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/2024/0112/c5474a174724/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: **Concrete, Nanomaterials, Polymers, Materials Properties** and **Ceramic**. 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.

CONCRETE

IEEE Trans Pattern Anal Mach Intell (impact factor: 20.8) 1 区 TOP

T2TD: Text-3D Generation Model Based on Prior Knowledge Guidance

Nie, Chen, et. al

Abstract:
In recent years, 3D models have been utilized in many applications, such as auto-drivers, 3D reconstruction, VR, and AR. However, the scarcity of 3D model data does not meet its practical demands. Thus, generating high-quality 3D models efficiently from textual descriptions is a promising but challenging way to solve this problem. In this paper, inspired by the creative mechanisms of human imagination, which concretely supplement the target model from ambiguous descriptions built upon human experiential knowledge, we propose a novel text-3D generation model (T2TD). T2TD

aims to generate the target model based on the textual description with the aid of experiential knowledge. Its target creation process simulates the imaginative mechanisms of human beings. In this process, we first introduce the text-3D knowledge graph to preserve the relationship between 3D models and textual semantic information, which provides related shapes like humans' experiential information. Second, we propose an effective causal inference model to select useful feature information from these related shapes, which can remove the unrelated structure information and only retain solely the feature information strongly related to the textual description. Third, we adopt a novel multi-layer transformer structure to progressively fuse this strongly related structure information and textual information, compensating for the lack of structural information, and enhancing the final performance of the 3D generation model. The final experimental results demonstrate that our approach significantly improves 3D model generation quality and outperforms the SOTA methods on the text2shape datasets.

IEEE Trans Image Process (impact factor: 10.8) 1 区 TOP

SIM-OFE: Structure Information Mining and Object-aware Feature Enhancement for Fine-Grained Visual Categorization.

Sun, He, et. al

Abstract:

Fine-grained visual categorization (FGVC) aims to distinguish visual objects from multiple subcategories of the coarse-grained category. Subtle inter-class differences among various subcategories make the FGVC task more challenging. Existing methods primarily focus on learning salient visual patterns while ignoring how to capture the object's internal structure, causing difficulty in obtaining complete discriminative regions within the object to limit FGVC performance. To address the above issue, we propose a Structure Information Mining and Object-aware Feature Enhancement (SIM-OFE) method for fine-grained visual categorization, which explores the visual object's internal structure composition and appearance traits. Concretely, we first propose a simple yet effective hybrid perception attention module for locating visual objects based on global-scope and local-scope significance analyses. Then, a structure information mining module is proposed to model the distribution and context relation of critical regions within the object, highlighting the whole object and discriminative regions for distinguishing subtle differences. Finally, an object-aware feature enhancement module is proposed to combine global-scope and local-scope discriminative features in an attentive coupling way for powerful visual representations in fine-grained recognition. Extensive experiments on three FGVC benchmark datasets demonstrate that our proposed SIM-OFE method can achieve state-of-the-art performance.

Sci Total Environ (impact factor: 8.2) 1 区 TOP

Assessment of sulfamethoxazole and oxytetracycline uptake and transformation in Eisenia fetida earthworms.

Vergara-Luis, Rutkoski, et. al

Abstract:

The scientific community is becoming increasingly concerned about the recent detection of transformation products (TPs) of antimicrobials (AMs) and their presence in the food chain. There are growing concerns about the potential consequences on food safety and the proliferation of antimicrobial resistance. In this work, the transformation process of sulfamethoxazole (SMX) and oxytetracycline (OTC) in soil was thoroughly evaluated. For that purpose, soils were homogeneously contaminated at three concentration levels of SMX and OTC, independently, and samples were analysed after 7 and 14 days by Ultra High-Performance Liquid Chromatography coupled to a triple quadrupole mass spectrometer (UHPLC-MS/MS). The results have demonstrated a remarkable transformation, particularly noteworthy for SMX, as it exhibited an 89 % - 94 % decrease in concentration within the initial 7 days of the experiment. In addition, to assess whether terrestrial organisms would be able to accumulate the AMs, Eisenia fetida (E. fetida) earthworms were exposed to the above-mentioned concentration levels of AMs in soil. Both AMs were accumulated in the organisms after 14 days, but higher bioaccumulation factor values (BCF) were determined for SMX (0.52-17.84) compared to OTC (0.02-0.21) at all tested concentrations. The analyses were extended to search for TPs in earthworms and soils using a suspect screening approach. Concretely, by means of UHPLC-high resolution mass spectrometry (UHPLC-HRMS) three TPs were identified at 2a and 2b of confidence level. To the best of our knowledge, one SMX-TP and one OTC-TP were identified in earthworms and soil, respectively, for the first time in the present work. Earthworms did not experience weight loss or mortality in the presence of these AMs at levels found in the environment, but there was a decrease in riboflavin levels, which is linked to changes in the immune system. This study represents a significant advancement in understanding the impact of AMs in soil and their subsequent entry into the food chain. It also provides valuable insights into the potential effects of AMs and their TPs on organisms.

NANOMATERIALS

Small (impact factor: 13) 2 区 TOP

Plasmonic Particle Integration into Near-Infrared Photodetectors and Photoactivated Gas Sensors: Toward Sustainable Next-Generation

Ubiquitous Sensing.

Schlicke, Maletz, et. al

Abstract:

Current challenges in environmental science, medicine, food chemistry as well as the emerging use of artificial intelligence for solving problems in these fields require distributed, local sensing. Such ubiquitous sensing requires components with 1) high sensitivity, 2) power efficiency, 3) miniaturizability, and 4) the ability to directly interface with electronic circuitry, i.e., electronic readout of sensing signals. Over the recent years, several nanoparticle-based approaches have found their way into this field and have demonstrated high performance. However, challenges remain, such as the toxicity of many of today's narrow bandgap semiconductors for NIR detection and the high energy consumption as well as low selectivity of state-of-the-art commercialized gas sensors. With their unique light-matter interaction and ink-based fabrication schemes, plasmonic nanostructures provide potential technological solutions to these challenges, leading also to better environmental performance. In this perspective recent approaches of using plasmonic nanoparticles are discussed for the fabrication of NIR photodetectors and light-activated, energy-efficient gas sensing devices. In addition, new strategies implying computational approaches are pointed out for miniaturizable spectrometers, exploiting the wide spectral tunability of plasmonic nanocomposites, and for selective gas sensors, utilizing dynamic light activation. The benefits of colloidal approaches for device fabrication are discussed with regard to technological advantages and environmental aspects, which are barely considered so far.© 2024 The Author(s). Small published by Wiley‐VCH GmbH.

Sci Adv (impact factor: 11.7) 1 ☒

Hybrid nanoparticle-mediated simultaneous ROS scavenging and STING activation improve the antitumor immunity of in situ vaccines.

Li, Wu, et al

Abstract:

In situ vaccine (ISV) is a versatile and personalized local immunotherapeutic strategy. However, the compromised viability and function of dendritic cells (DCs) in a tumor microenvironment (TME) largely limit the therapeutic efficacy. We designed a hybrid nanoparticle-based ISV, which accomplished superior cancer immunotherapy via simultaneously scavenging reactive oxygen species (ROS) and activating the stimulator of interferon genes (STING) pathway in DCs. This ISV was constructed by encapsulating a chemodrug, SN38, into diselenide bond-bridged organosilica nanoparticles, followed by coating with a Mn2+-based metal phenolic network. We show that this ISV can activate the STING pathway through Mn2+ and SN38 comediated signaling and simultaneously scavenge preexisting H2O2 in the TME and Mn2+-catalyzed •OH by leveraging the antioxidant property of diselenide and polyphenol. This ISV effectively activated DCs and protected them from oxidative

damage, leading to remarkable downstream T cell activation and systemic antitumor immunity. This work highlights a nanoparticle design that manipulates DCs in the TME for improving the ISV.

Sci Adv (impact factor: 11.7) 1 ☒

Biological self-protection inspired engineering of nanomaterials to construct a robust bio-nano system for environmental applications.

Ben Yedder, et. al

Abstract:
Nanomaterials can empower microbial-based chemical production or pollutant removal, e.g., nano zero-valent iron (nZVI) as an electron source to enhance microbial reducing pollutants. Constructing bio-nano interfaces is critical for bio-nano system operation, but low interfacial compatibility due to nanotoxicity challenges the system performance. Inspired by microorganisms' resistance to nanotoxicity by secreting extracellular polymeric substances (EPS), which can act as electron shuttling media, we design a highly compatible bio-nano interface by modifying nZVI with EPS, markedly improving the performance of a bio-nano system consisting of nZVI and bacteria. EPS modification reduced membrane damage and oxidative stress induced by nZVI. Moreover, EPS alleviated nZVI agglomeration and probably reduced bacterial rejection of nZVI by wrapping camouflage, contributing to the bio-nano interface formation, thereby facilitating nZVI to provide electrons for bacterial reducing pollutant via membrane-anchoring cytochrome c. This work provides a strategy for designing a highly biocompatible interface to construct robust and efficient bio-nano systems for environmental implication.

POLYMERS

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

A Self-Healing Crystal That Repairs Multiple Cracks.

Pathan, Balan, et. al

Abstract:
We report both cracking and self-healing in crystals occurring during a thermal phase transition, followed by a topochemical polymerization. A squaramide-based monomer was designed where the azide and alkyne units of adjacent molecules are positioned favorably for a topochemical click reaction. The monomer undergoes spontaneous single-crystal-to-single-crystal (SCSC) polymerization at room temperature via

regiospecific 1,3-dipolar cycloaddition, yielding the corresponding triazole-linked polymer in a few days. When heated at 60 °C, the polymerization completes in a SCSC manner in 24 h. Upon continuous heating from room temperature to 110 °C, the monomer crystals develop multiple cracks, and they self-heal immediately. The cracking occurs due to a thermal phase transition, as evidenced by differential scanning calorimetry (DSC). The cracks heal either upon further heating or upon cooling of the crystals due to the topochemical polymerization or reversal of the phase transition, respectively. Increasing the heating rate leads to the formation of longer and wider cracks, which also heal instantaneously. The self-healed crystals retained their integrity and the crystal structure of the self-healed crystals was analyzed by single-crystal X-ray diffraction. The quality of the self-healed crystals and their diffraction ability conform to those of the completely reacted crystals at room temperature or at 60 °C without developing cracks. This work demonstrates a novel mechanism for self-healing of molecular crystals that could expand the horizon of these materials for a plethora of applications.

Sci Adv (impact factor: 11.7) 1 区

Mechanochemically accelerated deconstruction of chemically recyclable plastics.

Hua, Peng, et. al

Abstract:
Plastics redesign for circularity has primarily focused on monomer chemistries enabling faster deconstruction rates concomitant with high monomer yields. Yet, during deconstruction, polymer chains interact with their reaction medium, which remains underexplored in polymer reactivity. Here, we show that, when plastics are deconstructed in reaction media that promote swelling, initial rates are accelerated by over sixfold beyond those in small-molecule analogs. This unexpected acceleration is primarily tied to mechanochemical activation of strained polymer chains; however, changes in the activity of water under polymer confinement and bond activation in solvent-separated ion pairs are also important. Together, deconstruction times can be shortened by seven times by codesigning plastics and their deconstruction processes..

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

Nitrogen-Rich Covalent Organic Frameworks Composited High-Temperature Proton Exchange Membranes with Ultralow Volume Expansion and Reduced Phosphoric Acid Leakage.

Zhang, Ji, et. al

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Abstract:
Phosphoric acid (PA) leakage and volume expansion are critical factors limiting long-term stable operation of PA-doped polybenzimidazole (PBI) for high-temperature proton exchange membrane fuel cells. Enhancing the interaction between the polymer matrix and PA provides an effective way to minimize PA loss and inhibit excessive membrane swelling. The covalent organic frameworks (COFs) are helpful in improving the performance of PA-PBI membranes due to the robust frameworks, adjustable structures, and good compatibility with polymers. Here, in this work, we synthesized porous COFs named TTA-DFP containing triazine rings and pyridine groups at room temperature for as short as 2 h without oxygen isolation. TTA-DFP was then blended with commercial poly[2,2'-(p-oxidiphenylene)-5,5'-benzimidazole] (OPBI) to prepare composite membranes. The abundant alkaline N sites in TTA-DFP exhibit strong interactions with PA and OPBI, which not only provide more proton transport pathways to promote proton conduction but also immobilize PA in acidophilic micropores to reduce PA leakage. The composite membranes exhibit a much lower volume swelling ratio than that of the OPBI membrane. The PA retention of the composite membrane after 120 h of treatment at 80 °C and 40% relative humidity can reach as high as 84.6%. Particularly, the proton conductivity of the composite membrane doped with 15 wt% TTA-DFP achieves 0.112 S cm-1 at 180 °C without humidification with a swelling ratio of 24.1%. In addition, it has an optimal peak power density of 824.4 mW cm-2 at 180 °C, which is 1.7 times that of the OPBI membrane. The stability of the composite membrane is much better than that of OPBI at a current density of 0.3 A cm-2 at 140 °C for 120 h.

MATERIALS PROPERTIES

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

Opening the Hysteresis Loop in Ferromagnetic Fe3GeTe2 Nanosheets Through Functionalization with TCNQ Molecules.

Kumar, Ruiz, et. al

Abstract
Ferromagnetic metal Fe3GeTe2 (FGT), whose structure exhibits weak van-der-Waals interactions between 5-atom thick layers, was subjected to liquid-phase exfoliation (LPE) in N-methyl pyrrolidone (NMP) to yield a suspension of nanosheets that were separated into several fractions by successive centrifugation at different speeds. Electron microscopy confirmed successful exfoliation of bulk FGT to nanosheets as thin as 6 nm. The ferromagnetic ordering temperature for the nanosheets gradually decreased with the increase in the centrifugation speed used to isolate the 2D material. These nanosheets were resuspended in NMP and treated with an organic acceptor,

7,7,8,8-tetracyano-quinodimethane (TCNQ), which led to precipitation of FGT-TCNQ composite. The formation of the composite material is accompanied by charge transfer from the FGT nanosheets to TCNQ molecules, generating TCNQ•- radical anions, as revealed by experimental vibrational spectra and supported by first principles calculations. Remarkably, a substantial increase in magnetic anisotropy was observed, as manifested by the increase in the coercive field from nearly zero in bulk FGT to 1.0 kOe in the exfoliated nanosheets and then to 5.4 kOe in the FGT-TCNQ composite. The dramatic increase in coercivity of the composite suggests that functionalization with redox-active molecules provides an appealing pathway to enhancing magnetic properties of 2D materials.© 2024 Wiley‐VCH GmbH.

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

Structural Isomerism in Bimetallic Ag20Cu12 Nanoclusters.

Deng, Malola, et. al

Abstract

Structural isomers of atomically precise metal nanoclusters are highly sought after for investigating structure-property relationships in nanostructured materials. However, they are extremely rare, particularly those of alloys, primarily due to the challenges in their synthesis and structural characterization. Herein, for the first time, a pair of bimetallic isomeric AgCu nanoclusters has been controllably synthesized and structurally characterized. These two isomers share an identical molecular formula, Ag20Cu12(C≡CR)24 (denoted as Ag20Cu12-1 and Ag20Cu12-2; HC≡CR is 3,5-bis(trifluoromethyl)phenylacetylene). Single-crystal X-ray diffraction data analysis revealed that Ag20Cu12-1 possesses an Ag17Cu4 core composed of two interpenetrating hollow Ag11Cu2 structures. This core is stabilized by four different types of surface motifs: eight -C≡CR, one Cu(C≡CR)2, one Ag3Cu3(C≡CR)6, and two Cu2(C≡CR)4 units. Ag20Cu12-2 features a bitetrahedron Ag14 core, which is stabilized by three Ag2Cu4(C≡CR)8 units. Interestingly, Ag20Cu12-2 undergoes spontaneous transformation to Ag20Cu12-1 in the solution-state. Density functional theory calculations explain the electronic and optical properties and confirm the higher relative stability of Ag20Cu12-1 compared to Ag20Cu12-2. The controlled synthesis and structural isomerism of alloy nanoclusters presented in this work will stimulate and broaden research on nanoscale isomerism.

Sci Adv (impact factor: 11.7) 1 区

Infrared single-photon detection with superconducting magic-angle twisted bilayer graphene.

Di Battista, Fong, et. al

Abstract

The moiré superconductor magic-angle twisted bilayer graphene (MATBG) shows exceptional properties, with an electron (hole) ensemble of only ~1011 carriers per square centimeter, which is five orders of magnitude lower than traditional superconductors (SCs). This results in an ultralow electronic heat capacity and a large kinetic inductance of this truly two-dimensional SC, providing record-breaking parameters for quantum sensing applications, specifically thermal sensing and single-photon detection. To fully exploit these unique superconducting properties for quantum sensing, here, we demonstrate a proof-of-principle experiment to detect single near-infrared photons by voltage biasing an MATBG device near its superconducting phase transition. We observe complete destruction of the SC state upon absorption of a single infrared photon even in a 16-square micrometer device, showcasing exceptional sensitivity. Our work offers insights into the MATBG-photon interaction and demonstrates pathways to use moiré superconductors as an exciting platform for revolutionary quantum devices and sensors.

CERAMIC

Adv Mater (impact factor: 27.4) 1 区 TOP

Stable Seawater Electrolysis Over 10 000 H via Chemical Fixation of Sulfate on NiFeBa-LDH.

Chen, Liu, et. al

Abstract

Although hydrogen production through seawater electrolysis combined with offshore renewable energy can significantly reduce the cost, the corrosive anions in seawater strictly limit the commercialization of direct seawater electrolysis technology. Here, it is discovered that electrolytic anode can be uniformly protected in a seawater environment by constructing NiFeBa-LDH catalyst assisted with additional SO4 2- in the electrolyte. In experiments, the NiFeBa-LDH achieves unprecedented stability over 10 000 h at 400 mA cm-2 in both alkaline saline electrolyte and alkaline seawater. Characterizations and simulations reveal that the atomically dispersed Ba2+ enables the chemical fixation of free SO4 2- on the surface, which generates a dense SO4 2- layer to repel Cl- along with the preferentially adsorbed SO4 2- in the presence of an applied electric field. In terms of the simplicity and effectiveness of catalyst design, it is confident that it can be a beacon for the commercialization of seawater electrolysis technology.

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

Boosting Electrochemical Performance via Extra-Role of La-Doped CeO2-δ Interlayer for "Oxygen Provider" at High-Current SOFC Operation.

Nguyen, Lee, et. al

Abstract:

Utilizing rare earth doped ceria in solid oxide cells (SOCs) engineering is indeed a strategy aimed at enhancing the electrochemical devices' durability and activity. Particularly, Gd-doped ceria (GDC) is actively used for barrier layer and catalytic additives in solid oxide fuel cells (SOFCs). In this study, experiments are conducted with La-doped CeO2 (LDC), in which the Ce sites are predominantly occupied by La, to prevent the formation of the Ce-Zr solid solution. This LDC is comparably used as a functional interlayer between the electrolyte and cathode if sintered at lower temperatures to avoid La2Zr2O7 impurity. In addition, the high substitution of La3+ into the ceria lattice improves the oxygen non-stoichiometry of LDC, leading to accelerated electrochemical high performance by the additional role of LDC for oxygen supplier capacitance at high current operation. Thus, it is confirmed that the improved SOFC high performance is achieved at the maximum power density (MPD) of ≈2.15 W cm-2 at 800 ° C when the optimized LDC buffer layer is hired at the anode-supported typed-Samsung's SOFC by lowering the sintering temperature to prevent LDC's impurity reaction.© 2024 The Author(s). Advanced Science published by Wiley‐VCH GmbH.

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

Perspective on Water-Soluble Two-Photon Initiator for Two-Photon Polymerization.

Bin, Zheng, et. al

Abstract:

Two-photon polymerization (TPP) as an unparalleled technology empowers the rapid prototyping of customized three-dimensional (3D) micro/nanostructures, garnering noticeable interest in tissue engineering, drug delivery, and regenerative medicine. These applications have a high requirement on the biocompatibility and integrity of 3D structures. Therefore, it is important to develop two-photon initiator with good water-solubility, initiation efficiency, and biocompatibility. Here, we share our insights into the development of a water-soluble two-photon initiator (WTPI) and applications from the material and manufacturing perspective. We highlight the nonlinear optical properties and the synthesis of WTPI through three pathways. Then we further demonstrate the applications of the TPP technique in the aqueous phase in the fields of tissue engineering, 4D printing, and ceramic manufacturing. Finally, a general conclusion and outlook are provided for the future development and application of WTPI.

Ⅱ Concentration

PHYSICS

Two-axis twisting using Floquet-engineered XYZ spin models with polar molecules

Miller, Calder, et al.

Abstract

Polar molecules confined in an optical lattice are a versatile platform to explore spin-motion dynamics based on strong, long-range dipolar interactions[1,2]. The precise tunability[3] of Ising and spin-exchange interactions with both microwave and d.c. electric fields makes the molecular system particularly suitable for engineering complex many-body dynamics[4,5,6]. Here we used Floquet engineering[7] to realize new quantum many-body systems of polar molecules. Using a spin encoded in the two lowest rotational states of ultracold $^{40}K^{87}Rb$ molecules, we mutually validated XXZ spin models tuned by a Floquet microwave pulse sequence against those tuned by a d.c. electric field through observations of Ramsey contrast dynamics. This validation sets the stage for the realization of Hamiltonians inaccessible with static fields. In particular, we observed two-axis twisting[8] mean-field dynamics, generated by a Floquet-engineered XYZ model using itinerant molecules in two-dimensional layers. In the future, Floquet-engineered Hamiltonians could generate entangled states for molecule-based precision measurement[9] or could take advantage of the rich molecular structure for quantum simulation of multi-level systems[10,11].

Observing the two-dimensional Bose glass in an optical quasicrystal

Yu, Jr-Chiun, et al.

Abstract

The presence of disorder substantially influences the behaviour of physical systems. It can give rise to slow or glassy dynamics, or to a complete suppression of transport as in Anderson insulators[1], where normally extended wavefunctions such as light fields or electronic Bloch waves become exponentially localized. The combined effect of disorder and interactions is central to the richness of condensed-matter physics[2]. In bosonic systems, it can also lead to additional quantum states such as the Bose glass[3,4]—an insulating but compressible state without long-range phase coherence that emerges in disordered bosonic systems and is distinct from the well-known superfluid and Mott insulating ground states of interacting bosons. Here we report the experimental realization of the two-dimensional Bose glass using ultracold atoms in an eight-fold

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symmetric quasicrystalline optical lattice[5]. By probing the coherence properties of the system, we observe a Bose-glass-to-superfluid transition and map out the phase diagram in the weakly interacting regime. We furthermore demonstrate that it is not possible to adiabatically traverse the Bose glass on typical experimental timescales by examining the capability to restore coherence and discuss the connection to the expected non-ergodicity of the Bose glass. Our observations are in good agreement with recent quantum Monte Carlo predictions[6] and pave the way for experimentally testing the connection between the Bose glass, many-body localization and glassy dynamics more generally[7,8].

Phantom energy in the nonlinear response of a quantum many-body scar state

Kangning Yang, Yicheng Zhang, et al.

Abstract

Quantum many-body scars are notable as nonthermal, low-entanglement states that exist at high energies. In this study, we used attractively interacting dysprosium gases to create scar states that are stable enough to be driven into a strongly nonlinear regime while retaining their character. We measured how the kinetic and total energies evolve after quenching the confining potential. Although the bare interactions are attractive, the atoms behave as if they repel each other: Their kinetic energy paradoxically decreases as the gas is compressed. The missing "phantom" energy is quantified by benchmarking our experimental results against generalized hydrodynamics calculations. We present evidence that the missing kinetic energy is carried by undetected, very high momentum atoms.

MATERIALS

Insulating electromagnetic-shielding silicone compound enables direct potting electronics

Xinfeng Zhou, Peng Min, et al.

Abstract

Traditional electromagnetic interference–shielding materials are predominantly electrically conductive, posing short-circuit risks when applied in highly integrated electronics. To overcome this dilemma, we propose a microcapacitor-structure model comprising conductive fillers as polar plates and intermediate polymer as a dielectric

layer to develop insulating electromagnetic interference–shielding polymer composites. The electron oscillation in plates and dipole polarization in dielectric layers contribute to the reflection and absorption of electromagnetic waves. Guided by this, the synergistic nonpercolation densification and dielectric enhancement enable our composite to combine high resistivity, shielding performance, and thermal conductivity. Its insulating feature allows for direct potting into the crevices among assembled components to address electromagnetic compatibility and heat-accumulation issues.

Solvent-mediated oxide hydrogenation in layered cathodes

Gang Wan, Travis P. Pollard, et al.

Abstract

Self-discharge and chemically induced mechanical effects degrade calendar and cycle life in intercalation-based electrochromic and electrochemical energy storage devices. In rechargeable lithium-ion batteries, self-discharge in cathodes causes voltage and capacity loss over time. The prevailing self-discharge model centers on the diffusion of lithium ions from the electrolyte into the cathode. We demonstrate an alternative pathway, where hydrogenation of layered transition metal oxide cathodes induces self-discharge through hydrogen transfer from carbonate solvents to delithiated oxides. In self-discharged cathodes, we further observe opposing proton and lithium ion concentration gradients, which contribute to chemical and structural heterogeneities within delithiated cathodes, accelerating degradation. Hydrogenation occurring in delithiated cathodes may affect the chemo-mechanical coupling of layered cathodes as well as the calendar life of lithium-ion batteries.

Stoichiometric reconstruction of the Al2O3 (0001) surface

Johanna I. Hütner, Andrea Conti, et al.

Abstract

Macroscopic properties of materials stem from fundamental atomic-scale details, yet for insulators, resolving surface structures remains a challenge. We imaged the basal (0001) plane of α–aluminum oxide (α-Al_2O_3) using noncontact atomic force microscopy with an atomically defined tip apex. The surface formed a complex $(31 \times 31)R\pm9°$ reconstruction. The lateral positions of the individual oxygen and aluminum surface atoms come directly from experiment; we determined with computational modeling how these connect to the underlying crystal bulk. Before the restructuring, the surface Al atoms assume an unfavorable, threefold planar coordination; the reconstruction allows a rehybridization with subsurface O that leads to a substantial energy gain. The reconstructed surface remains stoichiometric, Al_2O_3.

CHEMISTRY

Characterization of a Lewis adduct in its inner and outer forms

Wei-Chun Liu, François P. Gabbaï, et. al

Abstract

The entrance channel of bimolecular reactions sometimes involves the formation of outer complexes as weakly bound, fleeting intermediates. Here, we characterize such an outer complex in a system that models the bimolecular, C-O bond–forming reaction of a phosphine oxide Lewis base with a carbenium Lewis acid. Crystallographic studies show that the C-O distance in the outer form exceeds that of the final or inner adduct by 1.1 angstroms. As the system samples the two forms of the complex, which correspond to minima on the corresponding potential energy surface, the C-O linkage switches from a secondary interaction in the outer complex to a dative bond in the inner complex. This phenomenon is harnessed as a functional feature to stabilize xanthylium-based photoredox catalysts.

Closed-loop transfer enables artificial intelligence to yield chemical knowledge

Angello, Nicholas H., et. al

Abstract

Artificial intelligence-guided closed-loop experimentation has emerged as a promising method for optimization of objective functions1,2, but the substantial potential of this traditionally black-box approach to uncovering new chemical knowledge has remained largely untapped. Here we report the integration of closed-loop experiments with physics-based feature selection and supervised learning, denoted as closed-loop transfer (CLT), to yield chemical insights in parallel with optimization of objective functions. CLT was used to examine the factors dictating the photostability in solution of light-harvesting donor–acceptor molecules used in a variety of organic electronics applications, and showed fundamental insights including the importance of high-energy regions of the triplet state manifold. This was possible following automated modular synthesis and experimental characterization of only around 1.5% of the theoretical chemical space. This physics-informed model for photostability was strengthened using multiple experimental test sets and validated by tuning the triplet excited-state energy of the solvent to break out of the observed plateau in the closed-loop photostability optimization process. Further applications of CLT to additional materials systems support the generalizability of this strategy for augmenting closed-loop strategies. Broadly, these findings show that combining interpretable supervised learning models and physics-based features with closed-loop discovery processes can rapidly provide

fundamental chemical insights.

Catalytic asymmetric synthesis of meta benzene isosteres

Zhang, Mingkai et. al

Abstract

Although aromatic rings are common elements in pharmaceutically active compounds, the presence of these motifs brings several liabilities with respect to the developability of a drug[1]. Nonoptimal potency, metabolic stability, solubility and lipophilicity in pharmaceutical compounds can be improved by replacing aromatic rings with non-aromatic isosteric motifs[2]. Moreover, whereas aromatic rings are planar and lack three-dimensionality, the binding pockets of most pharmaceutical targets are chiral. Thus, the stereochemical configuration of the isosteric replacements may offer an added opportunity to improve the affinity of derived ligands for target receptors. A notable impediment to this approach is the lack of simple and scalable catalytic enantioselective syntheses of candidate isosteres from readily available precursors. Here we present a previously unknown palladium-catalysed reaction that converts hydrocarbon-derived precursors to chiral boron-containing nortricyclanes and we show that the shape of these nortricyclanes makes them plausible isosteres for *meta* disubstituted aromatic rings. With chiral catalysts, the Pd-catalysed reaction can be accomplished in an enantioselective fashion and subsequent transformation of the boron group provides access to a broad array of structures. We also show that the incorporation of nortricyclanes into pharmaceutical motifs can result in improved biophysical properties along with stereochemistry-dependent activity. We anticipate that these features, coupled with the simple, inexpensive synthesis of the functionalized nortricyclane scaffold, will render this platform a useful foundation for the assembly of new biologically active agents.

BIOLOGY

Microbial dietary preference and interactions affect the export of lipids to the deep ocean

Lars Behrendt, Uria Alcolombri, et al.

Abstract

Lipids comprise a significant fraction of sinking organic matter in the ocean and play a crucial role in the carbon cycle. Despite this, our understanding of the processes that

control lipid degradation is limited. We combined nanolipidomics and imaging to study the bacterial degradation of diverse algal lipid droplets and found that bacteria isolated from marine particles exhibited distinct dietary preferences, ranging from selective to promiscuous degraders. Dietary preference was associated with a distinct set of lipid degradation genes rather than with taxonomic origin. Using synthetic communities composed of isolates with distinct dietary preferences, we showed that lipid degradation is modulated by microbial interactions. A particle export model incorporating these dynamics indicates that metabolic specialization and community dynamics may influence lipid transport efficiency in the ocean's mesopelagic zone.

Autoregulated splicing of TRA2β programs T cell fate in response to antigen-receptor stimulation

Timofey A. Karginov, Antoine Ménoret, et. al

Abstract

T cell receptor (TCR) sensitivity to peptide–major histocompatibility complex (MHC) dictates T cell fate. Canonical models of TCR sensitivity cannot be fully explained by transcriptional regulation. In this work, we identify a posttranscriptional regulatory mechanism of TCR sensitivity that guides alternative splicing of TCR signaling transcripts through an evolutionarily ultraconserved poison exon (PE) in the RNA-binding protein (RBP) TRA2β in mouse and human. TRA2β-PE splicing, seen during cancer and infection, was required for TCR-induced effector T cell expansion and function. Tra2β-PE skipping enhanced T cell response to antigen by increasing TCR sensitivity. As antigen levels decreased, Tra2β-PE reinclusion allowed T cell survival. Finally, we found that TRA2β-PE was first included in the genome of jawed vertebrates that were capable of TCR gene rearrangements. We propose that TRA2β-PE splicing acts as a gatekeeper of TCR sensitivity to shape T cell fate.

Transcripts of repetitive DNA elements signal to block phagocytosis of hematopoietic stem cells

Cecilia Pessoa Rodrigues, Joseph M. Collins, et. al

Abstract

Macrophages maintain hematopoietic stem cell (HSC) quality by assessing cell surface Calreticulin (Calr), an "eat-me" signal induced by reactive oxygen species (ROS). Using zebrafish genetics, we identified Beta-2-microglobulin (B2m) as a crucial "don't eat-me" signal on blood stem cells. A chemical screen revealed inducers of surface Calr that promoted HSC proliferation without triggering ROS or

macrophage clearance. Whole-genome CRISPR-Cas9 screening showed that Toll-like receptor 3 (Tlr3) signaling regulated b2m expression. Targeting b2m or tlr3 reduced the HSC clonality. Elevated B2m levels correlated with high expression of repetitive element (RE) transcripts. Overall, our data suggest that RE-associated double-stranded RNA could interact with TLR3 to stimulate surface expression of B2m on hematopoietic stem and progenitor cells. These findings suggest that the balance of Calr and B2m regulates macrophage-HSC interactions and defines hematopoietic clonality.

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Ⅲ Calling for papers

ICMMT 2025 (EI)

Submission deadline: **Oct 15, 2024**
Conference date: **Mar 21, 2025 - Mar 23, 2025**
Full name: **16th International Conference on Materials and Manufacturing Technologies**
Location: **Sendai, Japan**

2025 16th International Conference on Materials and Manufacturing Technologies (ICMMT 2025) is a premier, annual forum for researchers and scholars from multiple disciplines to come together to share knowledge, discuss ideas, exchange information, and learn about cutting-edge research in diverse fields with the common theme of Materials and Manufacturing Technologies. It is the 16th event in the series of successful scientific meetings that begun in 2010 in Chongqing (China). This first event was followed by the subsequent meetings organized in Xiamen, China (2011), Chengdu, China (2012), Seoul, Korea (2013), Kuala Lumpur, Malaysia (2014), Bali, Indonesia (2015), Chiang Mai, Thailand (2016), Singapore (2017), and in Moscow, Russia (2018), Kuala Lumpur, Malaysia (2019), Bangkok, Thailand (Full Virtual Style in 2020), Full Virtual Style in 2021 & 2022, Ho Chi Minh City, Vietnam(2023), Nha Trang, Vietnam(2024).

Call for papers:

Additive Manufacturing
Metal Joining
Subtractive Manufacturing
Sustainable Manufacturing Technologies
Vibration Engineering
Mechanical Dynamics and Vibration
Mechanical Strength
Mechanical Design
Casting Technology and Equipment
Plastic Processing Technology
Cellular Manufacturing
Advanced Manufacturing Processes
Bio Materials
Building Materials
Ceramics, Shape Memory Alloys and
Nanomaterials
Materials for Aerospace Applications
Polymers and Polymer Composites
Glasses and Amorphous Systems
Characterization and Testing
MEMS/NEMS
Chemical Materials
Optical/Electronic Materials
Magnetic Materials
Cryogenic Materials
Micro/Nano Machining
Metal Forming
Green Manufacturing
Non-Conventional Machining Processes

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RSEJ 2024 (JOURNAL)

Submission deadline:	**Oct 15, 2024**
Conference date:	**N/A**
Full name:	**Renewable and Sustainable Energy**
Location:	**N/A**

Renewable and Sustainable Energy: An International Journal is a quarterly open access peer-reviewed journal that publishes articles which contribute new results in all areas of the Renewable and Sustainable Energy. The journal focuses on all technical and practical aspects Renewable and Sustainable Energy. The goal of this journal is to bring together researchers and practitioners from academia and industry to focus on understanding advances in Renewable and Sustainable Energy and establishing new collaborations in these areas.
Authors are solicited to contribute to the journal by submitting articles that illustrate research results, projects, surveying works and industrial experiences that describe significant advances in the areas of Renewable and Sustainable Energy

Topics of Interest :
Biomass
Distribution Power System
Eco-Design
Electricity Storage
Energy Efficiency
Energy Harvesting
Green Technology
Hydroelectric Power
Recent Trends
Renewable Energy for Electronics Equipments
Sea Power
Smart Grid
Solar Energy
Thermal and Recycling
Transportation Generation
Wind Energy

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AI FOR MATERIALS COMPUTING 2024 (JOURNAL)

Submission deadline: **N/A**
Conference date: **N/A**
Full name: **Intelligent Computing: Special Issue: AI for Materials Computing**
Location: **N/A**

The main focus of materials science is to study the complex relationship of "composition-process-structure-property" of materials. In the advent of the digital revolution, artificial intelligence (AI) has emerged as a powerful tool to accelerate the development of new materials and significantly reduce materials development costs. This special issue highlights the recent progress of novel AI-enhanced computational approaches that advance the state-of-the-art in property prediction, process optimization, and inverse design of new materials.

Call for Papers:
This special issue solicits original research, review articles, and commentary articles. Topics of interest include, but are not limited to:

Machine learning potentials for materials science
Density functional theory with machine learning
Quantum chemistry methods with machine learning
Quantum and classical dynamics with machine learning
Quantum Monte Carlo with machine learning
Phase field with machine learning
Finite element method with machine learning
Materials property prediction with machine learning
Inverse design of new materials with machine learning
Foundation Models/Large-language Models for materials science

ICMENS 2025

Submission deadline: **Nov 10, 2024**
Conference date: **Mar 21, 2025 - Mar 24, 2025**
Full name: **2025 9th International Conference on Materials Engineering and Nano Sciences**
Location: **Fukuoka, Japan**

2025 9th International Conference on Materials Engineering and Nano Sciences (ICMENS 2025) will be held in Fukuoka, Japan during March 21-24, 2025. The conference is co-sponsored by

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Kwansei Gakuin University, Japan and Chiba University, Japan.
ICMENS conferences have been successfully held in Singapore (2017), Hong Kong (2018), Hiroshima (2019, Japan), Pattaya (2020, Thailand), Virtual (2021&2022) , Chiba University (2023, Japan) and Kwansei Gakuin University (2024, Japan), which own good publication and index history.
ICMENS sincerely welcome prospective authors worldwide to submit their original manuscripts to ICMENS 2025.

***Call for papers:**

*Conference Topics-Included but not limited to:
-Materials Engineering
Advanced Characterization
Biological Materials
Materials for Energy and Environmental Applications
Biotechnology and Life Sciences
Materials Processing
Mechanical Behavior of Materials
Computational Materials Science
Mechanical Properties and Nanomechanics
Nanotechnology
Optical and Photonic Materials
Economics of Materials
Optoelectronics
Electrochemistry
-Nano Sciences
Nanotechnology and Materials Sciences
Nanooptics and Nanophotonics
Materials Science and Engineering: Nanotechnology
Nanowires
Advanced Applications in Nanoscience and Nanotechnology
Nanofluidics
Carbon Nanotubes and Biomolecules
Nanobiotechnology
Nanomaterials
Nanoscale Science and Technology

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ICMIM 2025

Submission deadline: **Feb 10, 2025**
Conference date: **Jun 30, 2025 - Jul 2, 2025**
Full name: **2025 The 7th International Conference on Materials and Intelligent Manufacturing**
Location: **Singapore**

2025 The 7th International Conference on Materials and Intelligent Manufacturing (ICMIM 2025) will be held in Singapore during June 30-July 2, 2025. ICMIM 2025 will gather leading scholars, researchers and industry people to discuss topics about the mainstream developing trend, materials and intelligent manufacturing.

New material technology is one of the significant symbols of today's high-tech revolution. Most of the high-tech development is on the premise of the breakthrough of new materials technology. Material is the foundation of strategic emerging industries. It plays an important role in the high-tech industry and it is the impetus of promoting technological progress. Every major technology development and successful development of new products is inseparable from the discovery and application of new materials. And in order for new material to get the actual application, exquisite preparation and manufacturing must be processed. No doubt manufacturing is critical in every walk of life. With rapid development computer technology, communications technology and network technology, traditional manufacturing process has evolved to intelligent manufacturing which is more intelligent, more precision and more efficiency.

Topics of interest

- Materials Processing Technology and Materials Science
- Design and Manufacturing Systems
- Superconducting Materials
- Materials Testing and Evaluation
- Building Materials
- Energy Materials
- Composite
- System Analysis and Industrial Engineering
- Production and Operation Management

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