounced dawn–dusk asymmetry, with signatures reaching the postdusk region, unlike Earth's near-noon cusp.

Y. Xu, Z. H. Yao & Y. Wei

Article
31 March 2026 | Open Access

Emergent surface magnetic ordering and surface electronic dipole layers in a two-dimensional spin=1/2 La_2CuO_4 film

Disentangling the exotic phases that can emerge at the surfaces of strongly correlated materials from the bulk is experimentally difficult. Here, Jain, Diao, Ong, Rusydi, and coauthors succeed in doing so, using grazing incident-angle dependent resonant X-ray scattering to find an emergent surface magnetic ordering and surface electronic dipole layers in the two-dimensional film of La2CuO4

Anjali Jain, Caozheng Diao & Andrivo Rusydi

Article
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Exploiting underpotential deposited hydrogen enables energy-efficient nitrate electroreduction to ammonia

Electrochemical nitrate reduction rivals Haber-Bosch ammonia synthesis rates but suffers from poor energy efficiency. Here, the authors show that underpotential deposited hydrogen can be unlocked to accelerate nitrate conversion, offering an pathway to energy-efficient ammonia production.

Leting Zhang, Rupeng Liu & Lehui Lu

Article
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High-mobility inertial domain walls driven by spin-transfer torque in a ferrimagnetic spinel oxide

Efficient electrical control of domain walls underpins fast, low-energy magnetic memories. Wu *et al* report field-free domain wall velocities of 1 km s^{-1} at 20 MA cm^{-2} in ferrimagnetic $NiCo_2O_4$, arising from giant nonadiabatic spin-transfer torque.

Mingxing Wu, Shilei Ding & Pietro Gambardella

Article
31 March 2026 | Open Access

A statistical understanding of oxygen vacancies in distorted high-entropy perovskite oxides

Oxygen vacancy defects, crucial to properties such as conductivity and thermal expansion, exhibited unique temperature dependence when cation mixing distorts the lattice, creating an energetic distribution of vacancy sites.

Adam Potter, Yifan Wang & Xiaolin Zheng

Article
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Flexible active-matrix micro-LED display with 1T-1FeMFET architecture featuring scaling-limit-free design

Flexible displays face challenges in power use, resolution, and durability. This work presents a flexible micro-LED display driven by HZO-based FeMFETs, achieving low power, high resolution, and strong mechanical reliability.

Tingrui Huang, Guangan Yang & Weifeng Sun

Article
31 March 2026 | Open Access

Reversible phase-transformation-induced thermal quenching in Mn(II) chlorides for high-precision information encryption and thermal energy storage

Photoluminescent materials are widely used in information security applications, yet high-precision optical information encryption remains difficult to achieve. Here the authors report two monoclinic zero-dimensional organic–inorganic hybrid Mn(II) chloride crystals and characterize their phase-transition-induced photoluminescence quenching.

Aibo Li, Zongqi Chen & Huaijun Tang

Article
31 March 2026 | Open Access

Triggering dynamically disordered lithium sublattice in superionic conductors

Superionic conductors are typically engineered from static crystal structures. Here, authors present how flexible polyanion rotations induce dynamic disorder in lithium sublattice, enabling liquid-like ion diffusion and enhanced ionic conductivity.

Chaohong Guan, Jiawei Zong & Hong Zhu

Article
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Iontronic click-to-release enables electrically controlled delivery of drugs and biomolecules beyond charge and size limitations

Iontronic drug delivery is limited to small, charged molecules. Here the authors couple iontronic transport with bio-orthogonal click-to-release chemistry to unlock electrically controlled activation of drugs and proteins beyond size and charge limits.

Sebastian Hecko, Marle E. J. Vleugels & Johannes Bintinger

Article
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Understanding and modelling ammonia partitioning and transport across reverse osmosis membrane

This study presents a mechanistic RO model to predict ammonia transport that explicitly distinguishes NH3 and NH4 + transport and explains the pH dependence of RO performance, providing insights for the reclamation of ammonia-rich wastewater.

Zhijie Wang, Kai Yang & Mohan Qin

Article
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Roadmap of phase transitions in hafnia-based superlattice films

The authors propose an asynchronous sublattice distortion mechanism to elucidate the complex phase transitions in HfO_2-based materials. The phase transitions among the orthorhombic, tetragonal, and monoclinic phases are governed by the orientation of the orthorhombic phase.

Wan-Rong Geng, Bo-Rui Wang & Xiu-Liang Ma

Article
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Accelerated directional growth of seaweed-like iron oxide branches driven by localized electric fields of gold nanoparticles in liquid

Controlling the morphology of dendritic nanostructures is crucial for enhancing their functionality, but remains a challenge. Here, the authors demonstrate that the local electric field between gold nanoparticles and iron oxide branches promotes directional and accelerated growth.

Mingrui Zhou, Wen Wang & Litao Sun

Article
31 March 2026 | Open Access

In-fibre logic and memory via tuneable passivation–corrosion

Traditional von Neumann electronic textiles rely on rigid chips for logic and memory, limiting wear comfort and integration. Here, the authors present stretchable fibres that integrate tuneable logic and memory functions, positioning each fibre as a building block for computing-capable textiles.

Yuanlong Li, Weifeng Yang & Carlo Menon

Article
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Single-molecule neuromorphic device with aJ-level power consumption per switching

Molecular devices offer the potential for the scalability and energy efficiency required to develop energy-sustainable AI. Zhang et al. report a single-molecule neuromorphic device that consumes 6.34 aJ per operation and support both short-term to long-term memory, featuring over 10 distinct conductance states.

Hua Zhang, Jingyao Ye & Wenjing Hong

Article
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Ultrahigh energy-storage in lead-free ceramic capacitors via local structure design

The authors propose a local structure design to overcome the restrictive relationship between polarization behavior and electric field durability, yielding an ultrahigh *Wrec* of 14.5 J cm^{-3}, which offers a feasible route for the cutting-edge energy-storage applications.

Ji Zhang, Zhiqing Li & Yaojin Wang

Article
31 March 2026 | Open Access

Disentangling the Janus-faced effects of cations in electrocatalysis

Cation identity and concentration influence electrocatalytic reactions, yet the origin remains debated. Here, the authors report a theoretical framework showing how cations modulate interfacial electrostatics and water dissociation kinetics, explaining multiple inversions of cation-dependent activity trends in alkaline hydrogen evolution reaction.

Xinwei Zhu, Tobias Binninger & Michael Eikerling

Article
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Single-breath-hold 3D abdominal metabolic MRI enables label-free diagnosis of liver cancer

A single-breath-hold 3D abdominal MRI technique (SSE-CEST) enables label-free mapping of glucose, glycogen and mobile protein in human liver, offering motion-robust, high-resolution imaging for cancer detection and metabolic monitoring.

Chuyu Liu, Nan Gao & Xiaolei Song

Article
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Lattice strain-mediated $MoSe_2$ enable superior piezocatalysis activity for upcycling of organic pollutants

A $MoSe_2$ piezocatalyst with lattice strain upcycles wastewater pollutants into value-added chemicals, offering an environmental and energy solution by accelerating carbon reduction and lowering reaction energy barriers.

Qiang Zhong, Yue Sun & Zhao-Qing Liu

Article
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Decoupling simultaneous motor imagination and execution via orthogonal ECoG neural representations

Neural population activity evolves on low-dimensional manifolds. Here, the authors identify shared and exclusive neural spaces in ECoG signals for motor execution and imagery, and show how these latent structures enable partial demixing of concurrently executed and imagined movements.

Leonardo Pollina, Lucas Struber & Silvestro Micera

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Identification of a universal three-body *s*-wave resonance in ^{10}He

Three-body low-energy *s*-wave states play an important role in few-body physics and associated universal phenomena, yet their experimental observation in nuclear system has been elusive. Here, the authors identify the three-body *s*-wave properties in neutron-rich ^{10}He nuclei with improved statistics and sensitivities.

Y. L. Sun, Y. Kikuchi & T. Uesaka

Article
31 March 2026 | Open Access

Preventing peritendinous adhesions using lubricious supramolecular hydrogels

Widely used, effective methods to prevent adhesions after digit flexor tendon injury are lacking. Here, authors develop a bioresorbable, supramolecular hydrogel as a lubricating barrier to preserve tendon biomechanics and improve functional recovery.

Emily L. Meany, Christian M. Williams & Eric A. Appel

Article
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Natural photosynthetic system for restoring homeostasis of animal organelle interaction network

Unlike animals, plant possess mitochondria and chloroplasts and exhibit a unique defensive adaptation to stress. Here, the authors demonstrate the feasibility of restoring organelle interaction network homeostasis in animal cells by introducing plant-derived photosynthetic systems.

Chen Xia, Zhanqiu Dai & Pengfei Chen

Article
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Spin-selective heterogeneous chiral perovskites for circular-polarization-resolved retinomorphic sensors

Yu et al. report a self-assembled heterogeneous microstructure consisting of chiral-deficit grains and chiral-rich grain boundaries in chiral perovskite with the former as in-plane spin valves for spin selection. Retinomorphic sensor arrays based on the chiral perovskite film enable binocular artificial visual systems.

De Yu, Xin Zhang & Qinghai Song

Article
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Versatile water-floated nanostructures for three-dimensional nanotransfer printing

Water-floating nanotransfer printing (WF-nTP) is proposed for transferring nanostructures onto three-dimensional substrates. Using WFnTP, an Au SERS nanomesh for pesticide detection on plants and a Pd-based hydrogen gas sensor are demonstrated.

Byung-Ho Kang, Ji-Hwan Ha & Inkyu Park

Article
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Synergistic dual anion regulation unlocks giant thermopower and power density in hydrogel

Converting low-grade heat into electricity is promising to power electronic devices, though it is often limited due to weak ion selectivity and insufficient concentration gradients. Here the authors use a calix[4]pyrrole as an ion trap enhancing electronic properties for energy harvesting.

Hongbing Li, Zhangjie Gu & Xiaodong Chi

Article
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Selective solar wax refining with nanoscale zero-valent iron

Current thermal wax refining methods are energy intensive. Here, the authors report a photothermal process using a nanoscale zero-valent iron catalyst and sunlight to refine low-grade waxes into high-grade waxes with narrow distributions.

Yifei Sun, Chengliang Mao & Lizhi Zhang

Article
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Polar solvent strategy enables scalable synthesis of perovskite nanocrystal scintillators for fast X-ray imaging

Hu et al. report a low-temperature polar-solvent strategy for high-yield (162 mg mL^{-1}) perovskite nanocrystal synthesis with suppressed self-absorption. The scintillator films achieve ~7 ns fast decay, 28,800 photons MeV^{-1} light yield, and dynamic X-ray imaging at 7,680 frame per second.

Xudong Hu, Zhicheng Wang & Omar F. Mohammed

Article
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In situ electrochemiluminescence microneedle device for real-time biomarker monitoring in vivo

Here, the authors present an integrated microneedle-based electrochemiluminescence device designed for real-time detection of protein biomarkers in interstitial fluid.

Huiwen Xiong, Chenxin Zhu & Xueen Fang

Article
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A parallel magnetic tunnel junction-based probabilistic Ising processor for efficient quadratic optimization

Combinatorial optimization challenges conventional computing due to high computational costs. Here, Yang et al. demonstrate a probabilistic processor for quadratic assignment problems, achieving fast and energy-efficient stochastic optimization.

Shuhan Yang, Youwei Bao & Hyunsoo Yang

Article
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Interchain supramolecular interactions drive nearly 21% efficiency organic solar cells

Organic solar cells (OSCs) rely on morphological optimization for high efficiency. The authors show cyclobutyl-mediated interchain supramolecular interactions among acceptors, suppressing electron-phonon coupling and optimizing acceptor alloy phase morphology in ternary OSCs to achieve efficiencies approaching 21%.

Wei Gao, Yulong Hai & Gang Li

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Featured

Article
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A megawatt ultra-wide bandgap semiconductor module for pulsed power electronics

Achieving high power scaling in ultrawide bandgap electronics remains challenging. Here, the authors present a Ga_2O_3 module using a high permittivity interface that enables fast megawatt pulsed switching with improved thermal performance.

Hehe Gong, Xin Yang & Yuhao Zhang

Article
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Axial oxygen coordination drives spin-regulated electron transfer in single-atom Fe catalysts for selective pollutant transformation

By linking axial coordination chemistry to spin-state control and reactive oxygen species selectivity, this study delivers mechanistic insights and a versatile design principle for single-atom catalysts in environmental catalysis.

Fei Miao, Yantao Wang & Xiaoguang Duan

Article
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Direct observation of cation-dependent polarisation switching dynamics in fluorite ferroelectrics

This study reveals how atoms move during polarization switching in ultrathin fluorite ferroelectrics, showing cation-dependent pathways that help explain and improve next-generation memory materials.

Kousuke Ooe, Yufan Shen & Joanne Etheridge

Article
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Dual-site single-atom catalysts achieve directional adsorption-oxidation control for enhanced photo-Fenton-like reactions

This work effectively addresses the long-standing challenge of competitive kinetics in heterogeneous Fenton-like systems through the synergistic interaction between nitrogen vacancies (Nv) and Fe sites on carbon nitride.

Chang-Wei Bai, Yi-Jiao Sun & Fei Chen

Article
30 March 2026 | Open Access

A two-mode thermomechanically squeezed phonon laser

Lasers find ubiquitous use in physics due to their coherence, spectral purity and high intensity. Here, authors create a two-mode thermomechanically squeezed phonon laser in an optical levitation system by combining nonlinear damping with parametric modulation of the coupling between two oscillation modes.

K. Zhang, K. Xiao & A. N. Vamivakas

Article
29 March 2026 | Open Access

Multi-field coupling enhanced plasmonic $Mo^{\delta+}$ active site to efficiently hydrolyze ammonia borane

The authors find that reconstructing the Moδ+ active site via multi-field coupling effectively boosts ammonia borane hydrolysis. They provide key insights into the plasmon polarization-induced carrier kinetics and hydrolysis mechanism.

Pengcheng Li, Nengrong Tu & Weiyou Yang

Article
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Exploring how deep learning decodes anomalous diffusion via Grad-CAM

Using Grad-CAM with ResNets, this study probes how deep learning classifies anomalous diffusion from raw trajectories. The method reveals trajectory segments and multiscale features driving predictions, improving interpretability and robustness to measurement noise.

Jaeyong Bae, Yongjoo Baek & Hawoong Jeong

Article
28 March 2026 | Open Access

Asymmetric hydrophilicity-driven fast water diffusion enabling heterogeneous hygroscopic gels toward high-yield atmospheric water harvest

Hygroscopic gels can harvest atmospheric water but face efficiency challenges. Here, authors developed a heterogeneous gel with a pectin shell and graphene oxide core, enhancing water uptake and release. This design achieves high water yield and rapid desorption, outperforming existing systems.

Ruiheng Han, Xianzhang Wu & Tao Chen

Article
28 March 2026 | Open Access

The role of the Helmholtz potential on electrocatalytic activity

Understanding the electrode-electrolyte interface is crucial for sustainable electrocatalysis. Here, the authors introduce a model including electronic equilibrium at the interface, showing that the Helmholtz potential controls activity, which can be enhanced by thin semiconductor layers.

Arsène Chemin, Louis Godeffroy & Tristan Petit

Article
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Nanoscale greenhouse effect for promoting solar-driven CO_2 reduction with water to CH_4

Photocatalytic CO_2 reduction is fundamentally limited by inefficient utilization of solar energy, particularly low-energy photons. Here, the authors report a nanoscale greenhouse structure ($Bi@Fe_2O_3$) that enables cascaded full-spectrum solar utilization and enhances solar-driven CO_2 reduction with water to CH_4.

Xiaofeng Kang, Mingyu Jiang & Liejin Guo

Article
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Iminium-linked hyperporphyrin covalent organic framework mediates type I photodynamic therapy via a photoredox process

Conventional photosensitizers mediate type II photodynamic therapy (PDT) via energy transfer, which is less effective in hypoxic tumors. Here, the authors combine photoredox chemistry with the hyperporphyrin effect in an iminium-linked covalent organic framework to enable efficient type I PDT under 725 nm irradiation in normoxic and hypoxic environments.

Zhibei Zhou, Yuxuan Xiong & Wenbin Lin

Article
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Critical spin fluctuations across the superconducting dome in $La_{2-x}Sr_xCuO_4$

Overdoped cuprate superconductors are strange metals above their superconducting transition temperature. Here, the authors study $La_{2-x}Sr_xCuO_4$ by inelastic neutron scattering and numerical calculations, establishing that low-energy spin excitations and spatial disorder are central to the strange metal behaviour.

Jacopo Radaelli, Aavishkar A. Patel & Stephen M. Hayden

Article
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In-situ growth of biomimetic ion-selective membranes via confined molecular encapsulation for superior fluoride/chloride separation

A "confined molecular encapsulation" strategy enables one-step fabrication of biomimetic ion-selective membranes. The in-situ formed MOFs with tunable sizes facilitate highly precise ion differentiation.

Qian Chen, Mei-Ling Liu & Weihong Xing

Article
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Oriented diffusion tailors interfacial strain-polarization coupling for broadband electromagnetic absorption

Authors propose an oriented diffusion strategy to design interfacial strain controlled magnetoelectric heterostructure, realizing the modulation of interfacial strain polarization coupling for enhancing electromagnetic absorption.

Longjun Rao, Xuebing Zhao & Renchao Che

Article
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Metal-dependent and metal-free mechanisms of peptide condensate catalysts

Researchers developed peptide condensate catalysts that catalyze chemical reactions. These findings provide a new green-chemistry framework for advanced materials and nanotechnology.

Tlalit Massarano, Yuqin Yang & Ayala Lampel

Article
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Predictive patterning via solid-state dewetting of transferred single-crystal films

Dewetting of single-crystal films offers opportunities for creating regular patterns. Here, the authors show that film transfer and multiscale calculations enable the designed and predictable formation of dewetting patterns on arbitrary substrates.

Seungjin Ju, Sangsun Lee & Jongpil Ye

Article
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Photo-electrochemical reduction of PFAS in complex water matrices

Researchers developed a light-driven electrochemical system featuring a palladium–titania cathode that generates highly reactive electrons, enabling efficient reductive degradation of "forever chemicals" in contaminated water.

Yunqiao Guan, Ankush Jain & Yang Yang

Article
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Unlocking the reactivity of difluoroketene and its synthetic applications

Although ketenes are important intermediates in chemical synthesis, the high reactivity of difluoroketene has impeded its controlled generation and practical application. Here, the authors report a transition-metal-free strategy for its mild, in situ production from difluorobromoacetylsilane, enabling cycloadditions, rearrangements and difluoroacetylations.

Sheng Xi, Chi Zhang & Chao Feng

Article
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Hydrogen transfer-triggered $C(sp^3)–C(sp^3)$ cleavage of 1,3-diols for mono-*N*-methylation of primary amines

Here, the authors establish 1,3-propanediol, a low-cost biomass-derived bulk chemical, as an efficient, green, and sustainable C1 source for the mono-N-methylation of primary amines, via chelation-free C(sp3)–C(sp3) bond cleavage.

Yang Long, Jun Liu & Yanling Zheng

Article
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Two-dimensional crystals catalyse hydrogen into protons

Hydrogen can permeate two-dimensional crystals like graphene in the form of protons at high rates, involving catalytic dissociation and recombination steps, with permeability tunable by material type, metal nanoparticles, or atmosphere, offering insights for separation membranes and energy technologies.

Jie Xu, Wenna Tang & Libo Gao

Article
28 March 2026 | Open Access

4f-5d orbital tag-team catalysis empowers high-loading zinc–iodine batteries

Conversion-type batteries face performance decay under high loading due to shuttle effects and sluggish kinetics. Here, authors introduce an f-d orbital tag-team catalysis mechanism using cerium single-atom catalysts, achieving a competitive iodine loading of 44.7 mg cm^{-2} and an areal capacity of 10.2 mAh cm^{-2} in zinc–iodine batteries.

Maoxin Chen, Yuanyuan He & Quan-Hong Yang

Article
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Direct visualization of the existence of surface local chemical order in a high-entropy CoCrFeMnNi alloy

The surface chemical ordering in high entropy alloys is revealed by the surface sensitive imaging tool - scanning tunneling microscopy – which is enabled by the subtle differences in the partial density of states among different elements.

Lauren Kim, Prince Sharma & TeYu Chien

Article
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A controllable human spinal cord model with full dorsoventral patterning

The authors developed a microfluidic human stem cell model of the embryonic spinal cord. The model mimics complete dorsoventral patterning, reveals new retinoic acid-BMP signaling crosstalk, and enables direct tracking of neural crest cell migration.

Jeyoon Bok, Yung Su Kim & Jianping Fu

Article
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Miniaturized olfactory sensor chip-based AI-wearable biometric ring for human body metabolic odor analysis

Decoding skin gases can reveal a lot about our health. Here, the authors introduce a monolithic AI-powered wearable ring designed to non-invasively monitor dermal volatile-organic-compounds associated with diet-related metabolism.

Wenhao Ye, Ruochen Ding & Zhiyong Fan

Article
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Role of fragility of the glass formers in the yielding transition under oscillatory shear

Simulations show how glass fragility controls yielding under oscillatory shear. Strong and fragile glasses behave similarly when poorly annealed, but with annealing the yield point rises in fragile glasses only.

Roni Chatterjee, Monoj Adhikari & Smarajit Karmakar

Article
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Deep active learning and knowledge transfer for rapid discovery of lithium metal battery electrolytes

Developing efficient battery electrolytes is a slow and complex challenge. Here, authors create a deep active learning framework that rapidly identifies high-performance materials and transfers knowledge to new designs, tripling battery lifespan while requiring significantly fewer experiments.

Xufeng Hong, Xizhe Wang & Benben Jiang

Article
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Graphene-inspired porous polymer network for ethane/ethylene separation and methane purification

A graphene-inspired porous polymer network acts as a molecular sieve, efficiently separating ethane from ethylene and purifying methane. Its finely tuned pores deliver record selectivity, offering a new path toward cleaner and energy-efficient natural gas processing.

Kelechi Festus, Fuan Guo & Hong-Cai Zhou

Article
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Programmable multiscale energy release in synergistic energetic composites with three dimensional printed architectures

This study presents an acoustic resonance–assisted direct ink printing strategy to create structured energetic composites with enhanced and tunable energy release, revealing how multiscale design influences performance and enabling new additive manufacturing pathways for energetic systems.

Yongjin Chen, Hui Ren & Qingjie Jiao

Article
27 March 2026 | Open Access

Programmable multimodal actuation in cholesteric liquid crystal elastomer hollow fibers beyond mechanochromism

Cholesteric liquid crystal elastomers are promising for color-changing soft robotics and photonic devices, though it is difficult to program their thermal or mechanical actuation. Here the authors design a hollow CLCE fiber system with tailored director alignments and preserving structural color.

Jiazhe Ma, John S. Biggins & Zhongqiang Yang

Article
27 March 2026 | Open Access

Decoupling charge–discharge electrolysis for hydrogen evolution and organic oxidation reactions

Using thermodynamically favourable organic oxidations instead of oxygen evolution enables energy-efficient cathodic reactions, but rates are limited by slow anodic kinetics. Here, the authors report decoupled charge–discharge electrolysis using a solid redox reservoir to overcome this limitation.

Yi Huang, Hongyu Zhou & Bin Zhang

Article
27 March 2026 | Open Access

π-π Stacking origin of irreversible dispersibility of graphene oxide

The interlayer π-π stacking primarily results in irreversible dispersibility of GO, providing supramolecular view for the regulation of graphene-based materials.

Yue Gao, Ya Wang & Zhen Xu

Matters Arising
27 March 2026 | Open Access

Questioning the near-intrinsic thermal conductivity of suspended graphene membranes fabricated via a cyclododecane-based transfer method

Mohsen Moazzami Gudarzi & Seyed Hamed Aboutalebi

Article
27 March 2026 | Open Access

Impedance-driven capacitance amplification in dielectric gradient all-fiber non-ionic electronic skin

Capacitive sensors based on electronic polarization typically exhibit low sensitivity as their dielectric modulation is confined to a single mode. Here, the authors develop a dielectric-gradient all-fiber non-ionic electronic skin that converts interfacial impedance into signal amplification for tactile sensing.

Wendong Li, Le Xi & Junlong Yang

Article
27 March 2026 | Open Access

Photoinduced Mn catalysis for efficient platform for C-heteroatom bond coupling of aryl halides

Here the authors present a photoinduced Mn(II)-bipyridine catalyzed cross-coupling reaction between aryl halides, particularly less-reactive aryl chlorides, and nucleophiles containing nitrogen, oxygen, and sulfur.

Geyang Song, Jiameng Song & Dong Xue

Article
27 March 2026 | Open Access

All-inorganic lattice-contracted fabric image sensors for extreme-temperature radiography

Achieving simultaneous flexibility, thermal stability and strong absorption in conventional X-ray sensors is challenging. Here, the authors develop an all-inorganic fabric X-ray sensor working from 80 K to 1373 K, enabling real-time imaging of molten metals and superconducting magnets.

Li Xu, Peng Ran & Yang Si

Matters Arising
27 March 2026 | Open Access

REPLY TO: Questioning the near-intrinsic thermal conductivity of suspended graphene membranes fabricated via a cyclododecane-based transfer method

Zhao Wang, Wenlin Liu & Hailin Peng

Article
27 March 2026 | Open Access

An asymmetric photothermal platform for coupled seawater splitting and desalination

This study reports an asymmetric single-atom catalyst in a floating photothermal platform, realising simultaneous solar-driven hydrogen production and seawater desalination in a scalable device.

Jingkai Lin, Hengyue Xu & Shaobin Wang

Article
27 March 2026 | Open Access

Room temperature collective blinking and photon bunching from $CsPbBr_3$ quantum dot superlattice

Perovskite quantum dot superlattices have emerged as a promising platform for studying collective optical phenomena. Here the authors report collective photoluminescence blinking and photon bunching in a self-assembled $CsPbBr_3$ quantum dot superlattice, which they attribute to cascade-like biexciton-exciton emission.

Qiwen Tan, Sudipta Seth & Martin Vacha

Article
27 March 2026 | Open Access

Defective three-dimensional covalent organic frameworks for enhanced hydrogen peroxide photosynthesis and organic transformation

By constructing tailored donor-acceptor structures in 3D COFs via artificial defects and electronic tuning, researchers overcame inherent limitations in conjugation and light absorption, achieving stable and efficient photocatalytic H_2O_2 production.

Tengteng Dong, Xiaohui Xu & Chong Cheng

Article
27 March 2026 | Open Access

Generative AI for misalignment-resistant virtual staining to accelerate histopathology workflows

Ma, Li, and colleagues present a virtual tissue staining method that overcomes data mismatch by separating image generation from spatial alignment. This approach produces highly accurate diagnostic images that expert pathologists cannot distinguish from real chemical stains.

Jiabo Ma, Wenqiang Li & Hao Chen

Article
27 March 2026 | Open Access

Supernetwork-based efficient mapping of deep learning applications to mixed-precision hardware using model adaptation

Deploying deep learning models efficiently on heterogeneous hardware remains challenging. Here, authors present a mixed-precision supernetwork that jointly optimizes model mapping and adaptation, enabling faster search, higher accuracy, and improved energy efficiency on analog-digital accelerators.

Hadjer Benmeziane, Corey Lammie & Abu Sebastian

Article
27 March 2026 | Open Access

Photolytic oxidation of ammonium chloride as a source of Cl_2 in the atmosphere

Sunlight triggers ammonium chloride in aerosols to produce Cl_2 gas, explaining 12-55% of daytime levels. This chlorine source, boosted by black carbon, impacts atmospheric oxidation.

Shuying Li, Yonghong Wang & Hong He

Article
27 March 2026 | Open Access

Eco-sustainable magnetoresistive sensors towards disposable magnetoelectronics

A fully green printing strategy enables biodegradable and recyclable magnetoresistive sensors made from iron-based materials. By combining sustainability with high low-field sensitivity, the work opens a pathway toward environmentally responsible disposable magnetoelectronics.

Lin Guo, Rui Xu & Denys Makarov

Article
27 March 2026 | Open Access

A nanoscale robotic cleaner

Submicron light-driven nanorobots powered by a plasmonic directional nanoantenna are controlled by laser polarization. They move rapidly along complex paths and capture, assemble, transport, and release bacteria, functioning as robotic cleaners.

Jin Qin, Carsten Büchner & Bert Hecht

Article
26 March 2026 | Open Access

Deformation- and damage-free transfer of soft electronics onto highly curved and fragile biological surfaces

Bio-interfaced applications are limited by the transfer of soft electronic devices onto high curvature and fragile surfaces. Here, the authors develop a stress-responsive transfer fluid that enables distortion-free, adhesion-switchable transfer for conformal integration and stable real-time bioelectronic sensing.

Kyeong Min Song, Myung-Kun Chung & Yeon Sik Jung

Article
26 March 2026 | Open Access

Smart-flame-retarding layered composite Li negative electrode for safe Li metal battery

The flammability of the Li electrode impedes its safe application in a battery. Here, the authors develop a layered Li electrode design to eliminate corrosion between Li metal and fire retardant, and smart release fire retardant against Li combustion during heating conditions, enabling a safe Li metal battery.

Haoying Qi, Lequan Deng & Hao Chen

Article
26 March 2026 | Open Access

Extending the mean-field microkinetics for an accurate and efficient modeling of complex heterogeneous catalyst surfaces

The study presents a fast model that predicts catalyst nanoparticle performance while accounting for surface crowding and diffusion between facets. It matches detailed simulations at far lower cost, enabling rapid catalyst screening

Yaqing Wang, Tonghao Shen & Xin Xu

Article
26 March 2026 | Open Access

Structure-adaptive single-atom nickel catalysts for pure hydrogen peroxide electrosynthesis at industrial current density

The hydrogen peroxide generation represents a promising avenue for sustainable chemical production. Here, the authors report a structure-adaptive electrocatalyst that stabilizes the valence state of single-atom Ni sites during the reaction, enabling the continuous output of hydrogen peroxide at 300 mA cm^{-2}.

Zining Wang, Hongbao Jia & Hongying Zhao

Article
26 March 2026 | Open Access

Screening and regulation of nanozyme activity via liquid metals coined electron rearrangement and phase engineering

The potential of liquid metals in tuning nanozyme catalytic performance has been underexplored. Here, the authors use liquid metals to screen high-performance nanozymes with excellent therapeutic effects, and liquid metals serve as the building templates, initial phase engineering to yield abundant catalytic active sites, and feature electron-rich microenvironment to improve catalytic activity.

Wenting Zhang, Jiawei Zhu & Xiaogang Qu

Article
26 March 2026 | Open Access

Formation of S- and Z-twist supramolecular micro-ropes by peptide stereoisomers

The reconstruction and control of supramolecular ropes using minimalist building units remains a fundamental challenge. Here the authors demonstrate self-assembly of cyclo-tryptophan-proline dipeptide stereoisomers into crystalline supramolecular triple-helical structures with tunable S- or Z-twists governed by the configuration of tryptophan residues.

Hui Yuan, Zhongyuan Yang & Ehud Gazit

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