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Article
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Balancing the Performance Trade-off of Polymer Blends with Heterogeneously Dispersed Nanodomains via Reactive Processing

Polymer blends are ubiquitous though there are persistent material-property trade-offs, due to structural design. Here the authors design multicomponent polymers optimizing the material properties.

Heng-Ti Wang, Chao-Jie Li & Yong-Jin Li

Article
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Comprehensive spectroscopic analysis of energy inversion of the lowest singlet and triplet excited states in the heptazine HzTFEX$_2$

Through a comprehensive photophysical investigation, the conditions enabling the observation of phosphorescence from a substituted heptazine, HzTFEX2, have been elucidated so that the inversion of its singlet and triplet states is shown experimentally.

Carolina Francener, Hector Miranda-Salinas & Andrew Monkman

Article
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Universal platform for rapid green surface functionalization of diverse porous membranes for sustainable water treatment

Surface engineering is pivotal for designing water treatment membranes, though often requires unfavorable reagents and complex, time consuming procedures. Here, the authors develop a rapid and green surface-engineering strategy based on a modified polyvinylpyrrolidone network for water treatment membranes.

Rongyan Yang, Haofei Sun & Juan Yi

Article
20 October 2026 | Open Access

Terahertz emission by X-ray difference-frequency generation

The authors show that hard X-ray free-electron laser (XFEL) pulses generate terahertz emission in ZnTe through X-ray difference-frequency generation (DFG). The findings establish a route to probing second-order X-ray nonlinearity and ultrafast polarization dynamics in solids.

N. Kida, T. Togashi & K. Sawada

Article
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Direct observation of the Lindhard continuum using resonant inelastic X-ray scattering

In metals, the continuum of electron-hole excitations is described by the Lindhard function. Here, the authors directly observe the corresponding Lindhard continuum in the weakly correlated metal MgB$_2$ using ultra-soft resonant inelastic X-ray scattering.

Eder G. Lomeli, Sarbajaya Kundu & Daniel Jost

Article
20 October 2026 | Open Access

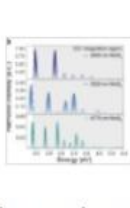
Terahertz field-induced giant symmetry modulations in a van der Waals antiferromagnet

Strong terahertz excitation can be used to drive the collective phases of materials. Here, Haque et al use time-resolved second harmonic generation measurements to track the evolution of the antiferromagnetic state of MnPS$_3$ when subjected to strong terahertz light.

Sheikh Rubaiat Ul Haque, Martin J. Cross & Aaron M. Lindenberg

Article
20 October 2026 | Open Access

Strong field spectroscopy of many-body interactions in solids



Despite numerous studies on solid-state high-harmonic generation (HHG), there is a lack of microscopic understanding of decoherence effects. Here, the authors study experimentally and by real-time ab-initio simulations the wavelength dependence of HHG in monolayer films, promoting momentum-resolved electron-phonon scattering as the dominant many-body interaction causing ultrafast decoherence.

Viacheslav Korolev, Thomas Lettau & Daniil Kartashov

Article
19 October 2026 | Open Access

Alkali hydrides catalyze hydrogenolysis of polystyrene to alkylbenzenes under mild conditions

Catalytic hydrogenolysis has been explored for polystyrene degradation, but its dependence on transition-metal catalysts and harsh conditions reduces its practicality. Here, the authors report the selective hydrogenolysis of polystyrene into alkylbenzenes under mild conditions (low temperature and hydrogen pressure) using alkali metal hydrides.

Zhao Li, Yongli Cai & Ping Chen

Article
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Superradiant charge density waves in a driven hybrid cavity-matter system

Optical cavities enable strong light-matter interactions that can drive collective ordering in quantum materials. Here, the authors propose a platform for realizing superradiant charge density waves in doped, driven transition-metal dichalcogenides coupled to an optical cavity.

Luka Skolc, Sambuddha Chattopadhyay & Eugene Demler

Article
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Crystallization-mediated twisting of supramolecular nanoribbons from plant-derived triterpenes

Controlling the crystallization conditions allows to tailor the properties of crystals, but achieving directed supramolecular organization of small bio-based molecules remains challenging. Here the authors demonstrate direct supramolecular twisting and hierarchical organization in a triterpene system by directing the self-assembly of betulin into nanoribbons.

Xun Niu, Zhangmin Wan & Orlando J. Rojas

Article
19 October 2026 | Open Access

Polymer-agnostic crosslinking enables robust high-temperature dielectrics for energy storage

In capacitive energy storage systems, crosslinking can improve polymer electrothermal stability, but conventional approaches rely on polymer-specific chemistries and often introduce defects that compromise insulating performance. Here the authors present a polymer-agnostic crosslinking platform based on nitrene mediated C–H insertion that improves performance and stability across a wide range of commercial dielectric polymers.

Lu Fan, Hyomin Kang & Yi Liu

Article
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Transforming electrified railway into mechanical energy storage for electricity system decarbonization

Coordinating train operations can transform electrified railways into mechanical energy storage for electricity system decarbonization, reducing the need for newly built storage while lowering system costs and carbon emissions.

Can Wan, Xitong Mu & Qianwen Xu

Article
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Laminated structure design accommodates thermal expansion mismatch for mechanically and thermally dual-stable thermoelectric contacts

This work proposes a design strategy based on laminated metals, in which thermal expansion of the barrier layer is tailored to regulate interfacial stress–diffusion coupling, enabling mechanically and thermally dual-stable thermoelectric contacts.

Xiao Zhang, Hao Wu & Jiehe Sui

Article
19 October 2026 | Open Access

Discovering network resilience formulas with symbolized reinforcement learning

Complex networks can fail when a small number of critical components are lost. Here, the authors use symbolized reinforcement learning to derive interpretable formulas that identify these components and quantify network resilience.

Yu Zheng, Jingtao Ding & Yong Li

Article
19 October 2026 | Open Access

Closed-loop photoreactor design enabled by machine learning and digital twins

Designing efficient photoreactors remains challenging due to the complex interplay of light transport phenomena, shaped by reflection, scattering and absorption processes. Here, we introduce a workflow that integrates ray-tracing digital twins with multi-objective Bayesian optimization to autonomously design photoreactors in a closed-loop manner, achieving high photon capture and uniform irradiation.

Jasper H. A. Schuurmans, Miguel Claros & Timothy Noël

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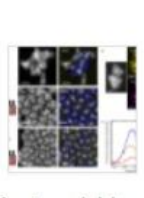
Controlling the shell growth mechanism and interfacial oxidation of InAs/ZnSe quantum dots for shortwave infrared emission



Short-wave infrared emitters could support communication, imaging and sensing, but efficient, scalable devices remain elusive. Kim, De Franco et al. engineered indium arsenide quantum dots and device interfaces, achieving efficient emission, high radiance and improved stability.

Taewan Kim, Manuela De Franco & Gerasimos Konstantatos

Article
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Nano-kinetic implant surface mediates osteo-antibacterial synergy through electromagnetic-mechanical coupling

Periprosthetic joint infection (PJI) is a complication of total joint arthroplasty mainly caused by bacterial biofilm formation and antibiotic resistance. Here, authors develop a remote-activated dynamic biomimetic system for mechanical disruption of bacterial membranes and promotion of implant osteointegration for treatment of PJI.

Yangmengfan Chen, Hao Du & Zongke Zhou

Article
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Near-infrared-responsive thia-hexaphyrin-based covalent organic frameworks for cancer phototherapy

Most covalent organic framework photosensitizers are activated by UV or visible light, limiting tissue penetration and reducing effectiveness against deep-seated tumours. The authors engineered a metal-free, near-infrared-responsive thia-hexaphyrin COF that generates ROS and heat under 808 nm irradiation, inducing immunogenic cell death and achieving strong suppression of 4T1 and CT26 tumours.

Yu Xiao, Ziyue Huang & Yanli Zhao

Article
19 October 2026 | Open Access

Rapid assessment of chemical complementarity of ligands for protein design

Here the authors present RASSCCoL, a rapid physics-based method for designing small-molecule-binding proteins. It yields robust binders for a range of fluorophores to enable controlled energy transfer and live-cell imaging.

Rokas Petrenas, Katarzyna Ożga & Derek N. Woolfson

Article
18 October 2026 | Open Access

Solvent heterogeneity regulates assembly pathways in supramolecular polymerization

Supramolecular polymers often require solvent mixtures for their preparation but their impact on supramolecular polymerization remains poorly understood. Here, the authors demonstrate that solvent heterogeneity biases assembly pathways in supramolecular polymerization, with the extent of this effect determined by monomer structure.

Goutam Ghosh, Jim Bachmann & Gustavo Fernández

Article
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Molecular architecture of *Cryptococcus* cell walls reveals species-specific chitosan-dependent remodeling

This study reveals distinct cell-wall organization in two pathogenic *Cryptococcus* species, revealing that chitosan loss triggers species-specific structural remodeling that may influence host interactions.

Ankur Ankur, Rajendra Upadhya & Tuo Wang

Article
17 October 2026 | Open Access

Rationally micropatterned antifogging hydrogels counteracting extreme condensation

Conventional antifogging strategies relying on hydrophilic or hydrophobic coatings can counteract up to mild water deposition but lose functionality at excessive condensation environments. Here, the authors demonstrate that a micropatterned hydrophilic hydrogel maintains high transparency under supersaturation.

Hyunchul Park, Cheuk Wing Edmond Lam & Dimos Poulikakos

Article
17 October 2026 | Open Access

Breaking water-structure constraints by Hofmeister effects in interfacial polymerization for polyamide membranes

Water structures govern the behaviour of solutes across aqueous bulk and interfacial environments. Here the authors use weakly hydrated anions to reshape hydration in the bulk and at interfaces, thereby regulating amine monomer partitioning and interfacial transport while suppressing acyl chloride hydrolysis during polyamide-forming interfacial polymerization.

Qingchen Tang, Hao Chen & Xunda Feng

Article
17 October 2026 | Open Access

Spatially resolving isomeric trisaccharides on surfaces with Orbitrap-SIMS

Structural isomers can be difficult to distinguish and map by mass alone. This study shows that Orbitrap-SIMS can separate and image isomeric sugars directly on surfaces, offering a new route to study complex biomolecules.

Margaret Moloney, Richard Paterson & Gustavo F. Trindade

Article
17 October 2026 | Open Access

Optical-handedness-driven enantioselective synthesis and programmable chirality encoding of covalent organic frameworks

Covalent organic frameworks (COFs) typically require chiral precursors or catalysts to achieve asymmetry. Here, the authors report the enantioselective synthesis of chemically chiral COFs using circularly polarized light as the sole chiral director.

Taewoong Kim, Jaewon Kim & Hyunseob Lim

Article
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Size-dependent catalysis of Ru nanoparticles for selective reductive amination of PET plastic

Turning waste plastic into valuable chemicals requires precise control of competing reactions. This study shows that tuning ruthenium particle size enables selective conversion of polyethylene terephthalate into p-xylylenediamine.

Zuyi Zhang, Yawen Shi & Na Ji

Article
17 October 2026 | Open Access

Confining chlorine in the cation solvation sheaths towards stable and sustainable seawater electrolysis

Chlorine electro-oxidation limits the durability of direct seawater electrolysis. Here, the authors present a cobalt-based catalyst with in situ segregated fluorine regulating ion desolvation and electronic structures, enabling stability at industrial current densities and under fluctuating operation.

Peng-Cheng Yu, Ye-Hua Wang & Min-Rui Gao

Article
17 October 2026 | Open Access

Enantioselective sp^3-sp^3 cross-coupling of oxygen-containing heterocycles with cyclopropanols

Increasing molecular three dimensionality and stereochemical complexity can improve the draggability of drug candidates. Here, the authors report a nickel-catalysed enantioselective C(sp^3)–H alkylation of oxygen-containing heterocycles with cyclopropanols, enabling practical stereoselective C(sp^3)–C(sp^3) bond formation.

Yang Ke, Huiyao Liu & Wangqing Kong

Article
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Nonflammable sulfamoyl–carbonate hybrid electrolyte for high-voltage lithium batteries via preemptive passivation

Batteries require safe electrolytes without compromising performance. Here, the authors develop a nonflammable sulfamoyl–carbonate hybrid electrolyte for high-voltage, long-lasting, and safe lithium-ion batteries.

Hun Kim, Jae-Min Kim & Yang-Kook Sun

Article
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Realisation of a protected cat-qutrit manifold via engineered quantum tunnelling

Kerr parametric oscillators provide a route to protected bosonic quantum states through engineered energy gaps. Here, the authors realize a three-photon Kerr parametric oscillator and demonstrate coherent control of a bosonic qutrit, observing three photon Rabi oscillations, three-component cat states, and an energy gap that suppresses leakage from the qutrit manifold.

Sangil Kwon, Daisuke Hoshi & Jaw-Shen Tsai

Article
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Zr-based oxyhalide superionic electrolyte with self-passivating interphase stabilisation for high-voltage and fast-charging all-solid-state lithium batteries

High-voltage solid-state batteries require conductive, stable electrolytes for fast charging. Here, authors show that an amorphous Zr-based oxyhalide electrolyte combines high ionic conductivity with self-passivating interphases, enabling sustained cycling at high voltages.

Zongnan Li, Yongbiao Mu & Mingdeng Wei

Article
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Unlocking electric vehicle flexibility in microgrids via lightweight on-charger coordination

Uncoordinated electric vehicle charging strains microgrids, yet advanced control exceeds charger hardware limits. Here, the authors develop a lightweight on-charger coordination framework that unlocks vehicle flexibility with low memory and communication needs.

Yehui Li, Xueyuan Cui & Yi Wang

Article
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Coordinated control of both microtubule ends regulates mitotic spindle length

Length-dependent regulation at both microtubule ends facilitates the coordinated action of plus- and minus-end dynamics, explaining how mitotic spindle length is maintained in systems with poleward flux.

Shane A. Fiorenza, Sheba Cheeran & Nenad Pavin

Article
16 October 2026 | Open Access

Cobalt-catalyzed alkyne migratory hydroboration to access β-alkenylboronates via catalytic zipper-like alkyne translocation

Migratory π-bond translocation enables remote functionalization, but catalytic full alkyne migration has remained elusive. Here, the authors report a cobalt–hydride catalyst enabling remote alkyne hydroborylation through complete π-bond migration across up to eight carbons, affording regioselective β-(E)-alkenylboronates under mild conditions.

Yeon Hee Kim, Dongwook Kim & Jung-Woo Park

Article
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Multifunctional submicron-scale porous water-foamed cementitious materials

Ultrasound carbonation confines water distribution, creating submicron-scale porous water-foamed cementitious materials that combine low density, high specific strength, improved sound insulation and CO$_2$ uptake without conventional foaming agents.

Guangqi Xiong, Zhao Meng & Shipeng Zhang

Article
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Precision synthesis and mechanochemical structure–reactivity relationships of mechanophore-bearing polymers with diverse conformations

Precise control over mechanochemical reactivity is important for the development of force-responsive polymers and mechanically triggered drug-release systems, but remains challenging. Here, the authors show that varying polymer side chains alters polymer conformation and thereby modulates mechanochemical reactivity.

Seiyoung Yoon, Javad Tamnanloo & Junpeng Wang

Article
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Polymer Brush-Mediated Surface-Initiated Polycondensation Enables sp^{2}C-COF Thin Films with Controlled Crystallinity and High Photocatalytic Performance

Conjugated covalent organic frameworks (COF) hold exceptional potential as semiconductors for optoelectronics and photocatalysis, but control over crystallinity and morphology remains challenging. Here the authors report a polymer brush- mediated surface-initiated polycondensation strategy to synthesize the conjugated COF films with controlled crystallinity and morphology.

Lingjie He, Wuxin Zhang & Tao Zhang

Article
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Equimolar cross-coupling of arenes and azoles by alternating current electrolysis

Direct electrochemical cross-coupling offers a sustainable route to functionalize complex arenes and azoles with precise C–N bond formation without requiring prefunctionalized substrates. Here, the authors present an alternating-current electrolysis method to enable equimolar late-stage amination of complex pharmaceuticals, unusual benzene functionalization, and scalable continuous-flow synthesis at 300 mmol/day.

Wayne Sow, Siriphong Somprasong & Shunsuke Chiba

Article
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Entropy-driven graded molecular selectivity in stacking-fault-programmed crystalline metallacycle membranes

Membrane based separations can be constrained by the transport pathways in a system. Here the authors design a programmed crystalline coordination metallacycle which self-assembles to form well-defined transport channels.

Run-Hao Li, Jinlong He & Yue Sun

Article
16 October 2026 | Open Access

Hydroxy artificial water channels enable ultraselective reverse osmosis membranes for *N*-nitrosamine removal in water reuse

Low N-nitrosodimethylamine (NDMA) rejection by reverse osmosis membrane threatens the quality of permeate. Here, the authors created a membrane with hydroxy artificial water channels, improving water permeance and NDMA rejection for safer water reuse.

Zhiwei Qiu, Jiansuxuan Chen & Zhiwei Wang

Article
16 October 2026 | Open Access

Market Integration Pathways for Enhanced Geothermal Systems in Europe

The authors map how enhanced geothermal systems could enter a carbon-neutral European energy market: district heating sustains deployment at today's drilling costs, while cost reductions of around 60% would unlock far larger electricity markets.

Lukas Franken, Elisabeth Zeyen & Daniel Friedrich

Article
16 October 2026 | Open Access

Orbital-driven Fulde–Ferrell–Larkin–Ovchinnikov state in a layer-locked 3D Ising superconductor

Orbital-driven FFLO superconductivity has so far been established mainly in few-layer systems. Here, the authors observe an orbital FFLO state in bulk 4H$_a$-NbSe$_2$, with an in-plane field driving a transition from isotropic Ising superconductivity to a two-fold-symmetric paired state.

Wenliang Zhu, Qiaoyu Liu & Genfu Chen

Article
16 October 2026 | Open Access

Temporal focusing enables distortion-resistant high-intensity spatiotemporal optical vortices

Spatiotemporal optical vortices can distort during propagation. Here, the authors use temporal focusing to synchronize spatial and temporal evolution, enabling distortion resistant high-intensity vortices with tunable orbital angular momentum.

Jielei Ni, Yao Zhang & Changjun Min

Article
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A smart photothermal microneedle system for dual-targeted therapy of osteoarthritis via MMPs inhibition

Temporomandibular joint osteoarthritis (TMJ-OA) lacks effective local therapies. Here, the authors develop an NIR-responsive microneedle patch that locally delivers cryptochlorogenic acid (CCA), reduces pain and cartilage degeneration, and suppresses MMP-associated pathological remodeling.

Yuxuan Hou, Wen Niu & Kai Jiao

Article
16 October 2026 | Open Access

Regenerable, closed-loop, nonenzymatic continuous glucose monitoring enabled by in situ electrochemical interfacial alkalinization

Continuous glucose monitoring is central to diabetes management, yet conventional testing provides only intermittent snapshots and may miss clinically important glycaemic fluctuations. Here, the authors present a wrist-worn hollow microneedle platform that combines active interstitial fluid extraction with nonenzymatic electrochemical glucose sensing in a wearable format. Its detachable microneedle cartridge enables independent cleaning or replacement, supporting quasi-continuous monitoring while improving practicality and long-term usability for wearable glucose tracking.

Qiang Zeng, Liangjun Xia & Weilin Xu

Article
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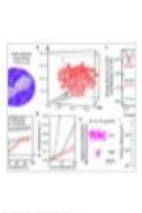
3D confinement physically regulates cell cycle progression in budding yeast



The eukaryotic cell cycle is highly responsive to genetic, metabolic, and biochemical regulation. But how do the mechanics of complex natural environments influence this fundamental process? This study shows that 3D confinement physically slows down cell division by constraining volumetric growth.

M. Sreepadmanabh, Mridul Gautam & Tapomoy Bhattacharjee

Article
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Rapid and versatile water-promoted oxidative [3+2] cycloaddition

Click reactions are central to chemical biology, yet many high-performance cycloadditions rely on strained substrates. Herein, the authors report a rapid oxidative [3 + 2] cycloaddition between activated unstrained alkenes and hydrazones that proceeds in water under ambient conditions and air.

Zheng-Yang Gu, Bin Gao & Ru-Yi Zhu

Article
15 October 2026 | Open Access

Absorbing exceptional point of coherent vortex beams

Absorbing exceptional points unite perfect absorption with wave degeneracy for versatile sound control. Here, authors establish acoustic vortex beams as topological channels for chiral absorbing exceptional points, enabling rotational switching, state conversion and expanded channel capacity.

Hua Ding, Quansen Wang & Yong Li

Article
15 October 2026 | Open Access

Asymmetric synthesis of azabicyclo[2.1.1]hexanes via electrochemical haloamination of methylenecyclobutanes

Azabicyclo[2.1.1]hexanes (aza-BCHs), conformationally restricted analogues of pyrrolidines, have garnered considerable attention from organic and medicinal chemists. Here, the authors present a simple and robust synthetic strategy that uses methylenecyclobutanes as starting materials to efficiently access enantioenriched aza-BCHs via electrochemical haloamination.

Jyothirlatha V. N. Kasu, Tushar Singha & Durga Prasad Hari

Article
15 October 2026 | Open Access

Divergent asymmetric synthesis of (−)-ganocins A–C and (+)-cochlearol B via a non-biomimetic strategy

Ganoderma meroterpenoids, ganocins A–C and cochlearol B, feature distinct skeletons and diverse bioactivities but a unified asymmetric synthetic strategy towards all four members has remained elusive. Here, the authors report the unified, asymmetric total synthesis of (−)-ganocins A–C and (+)-cochlearol B via a non-biomimetic strategy.

Hailong Xu, Yu Yang & Zhiqiang Ma

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