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Article
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Leveraging cation effect for low temperature aqueous Zn-based batteries

The high freezing point of water limits the performance of aqueous electrolyte at low temperatures. Here, authors demonstrate that cations lower the freezing point via deshielding effect, enhance ion transport kinetics by dual-cation effects, resulting in stable battery operation from 50 to −80 °C.

Doudou Feng, Yanchun Xie & Peiyi Wu

Article
20 October 2025 | Open Access

Modular esterification of unstrained carbonyls through palladium-catalyzed alkyne bridging C-C bond activation

While Baeyer-Villiger oxidation reaction has served as a cornerstone in organic synthesis, its scope remains limited to single oxygen-atom insertion into ketone substrates. Here, the authors report a versatile protocol that enables the insertion of alkynyl phenol analogues into unstrained C-C σ-bonds of diverse carbonyl compounds, including ketones, esters, and amides.

Mingruo Ding, Mengmeng Niu & Xueliang Huang

Article
20 October 2025 | Open Access

Temperature-dependent mechanism evolution on RhRu$_3$O$_x$ for acidic water oxidation

The oxygen evolution reaction enables many clean energy technologies, but most acid-unstable catalysts still block deployment. Here the authors report a temperature dependent mechanistic evolution in RhRu3Ox that links reaction pathways to stability, enabling durable acidic water electrolysis.

Ming-Rong Qu, Heng Liu & Shu-Hong Yu

Article
20 October 2025 | Open Access

Designing self-adaptative cyclized polyacrylonitrile-polyethyleneimine conjugates enhance uranium extraction from natural seawater

Uranium extraction is necessary to power nuclear reactors, though it is challenging to extract uranium from seawater. Here the authors design a polyacrylonitrile-polyethyleneimine adsorbent to extract uranium from seawater.

Ying Wang, Ruolan Zhao & Youxing Liu

Article
20 October 2025 | Open Access

Large protein-like leader peptides engage differently with RiPP halogenases and lanthionine synthetases

The biosynthesis of ribosomally synthesized and post-translationally modified peptides (RiPPs) involves binding of the N-terminal leader region of precursor peptides to peptide modifying enzymes and subsequent modification of the C-terminal core. Here, the authors describe the intermolecular protein-protein interactions that guide the post translational modification of atypically large and structured RiPP precursor peptides.

FNU Vidya, Youran Luo & Vinayak Agarwal

Article
20 October 2025 | Open Access

'Ghost' fossils of early coccolithophores point to a Triassic diversification of marine calcifying organisms

Here, the authors elucidate the evolutionary origins of coccolithophores, identifying impressions of their calcium carbonate skeletons in ~241- million-year-old rocks. Their presence in the Triassic, alongside unrelated calcifying organisms, suggests a diversification of marine calcifying organisms after the end-Permian mass extinction.

Sam M. Slater, Isaline Demangel & Sylvain Richoz

Article
20 October 2025 | Open Access

Fluorine-oxygen co-coordination of lithium in fluorinated polymers for broad temperature quasi-solid-state batteries

Polymer solid-state batteries operable across low and high temperatures face sluggish ion transport limitations. The authors develop a fluorinated polymer electrolyte with tailored Li–F/O coordination that decouples ion conduction from polymer relaxation, enabling stable Li metal cell operation from −50 to 70 °C.

Zhiyong Li, Wanming Li & Xin Guo

Article
20 October 2025 | Open Access

Leveraging platinum-protein interactions to overcome chemoresistance

A common mechanism by which cancer cells acquire resistance to chemotherapeutics is through the overexpression of efflux pumps, but platinum anticancer agents that crosslink DNA and interact with proteins are poor efflux pump substrates. Here, the authors design dual warhead drug conjugates by tethering a platinum pharmacophore to the doxorubicin backbone, which exhibit the activity of both parent anticancer compounds and can overcome drug efflux effectively due to covalent binding to intracellular biomolecules.

Fang Wang, Jonathan Braverman & Ömer H. Yilmaz

Article
20 October 2025 | Open Access

Single atom activated multi-stage active sites for thoroughgoing sodium utilization

Atomically dispersed metals can improve sodium deposition control. Here, authors show that tin single atoms on carbon films enhance sodium-ion adsorption and activate surrounding atoms, leading to uniform deposition and stable cycling in sodium batteries with improved capacity retention.

Shengyong Gao, Yibo Zhu & Jisheng Zhou

Article
20 October 2025 | Open Access

Long-range moiré tuning effect via inter-layer drag interaction

This study demonstrates that the influence range of moiré tuning can be significantly extended beyond the moiré superlattice to a distant conductor through inter-layer drag interaction, presenting a novel strategy for remote moiré engineering.

Lijun Zhu, Xiaoqiang Liu & Changgan Zeng

Article
20 October 2025 | Open Access

11-bit two-dimensional floating-gate memories

Floating gate memories (FGMs) hold potential for neuromorphic computing, but their single-device state capacity is normally insufficient for precision computing. Here, the authors report the realization of high-performance 11-bit 2D MoS$_2$ FGMs by using Schottky-barrier free Bi contacts and a dual-pulse state editing scheme.

Yanrong Wang, Yuchen Cai & Zhenxing Wang

Article
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CrystalFlow: a flow-based generative model for crystalline materials

Deep learning generative models hold significant promise for exploring the configuration space of crystalline materials. Here, the authors present CrystalFlow, a flow-based generative model for crystal structure prediction and materials discovery.

Xiaoshan Luo, Zhenyu Wang & Yanming Ma

Article
20 October 2025 | Open Access

Superintegrated conformable organic transistors based on a universal microlithographic strategy

Fabrication and integration of conformal devices on a large scale remains a challenge for commercialization. Here, the author developed a non-destructive photolithography method suitable for all organic materials, achieving 0.5 μm resolution and a device density of 5,120,000 transistors cm^{-2}.

Yanping Ni, Xiaoli Zhao & Yichun Liu

Article
20 October 2025 | Open Access

Cathode chemomechanics controls Li metal solid-state battery performance under low stack pressures

Solid-state batteries typically require high pressure to operate reliably. Here, the authors show that tuning cathode chemomechanics enables stable lithium metal battery cycling at room temperature and low pressure, eliminating the need for interlayers or elevated temperatures.

Saeed Moradi, Beniamin Zahiri & Paul V. Braun

Article
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Physics-based evolution of transmembrane helices reveals mechanisms of cholesterol attraction

Cholesterol plays a key role in membrane biology. Here, authors employ evolutionary molecular dynamics simulations to explore interactions driven by linear protein sequences, challenging the predictive power of traditional cholesterol-binding motifs.

Jeroen Methorst, Nino Verwei & Herre Jelger Risselada

Article
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Temporal matching as an accounting principle for green electricity claims

This study shows that annual matching obscures seasonal and intra-day mismatches in green electricity supply and demand, suggesting a phased transition to stricter temporal matching for more transparent claims.

Hanna F. Scholta & Maximilian J. Blaschke

Article
20 October 2025 | Open Access

SLEEPY: a comprehensive Python module for simulating relaxation and dynamics in nuclear magnetic resonance

Simulation is a critical tool in NMR development, and while powerful simulation software exists, simulating dynamic and relaxation effects remains challenging. Here, the authors describe SLEEPY, a Python module to simplify simulation of such effects.

Albert A. Smith & Kai Zumpfe

Article
17 October 2025 | Open Access

The cumulenic linear C$_5$ and its coupling-reaction products

Linear carbon (Cn), an elusive sp hybridized carbon allotrope, has attracted much interest both experimentally and among theorists due to remarkable properties and significant controversy. Here, the authors report the synthesis and characterization of an uncapped linear C5 as well as longer even- and odd-numbered carbon chains.

Luye Sun, Yuan Guo & Wei Xu

Article
17 October 2025 | Open Access

Membrane-free CO$_2$ electrolyzer design for economically efficient formic acid electro-synthesis

Electrolyzer engineering provides a promising platform to boost energy utilization beyond catalyst optimization. Here, the authors report a membrane-free CO$_2$ electrolyzer that enables energy-efficient and economically viable electrosynthesis of formic acid.

Xiaotong Li, Kainan Gao & Hao Bin Wu

Article
17 October 2025 | Open Access

Hydride formation pressures and kinetics in individual Pd nanoparticles with systematically varied levels of plastic deformation

Authors study H$_2$ absorption in single Pd nanoparticles with systematically varied plastic deformation. They report deformation-level dependent kinetics and hydride formation pressures, and reveal their complex evolution during H$_2$ cycling.

Carl Andersson, Jonathan Zimmerman & Christoph Langhammer

Article
17 October 2025 | Open Access

Intrinsic ferroelectric elastomers with ultrahigh Curie temperature and fast polarization switching

Ferroelectric materials are broadly applicable to wearable electronics, but it is challenging to design polymers which are stable without compromising stability. Here the authors designed a ferroelectric elastomer optimizing these properties for wearable electronics.

Yuxin Wang, Bowei Xu & Xiaoli Sun

Article
17 October 2025 | Open Access

Local microwave sensing of excitons and their electrical environment

Here, the authors introduce a cryogenic scanning probe photoelectrical sensing technique, termed exciton-resonant microwave impedance microscopy, to measure the excitonic responses in monolayer MoSe2 and identify exciton polarons and their Rydberg states.

Zhurun Ji, Mark E. Barber & Zhixun Shen

Article
17 October 2025 | Open Access

Synergy of pyrophosphate and unsaturated nitrogen sites for efficient uranium recovery from concentrated nitric acid

Uranium recovery from spent nuclear fuel reprocessing in ultra-acidic and radiation-intensive environments is challenging. Here, we present a pyrophosphate-g-C$_3$N$_4$ polymer with high resistance to HNO$_3$ and radiation, achieving a uranium adsorption capacity of 75.3 mg g^{-1} and 79.1% recovery efficiency.

Yaping Jian, Jiacheng Zhang & Ning Wang

Article
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Decoupling photothermal-mechanical degradation through lattice-stabilizing networks in Sn–Pb perovskites and all-perovskite tandem solar cells

Practical implementation of all-perovskite tandem solar cells faces challenges due to the self-reinforcing photothermal-mechanical degradation mechanism. Here, authors employ a polyamine ligand to establish I-Sn-N coordination for stabilizing lattice framework, achieving device efficiency of 29.6%.

Haibin Pan, Yang Bai & Ziyi Ge

Article
17 October 2025 | Open Access

Observation of a guest-free Si$_{46}$ clathrate-I framework from Ba$_{8-x}$Si$_{46}$ upon in situ vacuum heating

Preparation of a pure Si$_{46}$ framework in the clathrate-I structure is a challenge. Here, the authors demonstrate the stepwise Ba evacuation process and observe a guest-free Si$_{46}$ framework from Ba$_{8-x}$Si$_{46}$ using atomic-scale STEM imaging during in-situ heating.

Yi Zhou, Qing Zhang & Osamu Terasaki

Article
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Direct observation of substitutional and interstitial dopant diffusion in oxide grain boundary

Using electron microscopy, the authors demonstrate direct tracking of Hf dopant diffusion along the α-Al2O3 Σ31 grain boundary. Theoretical calculation elucidates that interstitial diffusion can greatly enhance diffusivity through shuffle motion.

Toshihiro Futazuka, Ryo Ishikawa & Yuichi Ikuhara

Article
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Dynamic identification of reactive iron-oxo species in heterogeneous fenton-like reaction via operando stopped-flow IR spectroscopy

An operando method combining stopped-flow technique and rapid-scan infrared spectroscopy has been developed to monitor, in real time, the lifetime of Fe-oxo species formed during heterogeneous Fenton-like reactions.

Qi Zhao, Qiang Huang & Jincai Zhao

Article
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Generation, transmission, and conversion of orbital torque by an antiferromagnetic insulator

Orbital torques can be used to control magnetization, however, their efficacy is strongly dependent on the conversion of the orbital torque to a spin torque, either in the ferromagnet, or a spacer layer. Here Ding et al demonstrate the potential of antiferromagnetic insulators, specifically CoO, as an extremely efficient orbital-to-spin transducer.

Shilei Ding, Paul Noël & Pietro Gambardella

Article
16 October 2025 | Open Access

1,1-polymerization of acetylene

Alkynes are well known to undergo linear 1,2-addition polymerisations, but their 1,1 addition is much rarer and more challenging. Here, the authors use a Cd-catalysed 1,1-carboboration process to polymerise acetylene via 1,1-addition.

Tairan Cheng, Jiayao Qiu & Shifa Zhu

Article
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Monopole-mediated light control of half skyrmion topology in nematic liquid crystals

Skyrmions, known for their robust topological protection, hold great promise for spintronic applications, but controlling their topological invariants has been a long-standing challenge. This work demonstrates light-induced manipulation of half skyrmions via eight identified monopole types, enabling topological transformations, tunable monopole interactions, and particle transport.

Zhawure Asilehan, Wentao Tang & Chenhui Peng

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Optically-biased Rydberg microwave receiver enabled by hybrid nonlinear interferometry

The researchers demonstrate an all-optical Rydberg-atom receiver employing optical-bias detection, enhancing sensitivity while eliminating the need for a microwave local oscillator.

Sebastian Borówka, Mateusz Mazelanik & Michał Parniak

Article
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A general finite-gel strategy for highly concentrated liquid metal inks

Liquid metal inks are promising for flexible electronics, but it is challenging to produce liquid metal inks due to surface tension and density. Here, the authors design a liquid metal-cryogel system to increase liquid metal concentration.

Ruiyu Ma, Lichuan Jia & Zhongming Li

Article
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Continuous time crystal coupled to a mechanical mode as a cavity-optomechanics-like platform

Continuous time crystals are phases of matter that spontaneously break continuous time-translation symmetry and have been realised in non-equilibrium systems. Here the authors couple a continuous time crystal formed by magnon Bose-Einstein condensate in superfluid 3He to an oscillator and show that the coupled system obeys the optomechanical Hamiltonian.

J. T. Mäkinen, P. J. Heikkinen & V. B. Eltsov

Article
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Ligand-exchange-assisted printing of colloidal nanocrystals to enable all-printed sub-micron optoelectronics

Researchers developed a nano-resolution, multi-material, and multi-layer printing method for the colloidal nanocrystal library. The electrohydrodynamic technique is enabled by in-situ ligand treatments to achieve fully printed infrared photodiodes.

Zhixuan Zhao, Ran An & Tianshuo Zhao

Article
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Long-range optical coupling with epsilon-near-zero materials

Long-range resonant quantum tunnelling of electrons happens across potential barriers when the wavefunction interferes constructively. Here, authors demonstrate an analogy in optical systems based on epsilon-near-zero materials, achieving long-range optical interactions beyond evanescent coupling.

Danqing Wang, Zheyu Lu & Junqiao Wu

Article
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Multiscale stress dynamics in sheared liquid foams revealed by tomo-rheoscopy

Understanding the complex flow of soft amorphous materials requires going beyond standard rheometers, which fail to capture stress heterogeneities at the mesoscopic scale. By combining shear rheometry with time-resolved X-ray micro-tomography on 3D foams, the study uncovers universal master curves in local stress dynamics and reveals how microstructural rearrangements drive non-local stress redistribution, explaining macroscopic elastoplastic behavior.

Florian Schott, Benjamin Dollet & Rajmund Mokso

Article
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Photonic neuromorphic computing using symmetry-protected zero modes in coupled nanolaser arrays

Nanolasers, valued for ultra-low power and nonlinearities, are promising for neuromorphic computing. Authors show coupled nanolaser arrays with symmetry-protected modes act as hidden nonlinear layers in photonic neural networks, enabling XNOR logic gates and highly compressed digit classification.

Kaiwen Ji, Giulio Tirabassi & Alejandro M. Yacomotti

Article
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High-temperature oxide ceramic microwave absorber enabled by thermionic migration mediated by electron delocalization

High-temperature, ultrathin, and high-performance microwave absorption is realized in the dual-layer structure with rare earth zirconate ceramics via electron delocalization-mediated thermionic migration and macroscopic interfacial resonance.

Ruopeng Cui, Zewen Duan & Chunlei Wan

Article
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Temperature-driven mechanistic transition in propylene oxidation over Pt/CeO$_2$ ensemble catalysts

Pt/CeO$_2$ ensemble catalysts show great potential for hydrocarbon oxidation, but the nature of active sites and interfacial evolution during reaction has been debated. Here, the authors demonstrate metallic Pt ensembles serve as the true active sites for C_3H_6 oxidation, and confirm dynamic nature of oxygen activation with the threshold temperature around 170 °C.

Zihao Li, Xingyan Chen & Naiqiang Yan

Article
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Dimensionless learning based on information

Dimensional analysis is deriving predictive dimensionless variables for physical systems. Here, the authors introduce IT-π, an information-theoretic, model-free framework that identifies the dimensionless variables with the highest predictive power for the quantity of interest.

Yuan Yuan & Adrián Lozano-Durán

Article
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Noise-aware training of neuromorphic dynamic device networks

Dynamic systems show promise for physical neural networks, but gradient based optimization requires mathematical models. Here, the authors present a data-driven framework for optimizing networks of arbitrary dynamic systems which is robust to noise, and enables tasks such as neuroprosthetic control.

Luca Manneschi, Ian T. Vidamour & Eleni Vasilaki

Article
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Pushing the boundary of quantum advantage in hard combinatorial optimization with probabilistic computers

Probabilistic computing has emerged as a powerful route for tackling hard optimization. Here, authors show p-computers co-designed with modern hardware to run Monte Carlo algorithms solve hard optimization efficiently and establish a rigorous classical baseline to assess practical quantum advantage.

Shuvro Chowdhury, Navid Anjum Aadit & Kerem Y. Camsari

Article
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Cu single-atom embedded g-C_3N_4 nanosheets rehabilitate multidrug-resistant bacteria infected diabetic wounds via photoswitchable cascade reaction

Strategies that can effectively combat multidrug-resistant bacteria, reduce glucose levels, control oxidative stress, regulate inflammation, and promote angiogenesis are desirable for the treatment of diabetic wounds but elusive. Here, the authors address these challenges by developing a strategy that utilises a photoswitchable cascade reaction based on Cu single-atom embedded g-C_3N_4 nanosheets.

Xichen Sun, Pengqi Zhu & Peng Li

Article
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Multifunctional van der Waals PdSe$_2$ for light detection, guiding and modulation

Optoelectronic and photonic devices require materials with multiple, often conflicting functionalities, leading to integration challenges. Here, the authors demonstrate that layered PdSe$_2$ is suitable for infrared photodetection, light guiding and photothermal applications due to its peculiar semimetallic band structure.

Aleksandr Slavich, Georgy Ermolaev & Valentyn Volkov

Article
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Ring expansion of bicyclo[1.1.0]butyl ketones to bicyclo[2.1.1]hexenes using ketone as both activating and reacting groups

Bicyclo[n.1.1]alkyl skeletons are of significant interest as bioisosteres of phenyl groups for lead drug modification. Common strategies for their synthesis utilize bicyclo[1.1.0]butanes, wherein the electron-withdrawing groups serve solely as activating groups to facilitate the cleavage of the bridged σ bond, leading to ring expansion by an insertion manner. Here, the authors utilize ketones in bicyclo[1.1.0]butane as both activating and reacting groups, promoting a tandem nucleophilic addition/intramolecular Horner-Wadsworth-Emmons olefination process by an exo-cyclic annulation manner.

Junjie Ge, Lihang Cao & Hua Chen

Article
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Enhancing cap-independent translation of linear mRNA

Cap-independently translated mRNAs could expand the scope of mRNA therapies, but yield limited protein, and existing enhancement strategies are imperfect. Here, the authors install a 5′-end modification that both boosts efficiency and facilitates in-depth characterisation of these mRNAs.

Sebastian Golojuch, Brendan Largey & Tom Brown

Article
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DNA StairLoop: enabling high-fidelity data recovery and robust error correction in DNA-based data storage

High-throughput electrochemical synthesis is ideal for DNA storage, but suffers from low fidelity. Here, authors propose a coding scheme named DNA StairLoop. Experiments demonstrate that it can recover data with high error rates and low sequencing depths, improving the practicality of this technique.

Zihui Yan, Guanjin Qu & Huaming Wu

Article
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Predicting sequence-specific amplification efficiency in multi-template PCR with deep learning

Multi-template PCR enables parallel DNA amplification but suffers from sequence-specific biases. Here, the authors develop a 1D-CNN model predicting amplification efficiency directly from the DNA sequence and discover adapter-mediated self-priming as a key cause of uneven amplification during PCR.

Andreas L. Gimpel, Bowen Fan & Robert N. Grass

Article
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Semi-crystalline and amorphous materials via multi-temperature 3D printing from one formulation

3D printing can be used to manufacture composite materials, but to modify material properties multiple feedstocks are required. Here the authors modify printing temperature or light intensity to modify the material properties and achieve property differentiation from a single feedstock.

Michael Göschl, Dominik Laa & Katharina Ehrmann

Article
15 October 2025 | Open Access

Coordination-tailored atomic interfaces for selective CH_4-to-C_2 conversion in aqueous solution

Selective CH_4-to-C_2 oxygenate conversion under mild conditions remains a key challenge in catalysis with notable commercial potential. Here the authors report the precise construction of densely packed O_2-bridged Fe diatomic sites on carbon nitride aerogel-supported Fe dual-atom catalysts, enabling selective methane oxidation to acetic acid in aqueous solution under mild conditions.

Fanle Bu, Jiayu Yan & Yurui Xue

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15 October 2025 | Open Access

Collectivity effect in cluster catalysis under operational conditions

Subnanometer metal clusters are limited by structural heterogeneity and dynamics under reaction conditions. Here, AI-driven multiscale modeling reveals collective activity of diverse Cu/CeO_2 sites via coordination-adsorption balance.

Jia-Lan Chen, Xue-Chun Jiang & Wei-Xue Li

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Rapid adaptive optics enabling near noninvasive high-resolution brain imaging in awake behaving mice

The authors present the adaptive optics system MD-FSS, which allows high-resolution brain imaging in awake mice with rapid aberrations correction against motion. It reveals differences in brain function between awake and anesthetized states, improving our understanding of neurovascular dynamics.

Zhentao She, Yiming Fu & Jianan Qu

Article
15 October 2025 | Open Access

Radical-enhanced photo-activated ultralong organic phosphorescence

Control over photo-activated phosphorescence lifetime and photo-activated time is desirable, but manipulation within a given material is challenging. Here, the authors report a method to increase phosphorescence emission by consumption of oxygen within the polymer matrix.

Yuefei Wang, Zaiyong Zhang & Wei Huang

Article
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Spatial biology using single-cell mass spectrometry imaging and integrated microscopy

Potthoff and colleagues present a MALDI-MSI-based method that integrates in-source brightfield and fluorescence microscopy, which allows for spatially-resolved analysis of lipids and metabolites at the (sub)cellular level.

Alexander Potthoff, Jan Schwenzfeier & Jens Soltwisch

Article
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Fine-structure constant sensitivity of the Th-229 nuclear clock transition

The authors report on new developments on the sensitivity of the nuclear clock transition in Th229 for new physics searches involving variations of the fine-structure constant. This highlights the need for developing of advanced nuclear models and parameter searches relating to experimental measurements.

Kjeld Beeks, Georgy A. Kazakov & Marianna S. Safronova

Article
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Spin density wave rather than tetragonal structure is prerequisite for superconductivity in $La_3Ni_2O_{7-\delta}$

The authors obtain tetragonal La3Ni2O6.92 single crystals at ambient pressure by post-annealing in a high-oxygen-pressure environment. Experimental results on these samples suggest that the tetragonal structure is not a prerequisite for achieving superconductivity in La3Ni2O7.

Mengzhu Shi, Di Peng & Xianhui Chen

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Distinct hydrologic response patterns and trends worldwide revealed by physics-embedded learning

A global differentiable model reveals major shifts in water availability which heighten floods and droughts. This largescale model highlights regions facing water challenges and delivers reliable, locally-relevant insights for water management.

Haoyu Ji, Yalan Song & Yoshihide Wada

Article
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Solution-processable and photo-curable system for low-cost and scalable transient electronics

Transient electronics require low-cost, scalable manufacturing for practical use. Here, the authors develop solution-processable, photo-curable materials to develop soft transient electronics at the wafer scale for biomedical applications.

Won Bae Han, Sungkeun Han & Suk-Won Hwang

Article
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Breathable, wearable skin analyzer for reliable long-term monitoring of skin barrier function and individual environmental health impacts

Monitoring skin hydration and water loss has diagnostic power. Here, the authors present a wearable skin analyzer that enables long-term monitoring of these parameters.

Insic Hong, Daseul Lim & Daeshik Kang

Article
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Subcellular mass spectrometry imaging of lipids and nucleotides using transmission geometry ambient laser desorption and plasma ionisation

Young and colleagues describe an atmospheric pressure transmission-geometry MALDI approach equipped with plasma ionisation, which allows for subcellular mass spectrometry imaging of lipids and nucleotides in cells and tissues.

Reuben S. E. Young, Ann-Katrin Piper & Shane R. Ellis

Article
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In vivo mechano-tissue engineering by hydrogels capable of transmitting intercellular mechanical stress

Here, authors develop a ligand-free strategy to mechanically activate cells in a hydrogel by utilizing a biorthogonal click reaction to form a covalent bond between azide-modified cellular integrins and the hydrogel. They then apply this strategy in vivo to show that the transmittance of mechanical stress using the hydrogel system promotes regeneration of skeletal muscle.

Natsumi Ueda, Hayato Okazaki & Koji Nagahama

Article
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Piezo1 regulates the mechanotransduction of soft matrix viscoelasticity

Matrix viscoelasticity regulates cell behavior in a stiffness-dependent manner. Here, the authors reveal that the mechanosensitive channel Piezo1 transduces soft matrix viscoelastic cues, through a coordinated interaction with molecular clutch mechanisms.

Mariana A. G. Oliva, Giuseppe Ciccone & Manuel Salmeron-Sanchez

Article
14 October 2025 | Open Access

Linking electrocatalytic turnover to elementary step rates in hydrocarbon fuel oxidation

The electrocatalytic oxidation of propane fuel is slow on Pt. By analyzing the rate of its individual steps, the authors show that slow propane oxidation is caused by a mismatch between the electrode potentials that promote propane adsorption, conversion of intermediates, and oxidation to CO_2.

Alexander J. Zielinski, Christine Lucky & Marcel Schreier

Article
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Sub-ångström resolution ptychography in a scanning electron microscope at 20 keV

A scanning electron microscope operated at 20 keV with distortion corrected ptychography achieves sub-ångström resolution, thus offering a compact and lower-cost alternative TEM imaging method that is well-suited to 2D materials and small proteins.

Arthur M. Blackburn, Cristina Cordoba & Robert A. McLeod

Article
14 October 2025 | Open Access

History of individual presolar SiC grains revealed by stellar winds

Origin of abundant noble gases in presolar silicon carbide (SiC) grains is under debate. Here, the authors measure 3D maps of helium within the SiC grains and reveal that these noble gases are evidence of hot stellar wind irradiation from central stars of planetary nebulae.

Ken-ichi Bajo, Tatsuki Izumi & Hisayoshi Yurimoto

Perspective
14 October 2025 | Open Access

Bio-hybrid photoelectrochemical catalysis for solar fuels and chemicals conversion

Bio-hybrid photoelectrochemical systems integrate microbial components with abiotic conductors/semiconductors for solar fuels and chemical conversion. Here, the authors analyze the bottlenecks related to catalytic efficiency, stability and scalability, and propose strategies to address these challenges.

Bin Cai, Mariia V. Pavliuk & Haining Tian

Article
14 October 2025 | Open Access

Monovalent anion-selective membranes fabricated via in situ interfacial polymerization

Designing monovalent anion-selective membranes is challenging due to the need to balance trade-offs between flux and selectivity, membrane stability, and cost-effective fabrication. Here, the authors synthesized a polymer via superacid polymerization and designed a membrane using in-situ interfacial polymerization to optimize membrane properties.

Noor Ul Afsar, Michael Holmboe & Naser Tavajohi

Article
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Raman identification of single nucleotides flowing through permeable plasmonic films

Ultrafast SERS combined with nanopore sequencing allows distinguishing similar nucleotides at the single-molecule level, offering a step towards molecular sequencing with the aid of machine learning.

Kirill Khabarov, Maria Blanco Formoso & Francesco De Angelis

Article
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Light-gated redox switching and actuation in polymer hydrogels

Light and redox switches are of interest for responsive materials, actuators and robotics. Here the authors integrated a redox- and photoresponsive switch into a polymer hydrogel enabling reversible redox-switching with high spatio-temporal precision.

Roza R. Weber, Robert Hein & Ben L. Feringa

Article
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Bipolar ethylene electrosynthesis from CO_2 and biowaste acid with total faradaic efficiency over 118%

Traditional thermocatalytic production of ethylene is hindered by high energy penalty and carbon footprint. Here, the authors report an ambient bipolar ethylene electrosynthesis system by coupling oxidative decarboxylation of propanoic acid biowaste with CO_2 electroreduction.

Wenjie Xue, Hui Jiang & Bo You

Article
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Operando-electrified solvay process

$NaHCO_3$ production is energy- and cost-intensive. Here the authors report an *operando* electrosynthesis system by embedding nitrate reduction reaction into Solvay system, achieving high $NaHCO_3$ productivity even up to 4.58 times of benchmark industrial route.

Qi Huang, Jingjing Duan & Sheng Chen

Article
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Precipitation induced by explosive volcanism on Mars and its implications for unexpected equatorial ice

New modeling shows that explosive volcanic eruptions on Mars could have repeatedly delivered ice to the equator, pointing to a volcanic origin for the mysterious excess hydrogen in the planet's shallow equatorial surface.

Saira S. Hamid, Laura Kerber & Amanda B. Clarke

Article
14 October 2025 | Open Access

Catastrophic localized deflagration formation mechanisms and safety precautions in proton exchange membrane water electrolyzer

Proton exchange membrane water electrolysis promises green hydrogen production but safety risks in industrial operations remain unexplored. Here, the authors identify water-starvation as the cause of water electrolysis stack deflagration and establish safety precautions for industrial scale-up.

Aidong Tan, Jiayi Song & Jianguo Liu

Article
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Dynamic beam-stabilized, additive-printed flexible antenna arrays with on-chip rapid insight generation

Authors present a flexible antenna array with a processor that stabilizes beams in real-time, addressing errors from dynamic deformation. It uses a cost-effective copper ink for printing, ensuring stable performance under strain and temperature changes, suitable for wearable and portable devices.

Sreeni Poolakkal, Abdullah Islam & Subhanshu Gupta

Article
14 October 2025 | Open Access

Understanding discrepancies in noncovalent interaction energies from wavefunction theories for large molecules

High-level electronic structure methods present discrepancies for noncovalent interactions in large molecules. Here, the authors investigate these discrepancies and propose a modified coupled-cluster method for improved accuracy in large-scale molecular predictions.

Tobias Schäfer, Andreas Irmler & Andreas Grüneis

Article
14 October 2025 | Open Access

Biomimetic KcsA channels enabled by 1D MOF-in-2D COF

Biomimetic membranes can mimic biological ion channels for selective ion transport. Here, authors developed 1D MOF-in-2D COF composite membranes that achieve high K^+/Na^+ and K^+/Mg^{2+} selectivity, offering a promising approach for single-species ion separation.

Qian Sun, Pengjia Dou & Jiangtao Liu

Article
14 October 2025 | Open Access

In situ coordinated HTL strategy for high-performance and scalable perovskite solar cells

Self-assembled monolayer (SAM)-based hole transport layer often suffers from weak interfacial adhesion, poor film uniformity, and limited stability, constraining their scalability. Here, authors in situ anchor SAM during NiOx synthesis, achieving maximum efficiency of 20.21% for large-area modules.

Yulu Sun, Ruoyao Xu & Hua Dong

Article
14 October 2025 | Open Access

Reconfigurable dynamic acoustic holography with acoustically transparent and programmable metamaterial

Ultra-fast dynamic acoustic holography that can be reconfigured is realised using partitioned transducer and programmable phase hologram. These attributes allow creating acoustic movies and dynamic ultrasound stimulus, with implications for future possibilities in broad acoustics, such as sonodynamic therapy and neuromodulation.

Mengru Zhang, Binjie Jin & Tao Xie

Article
14 October 2025 | Open Access

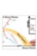
Catalyst-controlled stereodivergent synthesis of polysubstituted alkenes

The potential of leveraging diverse geometric configurations of the catalysts to achieve divergent synthesis remains largely untapped. Here, the authors report a stereodivergent three-component borylfunctionalization of alkynes, enabled by ligand-modulated geometric variations in nickel catalysts.

Chengmi Huang, Dong Wu & Guoyin Yin

Article
14 October 2025 | Open Access

Temperature measurement of Quark-Gluon plasma at different stages



Thermal lepton pairs are ideal probes for the temperature of quark-gluon plasma. Here, the STAR Collaboration uses thermal electron-positron pair production to measure quark-gluon plasma average temperature at different stages of the evolution.

B. E. Aboona, J. Adam & M. Zyzak

Article
14 October 2025 | Open Access

Evaluating large language model agents for automation of atomic force microscopy

LLM agents could revolutionize laboratory automation, but their capabilities remain poorly tested. Here, the authors create a framework automating atomic force microscopy with LLMs and benchmark them through an end-to-end evaluation suite, revealing major limitations and safety concerns

Indrajeet Mandal, Jitendra Soni & N. M. Anoop Krishnan

Article
14 October 2025 | Open Access

Overcoming limitations in Chan-Lam amination with alkylboronic esters via aminyl radical substitution

The application of Chan-Lam coupling reactions as a general platform for C(sp3)−N bond assembly remains a longstanding challenge due to the inherent limitation in boron-to-copper transmetalation. Here, the authors report an N-alkylation protocol that overcomes the limitations of Chan-Lam coupling by using versatile alkylboronic pinacol esters as radical precursors via aminyl radical-mediated boron abstraction.

Huanyu Xiao, Panting Cao & Tao Yang

Article
14 October 2025 | Open Access

Reprogramming mitochondrial metabolism and epigenetics of macrophages via miR-10a liposomes for atherosclerosis therapy

This study shows that restoring mitochondrial respiration in atherosclerotic macrophages reopens their chromatin, enabling phenotype reprogramming. Using targeted liposomes to deliver miR-10a, researchers successfully reduced atherosclerosis in mice by reprogramming macrophage phenotypes. The findings offer a promising epigenetic therapy for atherosclerosis

Fei Fang, Erxiang Wang & Xiaoheng Liu

Article
13 October 2025 | Open Access

High entropy engineered polymer blends with enhanced dielectric properties and high temperature stability

High performance dielectric polymers are applicable to power conversion systems for renewable energy generation and electric vehicles. Here, the authors report the melt blending of multiple immiscible polymers to achieve high dielectric permittivity while retaining low dielectric loss tangent.

Xin Qi, Xuankai Huang & Michael J. Reece

Article
13 October 2025 | Open Access

Enantioselective homologation of helical architectures from fluorenones to phenanthrenones with enhanced circular dichroism

The precise synthesis of enantiomerically enriched helicenes has attracted considerable interest in material science and chiral catalysis, but synthetic strategies for helical chirality remain relatively limited. Here, the authors report a chiral scandium(III)-catalyzed ring-expansion and kinetic resolution of racemic helical fluorenones with α-diazo esters.

Shiyang Li, Shi Yan & Xiaohua Liu

Article
13 October 2025 | Open Access

Valence restrictive metal-support interaction for boosting catalytic activity of Rh/CeO$_2$ in CO$_2$ hydrogenation

Metal-support interactions (MSI) on catalysts are poorly understood. This work identifies valence-restrictive MSI fixing nanocluster Rh$_n$ on CeO$_2$ as Rh$_n^{2+}$, boosting H$^-$ formation and enabling selective CO$_2$ to CH$_4$ hydrogenation.

Ze-Kai Yu, Mingxiang Jiang & Xue-Qing Gong

Article
13 October 2025 | Open Access

Wearable disposable electrotherapy

Electrotherapy requires electronic powered devices, set-up, and accessories. Here the authors, developed an integrated single-use platform for wearable electrotherapy as simple as a band-aid

Mohamad FallahRad, Kyle Donnery & Marom Bikson

Article
13 October 2025 | Open Access

Ultra-high energy storage in relaxor ferroelectric MLCCs at elevated temperatures via entropy modulated strain heterogeneity

The authors significantly enhance the high-temperature energy storage performance of bismuth sodium titanate-based relaxor ferroelectric multilayer ceramic capacitors via entropy modulated strain heterogeneity.

Ruirui Kang, Yang Li & Xiaojie Lou

Article
13 October 2025 | Open Access

Reac-Discovery: an artificial intelligence–driven platform for continuous-flow catalytic reactor discovery and optimization

Chemical reactor design has traditionally relied on human expertise. Here, the authors present Reac-Discovery, an AI-driven platform that designs, validates, fabricates and optimizes 3D-printed catalytic reactors.

Cristopher Tinajero, Marcileia Zanatta & Victor Sans

Article
13 October 2025 | Open Access

Spotting critical point from atomic sites to heterointerfaces on catalysts by oxygen adsorption energy-regulated luminescence

A diethyl ether-triggered luminescence strategy is designed to spot the critical point distinguishing atomic sites from heterointerfaces in In$_2$O$_3$/ZrO$_2$. It is validated for other metal oxide catalysts and serves as an alternative to HRTEM detection.

Yuanyuan Dai, Kaihang Sun & Chao Lu

Article
13 October 2025 | Open Access

Donor strand complementation and calcium ion coordination drive the chaperone-free polymerization of archaeal cannulae

Cannulae are heat-resistant protein nanotubes found on the surface of thermophilic archaea. Here, the authors report the structures of cannulae at the atomic level with insight into their high stability and mechanism of assembly, which has potential impact for biomaterials design.

Mike Sleutel, Ravi R. Sonani & Vincent P. Conticello

Article
13 October 2025 | Open Access

Global geo-hazard risk assessment of long-span bridges enhanced with InSAR availability

Authors integrate structural health monitoring and multi-temporal InSAR monitoring availability into geo-hazard risk assessment. Global analysis of 744 bridges reveals that, while less than 20% have structural health monitoring systems in place, Sentinel-1 could be used to augment monitoring of over 60% structures.

Dominika Malinowska, Pietro Milillo & Giorgia Giardina

Article
13 October 2025 | Open Access

Identifying key uncertainties in energy transitions with a Puerto Rico case study

This study supports uncertainty-aware energy transition planning by identifying key uncertainty sources. In Puerto Rico, hurricane frequency and institutional inefficiency emerge as the two main drivers.

Kamiar Khayambashi, Andres F. Clarens & Negin Alemazkoor

Article
13 October 2025 | Open Access

Allocentric flocking

Animals are often thought to follow simple alignment rules, but this study explores how collective behavior could instead emerge from neural ring-attractor networks encoding allocentric and egocentric bearings. The results show that group motion arises spontaneously when allocentric bearings are used, with rapid switching between the two representations further boosting coordination.

Mohammad Salahshour & Iain D. Couzin

Article
10 October 2025 | Open Access

Digitally fabricated 3D slippery architectures for multifunctional liquid manipulation

Control of liquid-based materials is important for developing materials based on these, but topological flexibility is limited. Here, the authors report a method for digital fabrication of slippery objects with solid-liquid composite interfaces and geometric design freedom.

Woo Young Kim, Seong Min Yoon & Young Tae Cho

Article
10 October 2025 | Open Access

Reversible shape memory two-dimensional covalent organic frameworks

While it is possible to synthesize two-dimensional covalent organic frameworks with reversible stacking phases and thus pore sizes, it is challenging because the slipped AA-stacking is the most thermodynamically stable phase. Here, the authors report shape memory 2D covalent organic frameworks with reversible interlayer stacking sequences.

Mingchao Shao, Jinyang Chen & Yunlong Guo

Article
10 October 2025 | Open Access

A high-κ homogeneous ink for printable electroluminescent devices

Flexible alternating-current electroluminescent devices have potential in a range of applications, but improving electrical properties can require loss of transparency. Here, the authors report a printable, high-dielectric, transparent ink, to allow efficient light transmission.

Tao Li, Zhengwen Li & Lei Shi

Article
10 October 2025 | Open Access

Strain-associated nanoscale fluctuating lithium transport within single-crystalline LiNi$_{1/3}$Mn$_{1/3}$Co$_{1/3}$O$_2$ cathode particles

Lithium-ion batteries rely on lithium diffusion within particles, traditionally assumed to follow concentration gradients. Here, authors use X-ray microscopy to track lithium movement in single particles, discovering that lithium can move against concentration gradients due to strain effects.

Danwon Lee, Chihyun Nam & Jongwoo Lim

Article
10 October 2025 | Open Access

Week-long-lifetime microwave spectral holes in an erbium-doped scheelite crystal at millikelvin temperature

The authors report spectral hole burning with a record hole lifetime in a Er^{3+} doped scheelite crystal CaWO$_4$ at mK temperatures. This can benefit applications in classical and quantum information processing.

Zhiren Wang, Sen Lin & Patrice Bertet

Article
10 October 2025 | Open Access

Regional coordination can alleviate the cost burden of a low-carbon electricity system

The authors model regional electricity grid coordination, which enables access to geographically dispersed resources. Results suggest grid integration can reduce planning uncertainty region-wide but may impact individual countries differently.

Jacob Wessel, AFM Kamal Chowdhury & Jonathan Lamontagne

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Nature Communications (***Nat Commun***) | ISSN 2041-1723 (online)

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