Science Newsletter

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Contents

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Introduction:

There are 3 main elements in the Science Newsletter which is composed. In the first part, we list the most up to date papers about central issues for each discipline in our university, and they are provided with 5 subjects for a time. In the second part, there are papers from the top journals last month, and most of them are from Nature and Science. In the third part, we post information about calling papers for international conferences. Hopefully, some of the information in this manuscript may be useful for those who are dedicating to scientific career. Besides, the journals are also posted on the website of our library, and they are available to be accessed any time at https://lib.jsut.edu.cn/2026/0409/c5474a210612/page.htm. If there are any questions or suggestions, please send e-mails to ccy@jsut.edu.cn in no hesitate.

Ⅰ Topics

The keywords of this month is **Chemistry**:
We post several papers which are related to the top concerned topics in researches on Chemistry. The papers are classified in 5 categories, and they are: **Catalysis, Electrochemistry, Supramolecular Chemistry, Chemical Biology** and **Analytical Chemistry**. Also, the listed papers are all arranged in a descending sort of JCR impact factor. If you want full pages of these papers, please contact us for help.

CATALYSIS

Adv Sci (Weinh) (impact factor: 15.8) 1 区

Curvature-Controlled Field Effect Enables Thermal Localization for Low-Temperature C—F Bond Activation.

Hang Zhang, Jialin Zheng, et. al

Abstract:
Geometric singularities are known to concentrate electric and optical fields, but whether curvature alone can localize thermal energy and thereby influence chemical kinetics remains unresolved. Here, we show experimentally and computationally that nanoscale curvature generates localized thermal fields that directly lower reaction barriers in heterogeneous catalysis. Using γ-Al2O3 architectures with systematically varied

curvature, nanoneedles, micro-needles, and spheres, while maintaining comparable composition, phase, acidity, and defect states, we observe curvature-dependent temperature localization of up to ~30 °C at nanoneedle tips under identical external heating. In situ infrared thermography confirms hotspot formation, and operando vibrational spectroscopy reveals enhanced water dissociation and increased *CF3 intermediate populations during CF4 decomposition. These effects reduce the apparent activation energy and enable complete CF4 decomposition at 580 °C, substantially below that required for lower-curvature structures. The results establish curvature-induced thermal localization as a general physical mechanism linking geometry to interfacial energy density and reaction kinetics, providing a universal design principle for activating strongly bound molecules.

Small (impact factor: 11.8) 2 ☒ TOP

Engineering Asymmetric Cu0/Cu+ Interfaces for Record-Efficiency Ammonia Electrosynthesis From Dilute Nitrate in Neutral Media.

Beibei Xu, Jingyu Lu, et. al

Abstract:

The electrocatalytic conversion of nitrate to ammonia in neutral media offers profound potential for sustainable nitrogen management, albeit it has been critically impeded by persistent hurdles such as the sluggish kinetics and competitive adsorption of H2O molecules. Herein, we report the reconstruction of copper foam to engineer asymmetric Cu0/Cu+ interfaces for electrocatalytic nitrate to ammonia conversion in neutral conditions with ultralow nitrate concentration. Employing microstructural characterizations complemented by kinetic isotope effect (KIE) analyses, we uncover that the Cu2O/Cu foam electrocatalyst fosters the formation of asymmetric rectifying interfaces, thereby facilitating nitrate adsorption and accelerating the hydrogenation of H-ON in neutral environments. Notably, under conditions of ultralow nitrate concentration (14 ppm NO3 --N), the Cu2O/Cu foam electrocatalyst demonstrates a remarkable 100% conversion of NO3 - to NH3 within 15 min, with a NO3 - removal ratio of 99.9% and an NH3 production rate of 0.39 mmol/h/cm2, effectively diminishing nitrate levels to adhere to the WHO safety limit.

Int J Biol Macromol (impact factor: 8.7) 2 ☒

Structure-reactivity relationships in the mild reductive depolymerization of technical hydrolysis lignins.

Matteo Deroma, Jeroen Lauwaert, et. al

Abstract:

This study investigates how the structure of hydrolysis lignins (HLs) impacts both their solubility and behavior in mild reductive catalytic depolymerization (RCD). Thorough characterization of 8 different HLs shows that solubility and depolymerization outcomes depend on intrinsic lignin properties as well as carbohydrate content. A 70/30 vol% ethanol/water mixture is generally the most effective solvent mixture, although the absolute solubility varies substantially among the HLs, with a high carbohydrate content and molecular weight typically lowering the solubility. The β-O-4 bond content is identified as the primary factor dictating both the monomer yield and number of para-substituted side chains formed during RCD, with a linear relationship between β-O-4 bond cleavage and monomer/side chain formation. However, the syringyl/guaiacyl ratio further steers monomer yields, with syringyl-rich lignins generating more monomers per cleaved β-O-4 bond. Despite structural diversity, para-substituted side chain selectivity in the monomer fraction remains consistent for all HLs, with approximately 85% propanol-substituted monomers. Similar trends were observed for other technical lignins, underscoring the broad applicability of the RCD protocol, although minor variations in side-chain selectivity were noted. Carbohydrate content also affects the evolution of aliphatic and carboxylic acid hydroxyl groups during RCD, with higher carbohydrate contents leading to sharp initial decreases in the former and increases in the latter. In all HLs formyl native end groups are reduced to methyl groups, and ethyl ester formation via esterification of carboxylic acid groups is confirmed. Lastly, high-molecular-weight HLs (> 9000 g/mol in this study) may experience initial diffusion limitations, delaying efficient depolymerization.

ELECTROCHEMISTRY

JACS Au (impact factor: 8.5) 1 ☒

Tuning Solid Electrolyte Interphase Formation before Plating Onset in Anode-Free Sodium Batteries.

Aaron Melemed, Sungil Hong, et. al

Abstract:
Sodium (Na) batteries are of growing interest due to the higher earth abundance of sodium than lithium, as well as their promising theoretical energy density when metallic Na anodes are used. However, Na plating and stripping are heavily influenced by the physicochemical properties of the solid electrolyte interphase (SEI), which is directly influenced by the solvent and salt used for the electrolyte. While most studies focus on the SEI that forms on the surface of Na metal after plating, we expand this analysis by identifying a nanoscale "pre-plating" SEI that forms on the current collector (CC) prior to the onset of Na plating. Here, we systematically

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investigate an array of Na salt and glyme solvents in the electrolyte and determine the associated impacts on pre-plating SEI formation on aluminum CCs. By combining analytical electrochemistry approaches with a multimodal suite of spectroscopy techniques (X-ray, infrared, and Raman), supported by density functional theory calculations, we reveal a direct correlation between the Na+ coordination environment and pre-plating SEI composition. We find that longer-chain glymes produce larger proportions of organic alkoxide products in the interphase, consistent with increased Na+-glyme interactions, while the fraction of salt-derived inorganic products (e.g., NaF) correlates with Na+-anion coordination. These insights highlight the critical influence of electrolyte composition particularly solvent identity and Na+ coordination on the initial SEI formation in anode-free Na batteries.

ACS Appl Mater Interfaces (impact factor: 7.8) 2 区 TOP

Tough Adhesive and Anti-Freezing Hydrogel Polymer Electrolyte with Ultra-Durable Electrochemistry for Extreme Deformations and Subzero Temperatures.

Lanlan Feng, Mingxin Guo, et al

Abstract:

Hydrogel polymer electrolytes (HGEs) are attracting significant attention due to their potential in the development of flexible and safe supercapacitors (SCs). However, the development of flexible supercapacitors based on HGE still faces numerous challenges, including issues such as interfacial delamination between the HGE/electrode under extreme deformations, and drastic performance deterioration at low temperatures. Herein, a tough adhesive polyacrylamide/H3PO4 (PAM/H3PO4) HGE was facilely prepared, exhibiting excellent flexibility, adhesion, ionic conductivity, and freeze resistance, which ensured close contact between the HGE and the polyaniline (PANI)-modified carbon cloth (C/PANI) electrode, thereby achieving a sandwich-type flexible supercapacitor with extremely low interface connection resistance and ultradurable electrochemistry under extreme deformations and subzero temperatures. Specifically, the interfacial adhesion energy between the HGE/electrode could reach up to 364 J/m2 at 25 °C and maintain 269 J/m2 even after exposure to -40 °C. The SC exhibited the capacitance retention rates of 98.42% and 96.78% after bending and twisting at 180° for 100,000 cycles, respectively. More impressively, the SC retains the capacitance value of 94.88% after 5000 cycles of 180° bending at -40 °C. This study proposed a simple and potentially commercialized HGE without any complex synthesis for constructing a highly flexible SC with excellent electrochemical stability under extreme mechanical and environmental conditions, while emphasizing the critical role of the HGE/electrode interface in enhancing the SC's durability.

Chem Biomed Imaging (impact factor: 6.7)

Integrating Electrochemistry and Optical Imaging to Probe Phospholipid Architectures: Emerging Paradigms in Fluorescence and Electrochemiluminescence Studies.

Fatma Ben Trad, Eric Labbé, et. al

Abstract:

The interplay between electrochemistry and optical microscopy is redefining how complex interfacial processes are visualized and quantified at the nanoscale. Here, we review and contextualize emerging strategies that integrate electrochemical control with fluorescence and electrochemiluminescence (ECL) imaging to probe phospholipid architectures, from supported lipid bilayers (SLBs) to liposomes or giant unilamellar vesicles (GUVs). In fluorescence-based approaches, the combination of electrochemical potential modulation with high-resolution microscopy enables a direct correlation between redox activity and molecular organization within membranes. Recent developments in total internal reflection fluorescence microscopy combined with electrochemical fluorescence microscopy (TIRF-ECFM) and redox-sensitive probes have revealed electrochemically induced lipid reorganization and redox processes within supported bilayers with unprecedented sensitivity. Complementarily, ECL microscopy extends this paradigm by exploiting light emission triggered by electron transfer at electrode interfaces, providing label-free and background-free imaging of lipid film integrity, membrane rupture, and peptide-induced permeabilization. Studies on ECL-active liposomes and SLBs demonstrate that variations in emission onset and intensity directly report on the local membrane composition, permeability, and electrostatics. Moreover, encapsulation of enzymatic + redox-active species within GUVs enables real-time, noninvasive ECL monitoring of confined biochemical reactions. Collectively, these emerging electro-optical methodologies establish a versatile toolbox for dissecting membrane dynamics and biochemical reactivity with molecular precision. Their convergence heralds an original analytical frontier at the interface of electrochemistry, optical imaging, and membrane biophysics, paving the way for next-generation biosensing, drug screening, and single-vesicle electroanalysis.© 2026 The Authors. Co-published by Nanjing University and American Chemical Society.

SUPRAMOLECULAR CHEMISTRY

J Control Release (impact factor: 12.4) 1 区 TOP

Engineering the fourth dimension of cell-instructive hydrogels through dynamic bonding.

Abstract:
Dynamic remodeling is a defining feature of native tissues, yet many synthetic biomaterials remain static and exhibit purely elastic mechanics. The extracellular matrix (ECM) continuously evolves through viscoelastic mechanical responses and temporally regulated remodeling processes, and cells are highly sensitive to these time-dependent mechanical cues. Traditional covalently crosslinked hydrogels can recapitulate stiffness and biochemical signals, but often fail to capture the fourth dimension of matrix mechanics-time-operationally defined here as the intrinsic stress relaxation timescale governed by reversible bond-exchange kinetics, and distinct from cell-driven enzymatic remodeling. Recent advances in non-covalent, supramolecular, and dynamic-covalent chemistries have enabled synthetic hydrogels with programmable stress relaxation, yielding, and self-healing across biologically relevant timescales. This review surveys a chemical toolbox spanning ionic and dynamic-covalent networks, host-guest and peptide-based supramolecular matrices, engineered protein association motifs, and DNA-crosslinked hydrogels. These platforms have enabled mechanobiology studies that decouple stiffness from relaxation in understanding cell spreading, proliferation, migration, and differentiation in ways inaccessible using traditional static hydrogels. Rheological and biophysical methods for quantifying frequency-dependent viscoelasticity, stress relaxation, and recovery are also discussed. By integrating molecular-level design with cell-instructive mechanics, dynamic hydrogels provide a versatile synthetic ECM platform for advanced 3D culture, regenerative medicine, and disease modeling.

Small (impact factor: 11.8) 2 区 TOP

Zwitterionic Dynamic Supramolecular Elastomer Electrolytes for High-Voltage and Dendrite-Free Lithium Metal Batteries.

Jieyan Li, Weiliang Dong, et. al

Abstract:
To simultaneously address the challenges of lithium (Li) dendrite growth, low ionic conductivity, and limited oxidative stability in lithium metal batteries (LMBs), flexible zwitterionic dynamic supramolecular elastomer electrolytes (DSEEs) with (bis(2-hydroxyethyl)-methyl-(3-sulfopropyl) azanium) and (2-ureido-4-pyrimidinone) as chain extenders are proposed. First, DSEEs promote the formation of an inorganic-rich solid electrolyte interface. Second, the polar groups within zwitterions regulate Li+ transport and the electric field at the Li surface, thereby homogenizing Li+ deposition. Third, the flexible DSEEs enable strong adhesion to the Li anode through electrostatic attraction, eliminating Li nucleation sites, and self-adapt to volume changes of the Li anode. Fourth, zwitterions enhance Li+ dissociation to achieve high ionic conductivity,

while their dipole moments and dense hydrogen-bonding network provide substantial oxidation resistance. Notably, the DSEE with balanced zwitterion and hydrogen-bonding density exhibits robust adhesion with a high shear strength (21.0 N cm- 2), a high ionic conductivity (9.55 × 10- 4 S cm- 1), and a wide electrochemical stability window (5.3 V). Importantly, the optimized DSEE enables reversible and stable Li plating/stripping without observable dendrites, as confirmed by morphological and simulation studies, and shows excellent compatibility with various cathodes. Overall, this study opens a new avenue for developing safe, dendrite-free LMBs with high energy density.© 2026 Wiley‐VCH GmbH.

Small (impact factor: 11.8) 2 区 TOP

From Mononuclear to Trinuclear: Tailoring Coordination Metal Cluster Node for High-Energy Li-S Batteries.

Kaiji Lin, Zhao Chen, et. al

Abstract:

As a new-generation high-energy-density energy storage system, the commercialization of lithium-sulfur (Li-S) batteries remains hindered by the polysulfide shuttle effect and sluggish redox kinetics. This study investigated the catalytic performance of mononuclear cobalt (MCo) and trinuclear cobalt (TCo) catalysts in Li-S batteries. By precisely regulating the nuclear number and spatial configuration of metal nodes, we revealed the enhancing effect of the multinuclear cooperative catalytic mechanism on the kinetics of sulfur redox. TCo provides multiple catalytic sites and forms a continuous electron-conducting network through intermetallic electron coupling, significantly accelerating the sulfur redox kinetics. Molecular orbital theory and density functional theory calculations indicate that the high-spin Co3+ in TCo exhibits enhanced adsorption capacity toward polysulfides, effectively mitigating the shuttle effect. Benefiting from this synergistic effect, the battery with TCo separator achieves a specific capacity of 1296.7 mAh g-1 at 0.1 C and exhibits a degradation rate of only 0.088% per cycle after 500 cycles at 1 C. This study provides a new horizon for developing next-generation Li-S battery catalysts.© 2026 Wiley‐VCH GmbH.

CHEMICAL BIOLOGY

Nat Commun (impact factor: 18.1) 1 区

The chemistry of habitable oceans in the Solar system

Jihua Hao, Yuke Zhu, Andrew H. Knoll, et. al

Abstract

Liquid water exists on the Earth and several other planetary bodies in our solar system. The chemical character of these aqueous reservoirs is central to evaluating their habitability. Here, we synthesize the chemical features of water reservoirs and their biological implications on the modern Earth. We then outline constraints on the evolutionary history of Earth's ocean chemistry and discuss its interplay with the biosphere. Furthermore, we examine the inferred chemical environments of water bodies on early Mars, dwarf planet Ceres, Jupiter's moon Europa and Saturn's moons Enceladus and Titan. We conclude by outlining priority questions for future planetary habitability studies.

Trends Biotechnol (impact factor: 16.6) 1 ☒ TOP

Engineering a capture-bioremediate-release microbial biofilm for simultaneous bioremediation of microplastics and adsorbed heavy metals.

Wei Wei, Song Chua, et. al

Abstract

Microplastics (MPs) pose escalating environmental and human health risks, particularly when they adsorb heavy metals and form complex, co-contaminated pollutants. Furthermore, when MPs are removed and sent to landfills or incineration, the adsorbed heavy metals often persist and re-enter the environment. However, most existing remediation strategies remove only single pollutants, which fail to address complex pollution. In this research article, we engineered an environmental Pseudomonas aeruginosa strain with three programmable functions: (i) enhanced biofilm formation for efficient aggregation and capture of MPs, (ii) increased pyoverdine production for bioremediation of heavy metals (lead and cadmium) adsorbed on MPs, and (iii) subsequent arabinose-inducible biofilm dispersal to release decontaminated MPs for convenient recovery. Our proof of concept was validated in a pilot trial with polluted Hong Kong seawater, demonstrating efficient dual-pollutant removal in environmentally relevant conditions. Hence, our work highlights the promise of biotechnology in advancing multi-pollutant environmental remediation.

Environ Res (impact factor: 8.2) 2 ☒

Microplastics as Emerging Viral Vectors: Nexus, Mechanisms, Ecological Implications and Health Risks.

Nicoletta Capuano, Alessia Giannattasio, et. al

Abstract

Microplastics (MPs) have emerged as pervasive environmental pollutants with complex implications for ecological and human health. Beyond their chemical toxicity and persistence, MPs act as dynamic microhabitats supporting microbial colonization and viral adsorption. This review provides a comprehensive overview of the physicochemical characteristics, environmental distribution, and degradation pathways of the most common polymeric MPs, including polystyrene, polyethylene, polypropylene, polyvinyl chloride, polyurethane, polyethylene terephthalate, polydimethylsiloxane, and biobased polyesters. Particular attention is given to the virus-microplastic interface, highlighting how MPs serve as vectors that enhance viral persistence, transport, and infectivity. Experimental and metagenomic evidence demonstrates that both enveloped and non-enveloped viruses can adhere to MPs via electrostatic and hydrophobic interactions, often mediated by biofilm and eco-corona formation. These interactions extend viral stability across environmental compartments and can modulate host immune responses, exacerbating infection outcomes. By integrating physicochemical, microbiological, and toxicological perspectives, this review emphasizes that MPs are not inert residues but active ecological interfaces that can reshape viral ecology and increase public-health risks. Future studies combining molecular, environmental, and epidemiological approaches are essential to quantify the real impact of MP-virus interactions on ecosystem balance and infectious-disease dynamics.

ANALYTICAL CHEMISTRY

Nat Chem (impact factor: 24.5) 1 区 TOP

Trefoil polymers from a knotted synthon

Chenchen Du, Zhi Chen, et. al

Abstract

Precise control over the presence and position of knots in polymers remains a long-standing synthetic challenge, with theory indicating broad implications for properties and function. Here we report on a topological synthon approach—extension and macrocyclization of an overhand knot—that enables the high yielding synthesis of closed-loop trefoiled polymers with narrow polydispersity and tunable topological parameters. From the same set of building blocks we prepared linear, cyclic and trefoiled topoisomers of matched chemical composition, allowing topology–property relationships to be examined directly. Low-temperature ultrahigh-vacuum scanning tunnelling microscopy resolved three conformers of trefoiled polystyrene, with high-, medium- and low-symmetry forms whose populations depend on chain length, local flexibility and solvation. Coarse-grained Langevin dynamics reproduce these

distributions and indicate that bending energy and conformational entropy govern conformer stability. Metal binding localizes the knotted region, reminiscent of protein/DNA knot translocation. The synthon also affords trefoiled poly(ethylene glycol) and trefoiled polystyrene–poly(ethylene glycol) diblock copolymers, demonstrating the generality of the approach across polymer backbones.

Nat Commun (impact factor: 18.1) 1 区

Gas-phase unfolding assay rapidly predicts structure-function relationships in engineered antibodies with tuned flexibilities

Rosendo C. Villafuerte-Vega, Michael R. Armbruster, et. al

Abstract:
Human (h)IgG2 monoclonal antibodies (mAbs) are potent agonists due, in part, to their ability to undergo disulfide shuffling within their hinge regions. Herein, we describe a rapid, sensitive, collision-induced unfolding (CIU) assay that possesses a predictive relationship between gas-phase protein unfolding and agonism in hIgG2 variants. Furthermore, our results highlight the significance of hinge engineering in tuning mAb structure-function relationships for the development of future biotherapeutics.

Bioresour Technol (impact factor: 8.2) 1 区 TOP

Interpretable machine learning for optimization of ultrasound-assisted polysaccharide extraction using natural deep eutectic solvents: From yield enhancement to structural and antioxidant activity validation.

Shulu Zhang, Jingting Han, et. al

Abstract:
Traditional methods for polysaccharide extraction are inefficient and environmentally harmful. To develop an environmentally friendly extraction process, we combined natural deep eutectic solvents (NADES) with ultrasonic-assisted extraction and introduced machine learning models to optimize the extraction parameters and achieve a prediction accuracy of 95.24%. The optimal extraction parameters were determined as follows: NADES water content 54.65%, NADES to Astragalus membranaceus leaf ratio (NAR) 29.75 mL/g, extraction time 30 min, ultrasound power 240 W, with an Astragalus membranaceus leaf polysaccharide (AMP) yield of 175.40 mg/g. NADES was characterized by FT-IR and NMR, verifying the successful synthesis of NADES. After extraction, the structure of AMP was characterized by UV, FT-IR, molecular weight, particle size, zeta potential and SEM. Then, through the monosaccharide composition analysis, the AMP contains six types of monosaccharides. Through DFT simulation calculations, the binding stability of each monosaccharide component in AMP with H2O / NADES was compared. These results confirmed that NADES has a

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strong binding affinity and interaction stability with all monosaccharides, theoretically verifying the excellent extraction performance of NADES. Thermal and rheological analysis further supported its potential applications. In antioxidant assays, the scavenging rates of inhibitory DPPH and hydroxyl radicals exceeded 50%, demonstrating that NADES effectively preserves biological activity. This intelligent optimization model offers an efficient, green strategy for natural product extraction, reducing prediction errors to within 5% and establishing a comprehensive framework for green extraction process optimization, with great practical value for the green chemical industry.

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Ⅱ Concentration

PHYSICS

Optical cooling by interfacial charge transfer in 2D heterostructures

Lin, Jiamin, Xiang, et al.

Abstract

Optical refrigeration, or laser cooling of solids[1], offers a cryogen-free route to temperature control for quantum and electronic systems. Existing progress[2,3,4,5,6,7,8] relies on a phonon-assisted up-conversion photoluminescence approach, which remains constrained by stringent material and excitation requirements. Here we demonstrate a distinct route, interfacial-charge-transfer-driven optical cooling, in two-dimensional semiconductor heterostructures. Photo-excited carriers in WSe_2 cross a type-II junction into $MoSe_2$ or WS_2, extracting lattice energy nonradiatively—through a phonon-assisted interfacial charge transfer process. Raman and photoluminescence measurements show prominent low-temperature signatures in the WSe_2 layer, with transient absorption spectroscopy identifying a phonon-assisted, barrier-activated interlayer charge transfer. Molecular dynamics simulations show a prominent interfacial thermal resistance sustaining the temperature gradient. This barrier-mediated phonon extraction bypasses the need for near-unity quantum efficiency or resonant excitation, offering a promising strategy for cryogen-free refrigeration and thermal management in quantum, optoelectronic and nanoscale systems.

GW250114 reveals signatures of post-merger black-hole horizon

Lu, Neil, Ma, et al.

Abstract

The horizon of a black hole, the ‘surface of no return’, is characterized by its rotation frequency Ω_H and surface gravity κ. A striking signature is that any infalling object appears to orbit at Ω_H owing to frame dragging, while its emitted signals decay exponentially at a rate set by κ as a consequence of gravitational redshift. Recent theoretical work[1] predicts that gravitational waves from binary black-hole mergers carry direct imprints of the properties of the merger remnant in the form of a ‘direct wave’. This gravitational-wave component oscillates near $2\Omega_H$, reflecting the horizon’s frame dragging, and decays at an increasing rate characterized by κ, with additional screening from the black hole’s spacetime. Here we report observational evidence of a

direct wave in GW250114[2], with a 90% credible matched-filter signal-to-noise ratio of \({15.8}_{-0.5}^{+0.1}\) (\({17.1}_{-0.4}^{+0.1}\)) in the LIGO Hanford (Livingston) detector. The measured properties are in full agreement with theoretical predictions for a Kerr black hole. These findings establish an observational channel to directly measure frame-dragging effects in black-hole ergospheres and explore (near-)horizon physics in dynamical, strong-gravity regimes.

Measurement of reactor neutrino oscillation with the first JUNO data

The JUNO Collaboration

Abstract

Neutrino oscillations (see refs. [1,2] and references therein), a quantum effect manifesting at macroscopic scales, are governed by lepton flavour mixing angles and neutrino mass-squared differences[3] that are fundamental parameters of particle physics, representing phenomena beyond the Standard Model. Precision measurements of these parameters are essential for testing the completeness of the three-flavour framework, determining the mass ordering of neutrinos and probing possible new physics. The Jiangmen Underground Neutrino Observatory (JUNO)[4] is a 20-ktonne liquid-scintillator detector located 52.5 km from multiple reactor cores, designed to resolve the interference pattern of reactor neutrinos with sub-percent precision[5,6]. Here we report, using the first 59.1 days of data collected since detector completion in August 2025, the first simultaneous high-precision determination of two neutrino oscillation parameters, \({\sin }^{2}{\theta }_{12}=0.3092\,\pm \,0.0087\) and \(\Delta {m}_{21}^{2}=(7.50\,\pm \,0.12)\times 1{0}^{-5}\,{\mathrm{eV}}^{2}\) for the normal mass ordering scenario, improving the precision by a factor of 1.6 relative to the combination of all previous measurements. These results advance the basic understanding of neutrinos, validate the design of the detector and indicate the readiness of JUNO for resolving the neutrino mass ordering with a larger dataset. The rapid achievement with a short exposure highlights the potential of JUNO to push the frontiers of precision neutrino physics and paves the way for its broad scientific programme.

MATERIALS

Scalable fabrication of COF membranes for aliphatic/aromatic separation of crude oil

Abstract

Distillation has been the cornerstone of crude oil refining for more than a century, relying on boiling point differences for fractionation. Although effective, it is highly energy-intensive and lacks the precision to separate specific hydrocarbon classes. We report crystalline covalent organic framework (COF) membranes with well-defined micropores and alkyl-functionalized frameworks that combine molecular sieving with preferential affinity to enrich aliphatics. An electric field–assisted roll-to-roll process enabled scalable fabrication of continuous membranes. These COF membranes enriched aliphatics to >95% and delivered permeance orders of magnitude higher than amorphous polymers in Arabian Light crude oil. A crude oil permeance of 0.34 liters m^{-2} $hours^{-1}$ bar^{-1} with >90% aliphatics enrichment was achieved using industrial-standard 1812 membrane modules, demonstrating a lower energy demand than distillation.

Ductile alloys offering 100 MPa tensile strength at 2,400 °C

Abstract

Extreme applications call for materials that are not only strong to withstand thermomechanical loads at temperatures in excess of 2,000 °C (refs. [1,2,3]), but also highly formable at room temperature to allow for processing into complex-shaped parts. The latter excludes brittle ceramics[4] and intermetallic compounds[5], limiting the selection to highly ductile metals and their alloys, but for them, an adequate strength at ultrahigh temperatures seems unreachable. Here we show a breakthrough in casting alloys that achieve both simultaneously. A boron-stabilized HfO_2-strengthened Ta-based alloy was carefully crafted using a new boron-intervened in situ oxidation reaction, producing about 50-nm diameter oxide particles dispersed densely and uniformly in the grain interior. The new alloy fills the blank at ultrahigh temperatures in terms of tensile yield strength, around 200 MPa at 2,000 °C and 100 MPa at 2,400 °C, while simultaneously possessing an excellent strength–ductility balance at room temperature (ultimate tensile strength >800 MPa, elongation-to-failure of about 35%), a property combination surpassing all previous refractory (including multi-principal-element) alloys. Moreover, the boron segregation around the oxide nanoparticles imparts excellent thermal stability against coarsening at 2,000–2,400 °C. Our strategy thus goes beyond traditional oxide-dispersion strengthening to enable highly ductile refractory alloys that are capable of load-bearing applications at extreme temperatures.

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Bottom-Up Synthesis of Molecular Nanodiamond from Nanographene

Liang, Jiaxu, Ender, et al.

Abstract

Nanodiamonds hosting colour centres are promising building blocks for quantum technologies, enabling advances in quantum computation1,2, nanoscale NMR spectroscopy3–6, single-spin magnetometry7,8, wide-field quantum imaging9 and single-photon sources10,11. However, the controlled bottom-up synthesis of ultrasmall and structurally uniform nanodiamonds has remained a major challenge, with existing methods producing heterogeneous materials that vary in size, morphology, impurity content and defect quality. Here we show that well-defined, hydrogen-terminated molecular nanographenes serve as chemically confined precursors for high-pressure, high-temperature synthesis of ultrasmall (3–4 nm), monodisperse and highly crystalline molecular nanodiamonds (m-NDs) with only a single sp^2 surface reconstruction and produced on a milligram scale. The same bottom-up platform also enables a two-component strategy for incorporating silicon- and germanium-based colour centres during synthesis, yielding SiV^- and GeV^- emitters without ion implantation, irradiation or post-treatment. Because the nanographene precursor defines both the confined carbon framework and the hydrogen content, this approach provides intrinsic, precursor-level control over nanodiamond size and composition, particularly in the low-nanometre regime relevant for biological and quantum sensing. Molecular nanographenes, ultralarge polycyclic aromatic hydrocarbons, therefore establish a scalable and modular route to high-quality molecular and fluorescent nanodiamonds and offer a general design principle for tailored quantum materials and nanoscale devices.

CHEMISTRY

Stereoretentive radical-based alkyl-alkyl cross-coupling

Yu Wang, Jiawei Sun, et. al

Abstract

The construction of stereogenic $C(sp^3)$–$C(sp^3)$ bonds through cross-coupling remains a formidable challenge owing to competing β-hydride elimination and homocoupling as well as the poor inherent stereocontrol of radical pathways. In this work, we report a scalable stereoretentive radical-radical cross-coupling of two distinct, transient alkyl radicals, derived from enantioenriched sulfonylhydrazides and achiral primary and

secondary alkyl halides, achieved without chiral ligands, directing groups, or exogenous redox agents. This substrate-controlled approach leverages a nickel-catalyzed, redox-neutral manifold, which enables precise kinetic matching of diazene-mediated radical generation and halogen atom transfer. The reaction produced enantiospecificities of 80 to 96% and synthetically useful yields (up to 90%) across diverse piperidine and pyrrolidine scaffolds while tolerating ethers, free amines, aryl halides, heterocycles, olefins, and other sensitive motifs. Mechanistic studies support caged radical rebound at nickel to preserve chirality, followed by nickel(I)-nickel(III)–mediated radical capture and reductive elimination.

Valorization of lithium hardrock concentrates into battery raw materials and commodity products

Benjamin A. W. Mowbray, et. al

Abstract

The production of lithium chemicals needs to increase to meet rising demand for lithium batteries. Spodumene [$LiAl(SiO_3)_2$] is an abundant mineral source of lithium, but its extraction is not cost-competitive with brine resources. Current spodumene-refining methods are energy- and waste-intensive, requiring high-temperature roasting (>1000°C) and chemical leaching. We demonstrate a low-temperature, near-zero-waste process that converts α-spodumene into battery-grade lithium carbonate (Li_2CO_3), smelter-grade alumina (Al_2O_3), and cementitious silica (SiO_2). Aqueous ammonium fluoride (NH_4F) is used as the reagent to solubilize the mineral feedstock at <100°C in a closed-loop process that regenerates the reagent. Techno-economic analysis indicates that this approach may reduce the cost of producing lithium from α-spodumene by >40% and enable cost parity with brines.

Dependence of catalytic properties of strongly supported platinum clusters with atom counts

Chyan Kyung Song, Junhyeok Jung, et. al

Abstract

Metal cluster structures composed of tens of atoms represent a new class of catalysts with potentially superior catalytic activity and durability compared with those of other conventional catalysts. However, controlling the number of constituent atoms in clusters and achieving high-density loading on supports remain challenging. We reduce $PtCl_4^{2-}$ with methanol to create platinum atoms forming strongly anchored platinum clusters with controlled atom counts on selected surfaces of alumina. We resolved the atomic structures of the platinum clusters and could correlate the degree of cluster-support interaction, catalytic activity, and durability with atom counts. We demonstrate

the promise of this approach by developing platinum clusters that exhibit the highest catalytic performance per platinum usage reported to date for hydrogen production from the dehydrogenation of cyclic hydrocarbon hydrogen carriers.

BIOLOGY

Maternal trans-vaccenic acid shapes neonatal T cell development and early-life immune imprinting

：HAO FAN, ZHONG ZHENG, et al.

Abstract

How maternal nutrition influences neonatal immune development and imprinting through breastfeeding remains largely unclear. We report that maternal supplementation with trans-vaccenic acid (TVA), the predominant naturally occurring trans-fatty acid in human breast milk, promoted neonatal T cell development in mice. Neonates fed by mothers on a TVA-enriched diet showed an expanded naïve cluster of differentiation 4 ($CD4^+$) T cell population and enhanced adaptive immunity against infection. TVA reprogrammed neonatal naïve $CD4^+$ T cells through a G protein–coupled receptor–CCCTC-binding factor axis and promoted T helper cells (Th1)–skewing by cooperating with the transcription factor TBX21. Early-life exposure to maternal TVA via breastfeeding supported long-lasting antiviral immunity in adulthood. Our findings establish the multifaceted benefits of maternal nutrition and breastfeeding via TVA in promoting infant immune homeostasis and protective immunity.

Fast cell wall softening causes Venus flytrap closure

Jeongeun Ryu, Mathieu Colombani, et. al

Abstract

Plants can move rapidly without muscles, as seen in the Venus flytrap's snapping lobes—a long-standing puzzle in plant biomechanics. Trap closure involves an elastic instability, but the active mechanical driver has remained elusive. Using in situ hydraulic and mechanical measurements, we identified the motor driving this transition. Closure occurs too quickly to be explained by water transport, revealing a distinct, nonhydraulic mechanism: a rapid (about one second) softening of the epidermal cell wall, releasing elastic energy stored in the trap. This represents the fastest modulation of wall mechanics reported in plants. Our finding reveals a mode of plant motility based on dynamic tuning of material properties, suggesting principles for muscle-free,

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bioinspired actuation.

Spermine is an endogenous iron chelator that inhibits ferroptosis

Li, Man, Yu, Xuexin, et. al

Abstract

Ferroptosis is an iron-dependent form of cell death driven by lipid peroxidation[1]. Here we identify spermine—a polyamine derived from spermidine[2]—as an endogenous iron chelator that directly suppresses ferroptosis. Integrating metabolomics, stable isotope tracing and biophysical studies of the interaction between spermine and Fe^{2+} ions, we demonstrate that aldehyde dehydrogenase 18 family member A1 (ALDH18A1) promotes an alternative glutamine-dependent pathway for de novo spermine synthesis. This process limits iron availability and lipid peroxidation in hepatocellular carcinoma. Genetic or pharmacological inhibition of ALDH18A1—through knockout, short hairpin RNA delivered using adeno-associated virus (AAV), or the small molecule inhibitor YG1702—triggers ferroptosis and impairs both spontaneous and chemically induced hepatocarcinogenesis. Conversely, supplementation of spermine protects against ferroptosis-associated ischaemia–reperfusion injury across multiple tissues, including the liver, intestine and kidneys. These findings uncover a pathophysiologically relevant metabolic circuit in which spermine-mediated iron chelation suppresses ferroptosis.

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Ⅲ Calling for papers

CHENG 2026

Submission deadline: **Jul 4, 2026**
Conference date: **Jul 28, 2026 - Jul 29, 2026**
Full name: **3rd International Conference on Advances in Chemistry & Chemical Engineering**
Location: **Virtual Conference**

3rd International Conference on Advances in Chemistry & Chemical Engineering (CHENG 2026) serves as a premier global platform for researchers, scientists, engineers, and industry professionals to exchange knowledge, present cuttingedge research, and explore emerging innovations across the full spectrum of chemistry and chemical engineering. As these fields continue to evolve at an unprecedented pace, driven by breakthroughs in artificial intelligence, sustainable technologies, advanced materials, and nextgeneration manufacturing, CHENG 2026 aims to foster meaningful dialogue and collaboration that will shape the future of chemical sciences and engineering. The conference brings together a diverse community from academia, research institutions, and industry to engage in crossdisciplinary discussions, share transformative ideas, and build new partnerships

Call for papers:
The topics of interest for submission include, but are not limited to:
Analytical, Physical and Theoretical Chemistry
Physical Chemistry and Chemical Physics
Theoretical and Computational Chemistry
Organic, Inorganic and Biological Chemistry
Inorganic, Bioinorganic and Biological Chemistry
Catalysis, Reaction Engineering and Process Chemistry
Reaction Engineering
Environmental, Green and Sustainable Chemistry
Energy, Electrochemistry and Advanced Chemical Systems
Electrochemistry
Advanced Chemical Systems
Materials Chemistry, Polymers and Nanoscience
Polymers and Soft Matter
Nanoscience and Nanotechnology
Chemical Engineering, Process Systems and Biotechnology
Process Systems Engineering (PSE)
Biotechnology and BioSystems Engineering
Emerging and Interdisciplinary

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ICCME 2026

Submission deadline: **Jul 10, 2026**
Conference date: **Nov 25, 2026 - Nov 28, 2026**
Full name: **the 13th International Conference on Chemical and Material Engineering**
Location: **Osaka, Japan**

After the immensely successful ICCME2025 (Osaka, Japan), ICCME2024 (Nagoya, Japan), ICCME2023 (Fukuoka, Japan), ICCME2022 (Tokyo, Japan), ICCME2021 & 2020 (Virtual Conference), ICCME2019 (Nanyang Technological University), ICCME2018 (Beijing), ICCME2014-2017, we are expecting ICCME2026, the 13th anniversary of ICCME, to be more exciting, stimulating & educative.

Welcome to 2026 the 13th International Conference on Chemical and Material Engineering (ICCME 2026), will be held in Osaka, Japan during November 25-28, 2026 as the workshop of ICMSET 2026.

ICCME2026 provides an international forum for presentation of original research results, as well as exchange and dissemination of innovative, practical development experiences. ICCME draws researchers and application developers from a wide range of Chemical and Material Engineering. By promoting novel, high quality research findings, and innovative solutions to challenging Chemical and Material Engineering problems, the conference seeks to continuously advance the state-of-the-art in Chemical and Material Engineering.

Topics of Interest :

Material Science and Engineering
Materials for Energy Harvesting and Storage
Materials for Data Storage
Materials for Electronic and Optical Applications
Concrete
Masonry Materials
Structural Materials
Building Materials
Biomaterials
Nanomaterials
Polymers
Composites
Synthesis, Properties or Applications of Materials
Heat Treatment Processes
Testing, Evaluation and Characterization of Materials
Geochemistry and Health
Chemical Engineering Fundamentals
Chemical Engineering Educational Challenges and Development
Physical, Theoretical and Computational Chemistry
Chemical Reaction Engineering
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ICCCP 2027

Submission deadline: **Oct 10, 2026**
Conference date: **Mar 3, 2027 - Mar 5, 2027**
Full name: **16th International Conference on Chemistry and Chemical Process**
Location: **Sapporo, Japan**

Chemical engineering is a multidisciplinary branch of applied engineering consisting of the application of physical science (Chemistry & Physics), life sciences including biochemistry with applied mathematics and economics to produce transform and use of chemicals, molecules materials, energy to make the whole production process successful with economic benefits. Basically it is the applied engineering dealing with the production process of chemical and biochemical products including design of process, plant, raw material processing, products formation, optimization, operation.

2027 16th International Conference on Chemistry and Chemical Process aims to foster and conduct collaborative interdisciplinary research in state-of-the-art methodologies and technologies within Chemistry, Chemical Engineering and Chemical Process. The meeting aims to attract participants with different backgrounds, to foster cross-pollination between different research fields, and to expose and discuss innovative theories, frameworks, methodologies, tools, and applications.

Call for Papers:

Track 1. Chemical Sciences and Molecular Engineering

- Organic, inorganic, and physical chemistry
- Analytical and theoretical chemistry
- Catalysis and reaction mechanisms
- ……

Track 2. Chemical Process and Industrial Engineering

- Chemical reaction engineering
- Process design and optimization
- Separation and purification
- technologies
- ……

Track 3. Sustainable Chemistry and Environmental Technologies

- Green chemistry and sustainable synthesis
- Environmental remediation technologies
- Waste valorization and recycling
- ……

Track 4. Advanced Functional Materials

- Functional and smart materials
- Nanomaterials and nanostructured materials
- Energy and catalytic materials
- ……

Track 5. Biotechnology and Molecular Engineering

- Biochemical and bioprocess engineering
- Industrial biotechnology
- Synthetic biology
- ……

Track 6. Intelligent Chemical Engineering and Digital Systems

- Artificial intelligence for chemistry and chemical engineering
- Machine learning for process
- optimization
- ……

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ICACER 2027

Submission deadline: **Nov 10, 2026**
Conference date: **Apr 9, 2027 - Apr 11, 2027**
Full name: **12th International Conference on Advances on Clean Energy Research**
Location: **Porto, Portugal**

After ICACER 2016 held in Bangkok (Thailand), ICACER 2017 in Berlin (Germany), ICACER 2018 in Barcelona (Spain), ICACER 2019 in Coimbra (Portugal), ICACER 2020-2022 (Virtual Conference), ICACER 2023 (Barcelona, Spain), ICACER 2024 (Lille, France), ICACER 2025 (Nice, France), ICACER 2026 (Porto, Portugal) successfully, 2027 12th International Conference on Advances on Clean Energy Research (ICACER 2027) will be planned in Porto, Portugal again on April 9-11, 2027, co-sponsored by Polytechnic of Porto, Polytech Engineering School-University of Lille, supported by Universitetet of Agder, Norway and Galati University 'Dunarea de Jos', Romania, etc.
The objectives of ICACER 2027 are to provide a forum to bring together researchers, scientists, engineers, academics and graduate students in the fields of advances on clean energy research, energy economics and energy policy to share up-to-date research results. We are confident that the participants benefited from the theoretical insights, practical knowledge and personal contacts that will help them to build a long-term, profitable and sustainable communication among researchers and practitioners in the related scientific areas. It is one of the leading international conferences for presenting novel and fundamental advances in the fields of clean energy research.

***Call for papers:**
The topics of interest for submission include, but are not limited to:
Wind, solar, biomass and geothermal energies
Ocean energy harvesting
CO2 capture and storage
Fossil-fuel power-stations with CO2 sequestration
Underground and gas-network storages
Future high-capacity energy-storages
Future battery technologies
Power-to-gas/gas-to-power-solutions
Green fuel/energy for mobility
Efficient long-distance transmission in supergrids
Efficient AC/DC/AC energy conversion
Sector coupling for energy creation and storage
Sector coupling at the consumer side
Coupling conventional with green power stations
Measuring and filtering harmonic oscillations in smart grids
Network stability before/after energy transition
Critical smart-grid states and counter measures

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ICCBS 2027

Submission deadline:	**Nov 15, 2026**
Conference date:	**Apr 2, 2027 - Apr 5, 2027**
Full name:	**4th International Conference on Chemical and Biological Sciences**
Location:	**Kyoto University (Yoshida Campus), Japan**

2027 14th International Conference on Chemical and Biological Sciences (ICCBS 2027) will be held in Kyoto, Japan during April 2-5, 2027. It is co-sponsored by Network Joint Research Center for Materials and Devices: Dynamic Alliance for Open Innovation Bridging Human, Environment and Materials and Chemistry and Materials Society.

The aim objective of ICCBS 2027 is to provide a platform for researchers, engineers, academicians as well as industrial professionals from all over the world to present their research results and development activities in Chemical and Biological Sciences. ICCBS provides opportunities for the delegates to exchange new ideas and application experiences face to face, to establish business or research relations and to find global partners for future collaboration. Submitted conference papers will be reviewed by technical committees of the Conference.

Topics of interest

★ Track 1: Biomedical Science and Engineering
★ Track 2: AI, Data Science and Computational Biology
★ Track 3: Biotechnology and Synthetic Biology
★ Track 4: Chemical Sciences and Engineering
★ Track 5: Materials, Nanoscience and Biomaterials
★ Track 6: Environmental, Energy and Sustainability
★ Track 7: Agriculture, Food and Biological Systems
★ Track 8: General Chemical and Biological Sciences
• Other related topics.....

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