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/2025/0228/c5474a193334/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 **Materials**:
We post several papers which are related to the top concerned topics of researches on Materials. The papers are classified in 5 categories, and they are: **Biological Materials, Nanomaterials, Polymers, Magnetic Materials** and **Intelligent Materials**. 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.

BIOLOGICAL MATERIALS

Nanomicro Lett (impact factor: 31.6) 1 区

Aggregation-Induced Emissive Scintillators: A New Frontier for Radiation Detection and Imaging

Xinyi Li, Jiafu Yu, et. al

Abstract:
Aggregation-induced emission (AIE) is a unique phenomenon where certain organic materials exhibit enhanced luminescence in their aggregated states, overcoming the typical quenching observed in conventional organic materials. Since its discovery in

2001, AIE has driven significant advances in fields like OLEDs and biological imaging, earning recognition in fundamental research. However, its application in high-energy radiation detection remains underexplored. Organic scintillators, though widely used, face challenges such as low light yield and poor radiation attenuation. AIE materials offer promising solutions by improving light yield, response speed, and radiation attenuation. This review summarizes the design strategies behind AIE scintillators and their very recent applications in X-ray, γ-ray, and fast neutron detection. We highlight their advantages in enhancing detection sensitivity, reducing background noise, and achieving high-resolution imaging. By addressing the current challenges, we believe AIE materials will play a pivotal role in advancing future radiation detection and imaging technologies.

Nano Lett (impact factor: 9.6) 1 区 TOP

A Brain-Targeting NIR-II Polymeric Phototheranostic Nanoplatform toward Orthotopic Drug-Resistant Glioblastoma.

Su, Liu, Zhong, et. al

Abstract:

Glioblastoma is the most common and devastating brain tumor owing to its high invasiveness and high-frequency drug resistance. Near infrared-II (NIR-II) imaging-guided phototherapy based on polymer luminogens provides a promising remedy against drug-resistant glioma, but it is difficult to maximize photoenergy utilization. Herein, we designed a series of semiconducting polymers to boost the visualization and ablation of glioblastoma. By subtly engineering the side chains or substituents on the phenothiazine and thiophene moieties, an NIR-II polymer luminogen with high-quality fluorescence performance, good solubility, superior photothermal conversion, and balanced reactive oxygen species generation is achieved. The optimal polymer possesses a branched alkyl chain and tetraphenylethylene pendant to manipulate the equilibrium between the radiative and nonradiative energy-dissipating channels. High-sensitivity NIR-II imaging was used to monitor the blood-brain barrier penetration and glioma cell targeting of apolipoprotein E-modified polymer nanoparticles. The NIR irradiation triggers and maximizes the photon utilization in prominent photodynamic/photothermal synergistic therapy in orthotopic drug-resistant glioblastoma.

Mikrochim Acta (impact factor: 5.3) 2 区

Unraveling the structural evolution of silver plasmonic hotspots for the detection of oxidative ONOO- radicals via SERS probe decay.

Zhu, Zhang, Qi, et. al

Abstract:

Peroxynitrite (ONOO-) plays a pivotal role in environmental pollution and ecosystem health, necessitating its detection for assessing ecological impacts and risks. Surface-enhanced Raman scattering (SERS) offers high sensitivity but is often limited by narrow Raman cross sections of analytes. Specialized molecules can aid SERS detection, but are complex to design and may cause nonspecific reactions in biological systems. Therefore, developing new SERS strategies is crucial for simpler, more accurate ONOO- detection. Herein, the shape instability of Ag nanomaterials in the hotspots, due to oxidation and dissolution of Ag atoms at the edges and corners, is investigated, and the detection of ONOO- is performed by SERS probes. ONOO- reacts first with the (111) facet, especially at the edges and corners. Consequently, the SERS signal of the adsorbed probe, Rhodamine 6G in hotspots can be used to monitor edge and corner dissolution that positively related to the ONOO- concentration. As a result, ONOO- concentration from 0.1 to 25 μM was detected, achieving a coefficient of determination of R2 = 0.9896. The method exhibits good reproducibility (RSD < 3.25%) and stability (> 7 days), and quantitative detection of ONOO- was achieved in bovine serum samples. Ag nanocubes exhibited an eightfold stronger response and higher precision compared to Ag nanoparticles in ONOO- detection. This simple detection technique offers a promising method for the accurate, quantitative detection of ONOO- in wide range of biological systems.© 2025. The Author(s), under exclusive licence to Springer-Verlag GmbH Austria, part of Springer Nature.

NANOMATERIALS

Nanomicro Lett (impact factor: 31.6) 1 区

Nanomaterials Enhanced Sonodynamic Therapy for Multiple Tumor Treatment

Mengyao Yang, Xin Wang, et. al

Abstract:

Sonodynamic therapy (SDT) as an emerging modality for malignant tumors mainly involves in sonosensitizers and low-intensity ultrasound (US), which can safely penetrate the tissue without significant attenuation. SDT not only has the advantages including high precision, non-invasiveness, and minimal side effects, but also overcomes the limitation of low penetration of light to deep tumors. The cytotoxic reactive oxygen species can be produced by the utilization of sonosensitizers combined with US and kill tumor cells. However, the underlying mechanism of SDT has not been elucidated, and its unsatisfactory efficiency retards its further clinical application. Herein, we shed light on the main mechanisms of SDT and the types of sonosensitizers, including organic sonosensitizers and inorganic sonosensitizers. Due to the development of nanotechnology, many novel nanoplatforms are utilized in this arisen

field to solve the barriers of sonosensitizers and enable continuous innovation. This review also highlights the potential advantages of nanosonosensitizers and focus on the enhanced efficiency of SDT based on nanosonosensitizers with monotherapy or synergistic therapy for deep tumors that are difficult to reach by traditional treatment, especially orthotopic cancers.

J Am Chem Soc (impact factor: 14.4) 1 区 TOP

Transforming 2D Imine into 3D Thiazole Covalent Organic Frameworks by Conjugated Connectors: Fully Conjugated Photocatalysts.

Deng, Chakraborty, et al

Abstract:

We developed a robust three-dimensional (3D) covalent organic framework (COF), fully conjugated in both the planar (x, y) and interlayer (z) directions, using a one-pot sulfurization process. We converted the two-dimensional (2D) imine-linked COF (Py-BDA-COF) to the 3D thiazole-linked COF (3D-Py-BDA-S-COF). In the interlayer direction (z-axis), the alternating covalently bound acetylene and ethylene arrangements serve as conjugated connectors ("pillars") and create a fully conjugated and very robust COF in all three dimensions. On top of this, the presence of the sulfur lone pair electrons in the thiazole rings considerably enhances the electron delocalization degree of the frameworks. The 3D-Py-BDA-S-COF is successfully evaluated in the photocatalytic reduction of nitrobenzene.

J Agric Food Chem (impact factor: 5.7) 1 区 TOP

Multiwalled Carbon Nanotubes Promoted Biofilm Formation and Rhizosphere Colonization of Bacillus subtilis Tpb55.

Lv, Liu, Cao, et. al

Abstract:

Plant growth-promoting bacteria (PGPB) achieve effective colonization by forming a biofilm on the root surface. However, the promoting effects and mechanisms of nanomaterials on PGPB biofilm formation and rhizosphere colonization are rarely studied. This study investigated the effects and the potential mechanism of multiwalled carbon nanotubes (MWCNTs) on biofilm formation and rhizosphere colonization of PGPB Bacillus subtilis. 10 and 100 mg/L MWCNTs increased biofilm biomass, extracellular polymeric substance components, live/dead cell ratio, and spores in biofilms. MWCNTs induced B. subtilis Tpb55 upregulated gene expressions of malL, sacX, tasA-tapA, and epsA-O correlated with carbohydrate metabolism and biofilm formation. MWCNTs first stimulated Tpb55 flagellar motility and then increased biofilm formation, thus promoting colonization in the tobacco rhizosphere. Greenhouse experiments showed that the combination of MWCNTs and Tpb55 reduced the occurrence of tobacco black shank. Therefore, MWCNTs have broad application

potential in enhancing the effectiveness of PGPB in agricultural disease control and yield enhancement.

POLYMERS

Nanomicro Lett (impact factor: 31.6) 1 区

An Ultra-Stable, High-Energy and Wide-Temperature-Range Aqueous Alkaline Sodium-Ion Battery with the Microporous C4N/rGO Anode

Mengxiao Li, Rui Li, Huige Ma, et. al

Abstract:

Common anode materials in aqueous alkaline electrolytes, such as cadmium, metal hydrides and zinc, usually suffer from remarkable biotoxicity, high cost, and serious side reactions. To overcome these problems, we develop a conjugated porous polymer (CPP) in-situ grown on reduced graphene oxide (rGO) and Ketjen black (KB), noted as C4N/rGO and C4N/KB respectively, as the alternative anodes. The results show that C4N/rGO electrode delivers a low redox potential (−0.905 V vs. Ag/AgCl), high specific capacity (268.8 mAh g−1 at 0.2 A g−1), ultra-stable and fast sodium ion storage behavior (216 mAh g−1 at 20 A g−1) in 2 M NaOH electrolyte. The assembled C4N/rGO//Ni(OH)2 full battery can cycle stably more than 38,000 cycles. Furthermore, by adding a small amount of antifreeze additive dimethyl sulfoxide (DMSO) to adjust the hydrogen bonding network, the low-temperature performance of the electrolyte (0.1 DMSO/2 M NaOH) is significantly improved while hydrogen evolution is inhibited. Consequently, the C4N/rGO//Ni(OH)2 full cell exhibits an energy density of 147.3 Wh Kg−1 and ultra-high cycling stability over a wide temperature range from −70 to 45 °C. This work provides an ultra-stable high-capacity CPP-based anode and antifreeze electrolyte for aqueous alkaline batteries and will facilitate their practical applications under extreme conditions.

Angew Chem Int Ed Engl (impact factor: 16.1) 1 区 TOP

High-Performance Ionogels from Dynamic Polyrotaxane-based Networks.

Gohy, Yan, et. al

Abstract:

The swelling of a polymer matrix by ionic liquids and additional lithium salts may lead to the formation of ionogel electrolytes. However, the introduction of additional ions usually results in a decreased lithium-ion transference number, because of the trapping

of the lithium ions in clusters and polymer-ion complexes. Achieving highly efficient lithium-ion migration and increasing lithium-ion transference number (tLi+) are however crucial for the successful application of ionogel electrolytes. Herein, we design a crosslinked polyrotaxane network and then introduce ionic liquid and a lithium salt to obtain an ionogel electrolyte based on the principle of competitive coordination with the lowest binding energy for lithium ions coordinated with both the polymer network and ionic liquid clusters. This facilitates their migration within the ionogel and their release from the coordination environment, thereby improving lithium-ion transport efficiency (ionic conductivity of 2.2×10-3 S cm-1 and tLi+=0.45 at 20 °C). As proof of concept, the lithium-lithium symmetrical cells achieve stable cycling for 2000 hours, while the NMC622||Li battery demonstrates good rate performance and excellent cycling stability at 20 °C (theoretical initial capacity, 300 cycles with a single cycle capacity loss of 0.03%).© 2025 Wiley - VCH GmbH.

ACS Appl Mater Interfaces (impact factor: 8.3) 2 区 TOP

Three-Photon Direct Laser Writing of the QD-Polymer Metasurface for Large Field-of-View Optical Holography.

Jue, Li, et. al

Abstract:

Conventional metasurface holography based on special structural designs is extremely sensitive to the angle of the incident light. Without complex angle optimization for metasurface units, even a small increase in the angle may lead to a rapid decrease in the diffraction efficiency and loss of imaging information. Moreover, the response spectral range of most metasurface holographies cannot be freely adjusted from ultraviolet to infrared. In this study, we prepare a quantum dot (QD)-polymer material system and introduce 1035 nm three-photon direct laser writing (DLW) technology to fabricate the QD-polymer metasurface for large field-of-view optical holography. Based on the stable light absorption characteristics and insensitivity to the angle of incident light of QDs, we achieve a binary amplitude-only holography with a large field of view of ±70°. Moreover, based on the quantum confinement effect of the QDs, the tunable broadband characteristic of the QD-polymer metasurface holography from the ultraviolet to near-infrared is demonstrated, and the binary amplitude-only holography also shows polarization independence. In addition, based on the QD-polymer material system, we can realize a Pancharatnam-Berry phase holography. DLW-processed QD-polymer metasurfaces have the potential to maintain a long-term stability. This study provides a material system and a versatile and flexible technology for realizing various nanoparticle-polymer metasurface holography with a large field of view and tunable broadband characteristics.

MAGNETIC MATERIALS

Innovation (Camb) (impact factor: 33.2) 1 区

Magnetically driven bionic nanorobots enhance chemotherapeutic efficacy and the tumor immune response via precise targeting.

Wang, Wang, Ji, et. al

Abstract
We developed magnetically driven bionic drug-loaded nanorobots (MDNs) to accurately target tumors and deliver chemotherapy agents using a customized three-dimensional (3D) magnetic manipulation platform (MMP) system to precisely control their movement mode. MDNs were based on polyethylene glycol-modified homogeneous ultrasmall iron oxide nanoparticles (7.02 ± 0.18 nm). Doxorubicin (12% ± 2% [w/w]) was encapsulated in MDNs by an imide bond. MDNs could imitate the movement mode of a school of wild herrings (e.g., re-dispersion/arrangement/vortex/directional movement) to adapt to the changing and complex physiological environment through the 3D MMP system. MDNs overcame blood flow resistance and biological barriers using optimized magnetic driving properties according to in vivo imaging (magnetic resonance imaging and fluorescence) and histopathology. The performance of fabricated MDNs was verified through cells and tumor-bearing mouse models. The MDNs showed high efficiency of drug delivery and targeting at the tumor site (>10-fold), lower toxicity than free doxorubicin (5 mg/kg body weight), activated immune response in the tumor site, and significantly lengthened survival for mice. The synergistic interaction between MDNs and the 3D MMP system underscores the immense potential of this drug delivery system, indicating a potential revolution in the field of tumor chemotherapy.© 2025 The Authors.

J Orthop Translat (impact factor: 5.9) 1 区

Piezoelectric biomaterials for providing electrical stimulation in bone tissue engineering: Barium titanate.

Huang, Wang, Liu, et. al

Abstract
With the increasing clinical demand for orthopedic implants, bone tissue engineering based on a variety of bioactive materials has shown promising applications in bone repair. And various physiological cues, such as mechanical, electrical, and magnetic stimulation, can influence cell fate and participate in bone regeneration. Natural bone has a piezoelectric effect due to the non-centrosymmetric nature of collagen, which can aid in cell adhesion, proliferation and differentiation, and bone growth by converting

mechanical stimuli into electrical stimuli. Piezoelectric materials have the same piezoelectric effect as human bone, and they are able to deform in response to physiological movement, thus providing electrical stimulation to cells or damaged tissue without the need for an external power source. Among them, Barium titanate ($BaTiO_3$) is widely used in tumor therapy, tissue engineering, health detection and drug delivery because of its good biocompatibility, low cytotoxicity and good piezoelectric properties. This review describes the piezoelectric effect of natural bone and the characteristics of various types of piezoelectric materials, from the synthesis and physicochemical characteristics of $BaTiO_3$ and its application in biomedicine. And it highlights the great potential of $BaTiO_3$ as piezoelectric biomaterials in the field of bone tissue engineering in anticipation of providing new ideas and opportunities for researchers. The translational potential of this article: This review systematically discusses barium titanate, a bioactive material that can mimic the piezoelectric effect of natural bone tissue, which can intervene in the regenerative repair of bone by providing a sustained electrical microenvironment for bone repair scaffolds. This may help to solve the current problem of poor osteogenic properties of bioactive materials by utilizing barium titanate.© 2025 The Authors.

J Mater Chem C Mater (impact factor: 5.7) 2 区 TOP

Magnetic proximity effect in biphenylene monolayer from first-principles.

López-Alcalá, Baldoví, et. al

Abstract

On-surface chemistry has emerged as a key technique for designing novel low-dimensional materials, enabling precise manipulation of their electronic and magnetic properties at the atomic scale. It also proves highly effective for the fabrication of heterostructures. Leveraging these benefits, herein, we perform a first principles study of the magnetic proximity effect (MPE) in a heterostructure formed by a monolayer of the two-dimensional carbon allotrope biphenylene network (BPN) deposited on the surface of the above-room-temperature ferrimagnet yttrium iron garnet (YIG). Our results reveal strong hybridization between BPN orbitals and YIG surface states, resulting in non-homogeneous electron transfer and robust MPE. The proposed methodology accurately describes YIG magnetic interactions, allowing us to study the tuning effects of BPN on the magnetic properties of the substrate for the first time. Additionally, we explore the impact of van der Waals (vdW) distance at the interface, finding enhanced spin splitting up to 30% under external pressure. These findings highlight a promising strategy for inducing spin polarization in BPN without chemical modifications, opening new possibilities for BPN-based spintronic devices through the creation of heterostructures with magnetic materials.This journal is © The Royal Society of Chemistry.

Nat Genet (impact factor: 31.7) 1 区 TOP

Smart polymer dielectrics enabling autonomous indication in response to electrical degradation.

Liu, Zhu, et. al

Abstract

In nature, animals adapt themselves to different states in response to environmental changes for the purposes of alarming danger, courtship, protection, andso forth, which are realized by altering in-body molecules or microstructures. Forexample, chameleons will change skin colors (Figure 1A) to attract the attentionof mates or warn potential enemies, and the color variation is closely related tothe molecules released by pigment cells. Inspired by these smart behaviors, scientists are endeavoring to explore and design smart materials for advanced applications, which are demanded to achieve an intelligent, sustainable, andcomfortable human life in the future.Numerous smart materials can imitate the intelligent responses in biologicalsystems, exemplified by alterations in color and shape triggered under externalstimuli or specific environmental conditions. Hence, smart materials, such asshape-memory alloys, biomimetic self-healing materials, photochromic materials, and mechanical-stress-responsive matters, etc., have been progressivelydeveloped for applications in energy, information, and biomedicines.1,2 It is recognized that rapid developments in modern communication, transportation, healthcare, artificial intelligence (AI), and other fields have led to a significant increase inthe demand of electricity, ultimately overwhelming electrical grids. As a consequence, polymer dielectric materials, functioning as insulation to prevent electrical shorts and failures, are of importance in ensuring the stable operation of electrical grids. They are extensively used in electrical equipment such as capacitors,transformers, circuit breakers, and cables, etc. Therefore, the implementation ofsmart polymer dielectric materials in electrical fields is crucial to monitor the safeoperation of power equipment as well as reduce the risks and maintenance costsof electrical grids.Polymer dielectrics with a self-healing characteristic under electrical degradation have been documented in recent years.3 However, smart dielectric materialswith the ability to autonomously indicate the initial degradation of polymer dielectrics in electrical systems are still missing even though this is significant for electrical safety. Currently, spectroscopic analysis has been employed to monitor theelectrical degradation of polymer dielectrics, relying on the optical radiationgenerated by partial discharges.4However, it suffers from complexity, high costs,susceptibility to environmental interference, and limited sensitivity, making theearly detection and warning of electrical degradation more challenging. Therefore, developing smart materials with facile detectable signals for electricaldegradation of polymer dielectrics is highly desirable in the electrical engineeringfield.

J Am Chem Soc (impact factor: 14.4) 1 区 TOP

Thiophene Sulfone Single Crystal as a Reversible Thermoelastic Linear Actuator with an Extended Stroke and Second-Harmonic Generation Switching.

Wang, Shi, Tahir, et. al

Abstract:

Dynamic organic crystals are becoming recognized as some of the fastest materials for converting light or heat to mechanical work. The degree of deformation and the response time of any actuating material are often exclusive of each other; however, both factors influence the material's overall performance limits. Unlike polymers, whose disordered structures are not conducive to rapid energy transfer, cooperative phase transitions in dynamic molecular crystals that are amenable to rapid and concerted martensitic-like structure switching could help circumvent that limitation. Here, we report that single crystals of a dibenzothiophene sulfone derivative exhibit extraordinarily large, rapid, and reversible elongation when they undergo a thermally induced phase transition. The value for the linear stroke of ∼15% along the long crystal axis with retention of macroscopic integrity of this material is remarkable and capitalizes on an anisotropic lattice switching with relative changes of 14.8% and -9.5% along its crystallographic a and c axes, respectively, resulting in a visible macroscopic elongation of the crystal. The transitioning crystals deliver forces ranging from 0.19 to 15 μN and a work density of ~7 × 10-3 J m-3. The phase transformation is accompanied by a change in symmetry between centrosymmetric and noncentrosymmetric space groups and a significant change in both the fluorescence and the second-order nonlinear optical (NLO) response. The combination of these properties makes this material a favorable choice for low-power, precise, and small-scale NLO actuation applications.

Small (impact factor: 13) 2 区 TOP

Tailoring Crystalline States of Alloy Coating for High Current Density and Large Areal Capacity of Zn.

Chen, Ouyang, et. al

Abstract:

Due to issues of hydrogen evolution, corrosion, and uncontrolled deposition behaviors at the Zn anode, the practical implementation of Zn-ion batteries has faced significant obstacles. Very limited attention is directed toward various alloy crystalline states for the Zn anode protection primarily due to the challenge of synthesizing high-quality alloy coatings with diverse crystalline states. In this study, the crystalline state of NiCr alloy coating is precisely manipulated using magnetron sputtering, revealing distinct thermodynamic and kinetic changes induced by variation in the crystalline state. This research emphasizes the fundamental understanding of microstructure dynamics and

achieves a highly reversible Zn anode at harsh conditions of high current density (80 mA cm-2) and large areal capacity (40 mAh cm-2), thus enabling high-capacity and longevous pouch battery.© 2025 Wiley‐VCH GmbH.

Ⅱ Concentration

PHYSICS

Four-dimensional conserved topological charge vectors in plasmonic quasicrystals

Shai Tsesses, Pascal Dreher, et al.

Abstract

According to Noether's theorem, symmetries in a physical system are intertwined with conserved quantities. These symmetries often determine the system topology, which is made ever more complex with increased dimensionality. Quasicrystals have neither translational nor global rotational symmetry, yet they intrinsically inhabit a higher-dimensional space in which symmetry resurfaces. Here, we discovered topological charge vectors in four dimensions (4D) that govern the real-space topology of 2D quasicrystals and reveal their inherent conservation laws. We demonstrate control over the topology in pentagonal plasmonic quasilattices, mapped by both phase-resolved and time-domain near-field microscopy, showing that their temporal evolution continuously tunes the 2D projections of their distinct 4D topologies. Our work provides a route to experimentally probe the thermodynamic properties of quasicrystals and topological physics in 4D and above.

Squeezed dual-comb spectroscopy

Daniel I. Herman, Mathieu Walsh, et al.

Abstract

Optical frequency combs have enabled distinct advantages in broadband, high-resolution spectroscopy and precision interferometry. However, quantum mechanics ultimately limits the metrological precision achievable with laser frequency combs. Quantum squeezing has led to substantial measurement improvements with continuous wave lasers, but experiments demonstrating metrological advantage with squeezed combs are less developed. Using the Kerr effect in nonlinear optical fiber, a 1-gigahertz frequency comb centered at 1560 nanometers is amplitude-squeezed by >3 decibels (dB) over a 2.5-terahertz bandwidth. Dual-comb interferometry yields mode-resolved spectroscopy of hydrogen sulfide gas with a signal-to-noise ratio nearly 3 dB beyond the shot-noise limit. The quantum noise reduction leads to a twofold quantum speedup in the determination of gas concentration, with implications for high-speed measurements of multiple species in dynamic chemical environments.

Two-dimensional non-Hermitian skin effect in an ultracold Fermi gas

Zhao, Entong, et al.

Abstract

The concept of non-Hermiticity has expanded the understanding of band topology, leading to the emergence of counter-intuitive phenomena. An example is the non-Hermitian skin effect (NHSE)[1,2,3,4,5,6,7], which involves the concentration of eigenstates at the boundary. However, despite the potential insights that can be gained from high-dimensional non-Hermitian quantum systems in areas such as curved space[8,9,10], high-order topological phases[11,12] and black holes[13,14], the realization of this effect in high dimensions remains unexplored. Here we create a two-dimensional (2D) non-Hermitian topological band for ultracold fermions in spin–orbit-coupled optical lattices with tunable dissipation, which exhibits the NHSE. We first experimentally demonstrate pronounced nonzero spectral winding numbers in the complex energy plane with nonzero dissipation, which establishes the existence of 2D skin effect. Furthermore, we observe the real-space dynamical signature of NHSE in real space by monitoring the centre of mass motion of atoms. Finally, we also demonstrate that a pair of exceptional points are created in the momentum space, connected by an open-ended bulk Fermi arc, in contrast to closed loops found in Hermitian systems. The associated exceptional points emerge and shift with increasing dissipation, leading to the formation of the Fermi arc. Our work sets the stage for further investigation into simulating non-Hermitian physics in high dimensions and paves the way for understanding the interplay of quantum statistics with NHSE.

MATERIALS

Engineering grain boundaries in monolayer molybdenum disulfide for efficient water-ion separation

Jie Shen, Areej Aljarb, et al.

Abstract

Two-dimensional (2D) materials have long been considered as ideal platforms for developing separation membranes. However, it is difficult to generate uniform subnanometer pores over large areas on 2D materials. We report that the well-defined eight-membered ring (8-MR) pores, typically formed at the boundaries of two antiparallel grains of monolayer molybdenum disulfide (MoS2), can serve as molecular sieves for efficient water-ion separation. The density of grain boundaries and, consequently, the number of 8-MR pores can be tuned by regulating the grain size.

Optimized MoS2 membranes outperformed the state-of-the-art membranes in forward osmosis tests by demonstrating both ultrahigh water/sodium chloride selectivity and exceptional water permeance. Creating precise pore structures on atomically thin films through grain boundary engineering presents a promising route for producing membranes suitable for various applications.

Good plasmons in a bad metal

Francesco L. Ruta, Yinming Shao, et al.

Abstract

Correlated metals may exhibit unusually high resistivity that increases linearly in temperature, breaking through the Mott-Ioffe-Regel bound, above which coherent quasiparticles are destroyed. The fate of collective charge excitations, or plasmons, in these systems is a subject of debate. Several studies have suggested that plasmons are overdamped, whereas other studies have detected propagating plasmons. In this work, we present direct nano-optical images of low-loss hyperbolic plasmon polaritons (HPPs) in the correlated van der Waals metal MoOCl2. HPPs are plasmon-photon modes that waveguide through extremely anisotropic media and are remarkably long-lived in MoOCl2. Photoemission data presented here reveal a highly anisotropic Fermi surface, reconstructed and made partly incoherent, likely through electronic interactions as explained by many-body theory. HPPs remain long-lived despite this, revealing previously unseen imprints of many-body effects on plasmonic collective modes.

Two-dimensional polyaniline crystal with metallic out-of-plane conductivity

Zhang, Tao, Chen, Shu, et al.

Abstract

Linear conducting polymers show ballistic transport, imposed by mobile carriers moving along the polymer chains[1,2], whereas conductance in the extended dimension, that is, between polymer strands or layers, remains weak due to the lack of intermolecular ordering and electronic coupling[3,4,5]. Here we report a multilayer-stacked two-dimensional polyaniline (2DPANI) crystal, which shows metallic out-of-plane charge transport with high electrical conductivity. The material comprises columnar π arrays with an interlayer distance of 3.59 Å and periodic rhombohedral lattices formed by interwoven polyaniline chains. Electron spin resonance spectroscopy reveals significant electron delocalization in the 2DPANI lattices. First-principles calculations indicate the in-plane 2D conjugation and strong interlayer electronic coupling in 2DPANI facilitated by the Cl-bridged layer stacking. To assess the local optical conductivity, we used terahertz and infrared nanospectroscopy to unravel a

Drude-type conductivity with an infrared plasma frequency and an extrapolated local d.c. conductivity of around 200 S cm^{-1}. Conductive scanning probe microscopy showed an unusually high out-of-plane conductivity of roughly 15 S cm^{-1}. Transport measurements through vertical and lateral micro-devices revealed comparable high out-of-plane (roughly 7 S cm^{-1}) and in-plane conductivity (roughly 16 S cm^{-1}). The vertical micro-devices further showed increasing conductivity with decreasing temperature, demonstrating unique out-of-plane metallic transport behaviour. By using this multilayer-stacked 2D conducting polymer design, we predict the achievement of strong electronic coupling beyond in-plane interactions, potentially reaching three-dimensional metallic conductivity[6,7].

CHEMISTRY

Ultrastable supported oxygen evolution electrocatalyst formed by ripening-induced embedding

Wenjuan Shi, Tonghao Shen, et. al

Abstract

The future deployment of terawatt-scale proton exchange membrane water electrolyzer (PEMWE) technology necessitates development of an efficient oxygen evolution catalyst with low cost and long lifetime. Currently, the stability of the most active iridium (Ir) catalysts is impaired by dissolution, redeposition, detachment, and agglomeration of Ir species. Here we present a ripening-induced embedding strategy that securely embeds the Ir catalyst in a cerium oxide support. Cryogenic electron tomography and all-atom kinetic Monte Carlo simulations reveal that synchronizing the growth rate of the support with the nucleation rate of Ir, regulated by sonication, is pivotal for successful synthesis. A PEMWE using this catalyst achieves a cell voltage of 1.72 volts at a current density of 3 amperes per square centimeter with an Ir loading of just 0.3 milligrams per square centimeter and a voltage degradation rate of 1.33 microvolts per hour, as demonstrated by a 6000-hour accelerated aging test.

Thermal catalytic reforming for hydrogen production with zero CO2 emission

Mi Peng, Yuzhen Ge, et. al

Abstract

Carbon-neutral hydrogen production is of key importance for the chemical industry of

the future. We demonstrate a new thermal catalytic route for the partial reforming of ethanol into hydrogen and acetic acid with near-zero carbon dioxide emissions. This reaction is enabled by a catalyst containing a high density of atomic Pt1 and Ir1 species supported on a reactive alpha-molybdenum carbide substrate, achieving a hydrogen production rate of 331.3 millimoles of hydrogen per gram catalyst per hour and an acetic acid selectivity of 84.5% at 270°C, and is therefore more energy-efficient compared with standard reforming. Techno-economic analysis of partial ethanol reforming demonstrates the potential profitability for operation at an industrial scale, presenting the opportunity to produce hydrogen and acetic acid with a substantially reduced carbon dioxide footprint.

F Selective chemical looping combustion of acetylene in ethylene-rich streams

Matthew Jacob, Huy Nguyen, et. al

Abstract

The requirement for C2H2 concentrations below 2 parts per million (ppm) in gas streams for C2H4 polymerization necessitates its semihydrogenation to C2H4. We demonstrate selective chemical looping combustion of C2H2 in C2H4-rich streams by Bi2O3 as an alternative catalytic pathway to reduce C2H2 concentration below 2 ppm. Bi2O3 combusts C2H2 with a first-order rate constant that is 3000 times greater than the rate constant for C2H4 combustion. In successive redox cycles, the lattice O of Bi2O3 can be fully replenished without discernible changes in local Bi coordination or C2H2 combustion selectivity. Heterolytic activation of C–H bonds across Bi–O sites and the higher acidity of C2H2 results in lower barriers for C2H2 activation than C2H4, enabling selective catalytic hydrocarbon combustion leveraging differences in molecular deprotonation energies.

Biology

KLF2 maintains lineage fidelity and suppresses CD8 T cell exhaustion during acute LCMV infection

Eric Fagerberg, John Attanasio, et al.

Abstract

Naïve CD8 T cells have the potential to differentiate into a spectrum of functional states during an immune response. How these developmental decisions are made and what

mechanisms exist to suppress differentiation toward alternative fates remains unclear. We employed in vivo CRISPR-Cas9–based perturbation sequencing to assess the role of ~40 transcription factors (TFs) and epigenetic modulators in T cell fate decisions. Unexpectedly, we found that knockout of the TF Klf2 resulted in aberrant differentiation to exhausted-like CD8 T cells during acute infection. KLF2 was required to suppress the exhaustion-promoting TF TOX and to enable the TF TBET to drive effector differentiation. KLF2 was also necessary to maintain a polyfunctional tumor-specific progenitor state. Thus, KLF2 provides effector CD8 T cell lineage fidelity and suppresses the exhaustion program.

Conformational ensembles reveal the origins of serine protease catalysis

Siyuan Du, Rachael C. Kretsch, et. al

Abstract

Enzymes exist in ensembles of states that encode the energetics underlying their catalysis. Conformational ensembles built from 1231 structures of 17 serine proteases revealed atomic-level changes across their reaction states. By comparing the enzymatic and solution reaction, we identified molecular features that provide catalysis and quantified their energetic contributions to catalysis. Serine proteases precisely position their reactants in destabilized conformers, creating a downhill energetic gradient that selectively favors the motions required for reaction while limiting off-pathway conformational states. The same catalytic features have repeatedly evolved in proteases and additional enzymes across multiple distinct structural folds. Our ensemble-function analyses revealed previously unknown catalytic features, provided quantitative models based on simple physical and chemical principles, and identified motifs recurrent in nature that may inspire enzyme design.

Evolutionary convergence of sensory circuits in the pallium of amniotes

Eneritz Rueda-Alaña, Rodrigo Senovilla-Ganzo, et. al

Abstract

The amniote pallium contains sensory circuits that are structurally and functionally equivalent, yet their evolutionary relationship remains unresolved. We used birthdating analysis, single-cell RNA and spatial transcriptomics, and mathematical modeling to compare the development and evolution of known pallial circuits across birds (chick), lizards (gecko), and mammals (mouse). We reveal that neurons within these circuits' stations are generated at varying developmental times and brain regions across species and found an early developmental divergence in the transcriptomic

progression of glutamatergic neurons. Our research highlights developmental distinctions and functional similarities in the sensory circuit between birds and mammals, suggesting the convergence of high-order sensory processing across amniote lineages.

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Ⅲ Calling for papers

AMTME 2025 (EI/SCOPUS)

Submission deadline: **Feb 27, 2025**
Conference date: **Mar 21, 2025 - Mar 23, 2025**
Full name: **International Conference on Advanced Manufacturing Technology and Materials Engineering**
Location: **Guangzhou, China**

AMTME 2025 is to bring together innovative academics and industrial experts in the field of advanced manufacturing technology and materials engineering to a common forum. The primary goal of the conference is to promote research and developmental activities in advanced manufacturing technology and materials engineering and another goal is to promote scientific information interchange between researchers, developers, engineers, students, and practitioners working all around the world. The conference will be held every year to make it an ideal platform for people to share views and experiences in advanced manufacturing technology and materials engineering and related areas.

Call for papers:

The topics of interest for submission include, but are not limited to:

1.Advanced Manufacturing Technology
(01) Material processing and forming technology
(02) Laser processing technology
(03) Intelligent Manufacturing Technology
(04) Additive Manufacturing Technology
(05) Microelectronics packaging, testing and manufacturing technology
(06) Smart Construction Technology
(07) Precision ultra-precision machining technology

2.New materials and Advanced Materials
(01) Advanced Engineering Materials
(02) Engineering Composites Materials
(03) Micro / Nano Materials & Technologies
(04) Electronic Ceramic Materials
(05) Optical/Electronic/Magnetic Materials
(06) Smart/Intelligent Materials
(07) Semiconductor material
(08) Superconducting materials
(09) Microelectronic Materials
(10) Laser Material
(11) Sensor Material
(12) Surface Engineering/Coating
(13) Material Deformation Mechanics and Fracture

3.Manufacturing systems and automation
(01) Mechatronics
(02) Robots and Intelligent Systems
(03) Machine Vision and Sensor Technology
(04) Fault diagnosis and measurement control
(05) Machinery control and information processing technology
(06) Embedded system
(07) Automation and automatic control technology

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ICAPMS 2025 (EI/SCOPUS)

Submission deadline: **Feb 28, 2025**
Conference date: **Mar 21, 2025 - Mar 23, 2025**
Full name: **International Conference on Applied Physics and Materials Science**
Location: **Guangzhou,China**

With a diverse range of topics including nanomaterials, biomaterials, electronic materials, quantum physics, and sustainable technologies, attendees will have the opportunity to engage in enriching discussions through keynote speeches, oral sessions, and poster. This conference aims to foster collaboration, inspire partnerships, and propel research efforts, ultimately contributing to technological advancements and applications that impact society positively. Join us for an exciting exchange of ideas and the opportunity to network with leading experts in the field!

Topics of Interest :
The topics of interest for submission include, but are not limited to:
◪ Nanomaterials and Nanotechnology
- Preparation and Application of Nanomaterials
- The effect of nanostructures on the properties of materials
- Applications of nanomaterials in energy storage and conversion

◪ Solar Energy and New Energy Materials
- New Solar Cell Materials and Technologies
- Energy storage materials and systems
- Application of catalytic materials in renewable energy
- Fuel Cells and Hydrogen Energy Materials

◪ Biomaterials, Biophysics and Medical Applications
- Research and development of biocompatible materials
- Application of Nanotechnology in Biomedicine
- Biocompatible materials
- Medical device materials

◪ Advanced composite materials
- High performance fiber reinforced composites
- Metal matrix and polymer matrix composites
- Manufacturing process and application of composite materials
- Applications of composites in the aviation, aerospace and automotive industries

◪ Physics and Electronic Applications of Materials
- lectronic Materials and Devices
- New semiconductor materials
- Magnetic Materials and Storage Devices
- Terahertz Technology and Materials

◪ Advanced manufacturing and material processing
- 3D Printing and Additive Manufacturing
- Nanometer manufacturing and processing technology

ICMMME 2025 (SCI)

Submission deadline: **Mar 20, 2025**
Conference date: **Jul 23, 2025 - Jul 25, 2025**
Full name: **International Conference on Manufacturing, Material and Metallurgical Engineering**
Location: **Okinawa, Japan**

Following the successes of previous events, the 9th International Conference on Manufacturing, Material and Metallurgical Engineering, will take place in Okinawa, Japan from July 23-25, 2025. The key goal of the conference is aimed at bringing together academicians, scientists, engineers, and researchers working in various disciplines of these fields to exchange views as well as to share their expertise, experience and research results, and discuss the challenges and future directions in their specialized areas of research in these fields.

Call for Papers:
(Included but not limited)
- Advanced Manufacturing Technology
- Manufacturing system and simulation
- Cellular manufacturing
- Automation, Control and Information Technology
- Manufacturing processes and technology
- Manufacturing Engineering
- Manufacturing Systems and Equipment

ICIIL 2025 (EI)

Submission deadline: **Apr 10, 2025**
Conference date: **Aug 22, 2025 - Aug 24, 2025**
Full name: **11th International Conference on Innovation and Industrial Logistics**
Location: **Macau, China**

2025 11th International Conference on Innovation and Industrial Logistics (ICIIL 2025), will take place in August 22-24, 2025 in Macau, China again, as workshop of "ICTLE 2025", co-sponsored by Macau University of Science and Technology, technical sponsored by Faculty of Science and Technology (FST) of University of Macau. The topics related to reporting advances in industrial engineering theory, techniques, methodology, applications and practice; general surveys and critical reviews; announcements; etc. will be pondered on, through the interactions between academic researchers from different regions and cultures. Timely research topics will be discussed via presentations of the latest progresses and developments of Innovation and Industrial Logistics for solving social problems. We would unparalleled opportunities to interact and network with qualified professionals from throughout the world. We are looking forward to meeting you in Macau!

***Call for papers:**

Supply Chain Management;
Inventory Management;
Material Handling;
Operations Management and Scheduling;
Warehousing;
Transportation;
Global Logistics;
Warehouse Process Optimization;
Reliability and Maintenance of Logistic Systems

GMMT 2025 (EI/SCOPUS)

Submission deadline: **May 2, 2025**
Conference date: **Jun 23, 2025 - Jun 25, 2025**
Full name: **International Conference on Green Materials and Manufacturing Technology**
Location: **University of Cambridge, UK**

2025 International Conference on Green Materials and Manufacturing Technology (GMMT 2025) will take place in Churchill College, University of Cambridge from June 23 to 25, 2025 (in Britain time).This conference aims to bring together leading researchers, engineers and specialists to discuss the latest advancements in sustainable materials and innovative manufacturing techniques.

Topics of interest

The topics of interest for submission include, but are not limited to:

◕ Advanced Materials for Emerging Applications

- Innovative materials advancing green energy generation and storage, with applications in batteries, supercapacitors, fuel cells, photocatalysis, photovoltaics, water splitting, and alternative energy applications
- Innovative materials for biomedical applications and cancer therapy

◕ Green Materials Processing Technologies

- Clean production methods for metallic, ceramic and organic materials and composites
- Additive manufacturing
- Green chemistry approaches
- AI-enhanced techniques in materials processing

◕ Waste Recycling, Upcycling and Circular Economy

- Novel methods for recycling or upcycling waste materials, including waste plastics, biomass, spent batteries, and radioactive waste

◕ Policies for Green Materials and Circular Economy

- Governmental and institutional strategies to promote sustainable materials innovation
- Establish recycling standards, integrate lifecycle analysis across industries, and address societal implications

◕ Innovative Techniques for Separation, Purification and Characterization of Materials

- Advances in techniques for the purification of materials, such as wastewater treatment
- Novel approaches for characterizing the structural, microstructural, mechanical and physical properties of advanced materials, including nanostructured and 2D materials

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