Science Newsletter

2023 Volume 9 (Total 45) *Website:http://lib.jsut.edu.cn/2018/1015/c5474a113860/page.htm*
November, 2023

Contents

Editor: Chaoyi Chu（褚朝奕） TEL: 3548 Email: ccy@jsut.edu.cn

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/2018/1015/c5474a113860/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 **Environment**:
We post several papers which are related to the top concerned topics in researches on environment. The papers are classified in 5 categories, and they are: **Energy storage systems, Water Pollution, Industrial Water Treatment, Environmental Impact Assessment,** and **Desertification**. Also, the listed papers are all arranged in a descending sort of JCR impact factor, and there are also accesses right after each abstract of papers.

ENERGY STORAGE SYSTEMS

Angew Chem Int Ed Engl (impact factor: 16.6) 1 区 TOP

Converting Waste Plastic to Liquid Organic Hydrogen Carriers.

Soltani, Rorrer, et. al

Abstract:
The accumulation of waste plastics in landfills and the environment, as well as the contribution of plastics manufacturing to global warming, call for the development of new technologies that would enable circularity for synthetic polymers. Thus far, emerging approaches for chemical recycling of plastics have largely focused on producing fuels, lubricants, and/or monomers. In a recent study, Junde Wei and

colleagues demonstrated a new catalytic system capable of converting oxygen-containing aromatic plastic waste into liquid organic hydrogen carriers (LOHCs), which can be used for hydrogen storage. The authors utilized Ru-ReOx /SiO2 materials with zeolite HZSM-5 as a co-catalyst for the direct hydrodeoxygenation (HDO) of oxygen-containing aromatic plastic wastes that yield cycloalkanes as LOHCs with a theoretical hydrogen capacity of ≈ 5.74 wt % under mild reaction conditions. Subsequent efficiency and stability tests of cycloalkane dehydrogenation over Pt/Al2 O3 validated that the HDO products can serve as LOHCs to generate H2 gas. Overall, their approach not only opens doors to alleviating the severe burden of plastic waste globally, but also offers a way to generate clean energy and ease the challenges associated with hydrogen storage and transportation.

Proc Natl Acad Sci U S A (impact factor: 11.1) 1 区 TOP

Electrochemical interfacial catalysis in Co-based battery electrodes involving spin-polarized electron transfer.

Zuo, Zhang, et. al

Abstract:

Interfacial catalysis occurs ubiquitously in electrochemical systems, such as batteries, fuel cells, and photocatalytic devices. Frequently, in such a system, the electrode material evolves dynamically at different operating voltages, and this electrochemically driven transformation usually dictates the catalytic reactivity of the material and ultimately the electrochemical performance of the device. Despite the importance of the process, comprehension of the underlying structural and compositional evolutions of the electrode material with direct visualization and quantification is still a significant challenge. In this work, we demonstrate a protocol for studying the dynamic evolution of the electrode material under electrochemical processes by integrating microscopic and spectroscopic analyses, operando magnetometry techniques, and density functional theory calculations. The presented methodology provides a real-time picture of the chemical, physical, and electronic structures of the material and its link to the electrochemical performance. Using Co(OH)2 as a prototype battery electrode and by monitoring the Co metal center under different applied voltages, we show that before a well-known catalytic reaction proceeds, an interfacial storage process occurs at the metallic Co nanoparticles/LiOH interface due to injection of spin-polarized electrons. Subsequently, the metallic Co nanoparticles act as catalytic activation centers and promote LiOH decomposition by transferring these interfacially residing electrons. Most intriguingly, at the LiOH decomposition potential, electronic structure of the metallic Co nanoparticles involving spin-polarized electrons transfer has been shown to exhibit a dynamic variation. This work illustrates a viable approach to access key information inside interfacial catalytic processes and provides useful insights in controlling complex interfaces for wide-ranging electrochemical systems.

Nano Lett (impact factor: 10.8) 1 区 TOP

Toward Ultrastable Metal Anode/Li6PS5Cl Interface via an Interlayer as Li Reservoir.

Lu, Zhang, He, et. al

Abstract:
All-solid-state sulfide-based Li metal batteries are promising candidates for energy storage systems. However, thorny issues associated with undesired reactions and contact failure at the anode interface hinder their commercialization. Herein, an indium foil was endowed with a formed interlayer whose surface film is enriched with LiF and LiIn phases via a feasible prelithiation route. The lithiated alloy of the interlayer can regulate Li+ flux and charge distribution as a Li reservoir, benefiting uniform Li deposition. Meanwhile, it can suppress the reductive decomposition of the Li6PS5Cl electrolyte and maintain sufficient solid-solid contact. In situ impedance spectra reveal that constant interface impedance and fast charge transfer are realized by the interlayer. Further, long-term Li stripping/plating over 2000 h at 2.55 mA cm-2 is demonstrated by this anode. All-solid-state cells employing a LiCoO2 cathode and the Pre In anode can work for over 700 cycles with a capacity retention of 96.15% at 0.5 C.

WATER POLLUTION

Water Res (impact factor: 12.8) 1 区 TOP

Self-cleaning foulant attachment on near-infrared responsive photocatalytic membrane for continuous dynamic removing antibiotics in sewage effluent environment.

Song, Meng, et. al

Abstract:
Bifunctional photocatalytic nanofiltration (PNF) membrane has become a reliable frontier technique for removing refractory organic micropollutants. However, the active mitigated fouling mechanism from the microscopic perspective during its long-term operation of purifying real micro-polluted water is rarely studied. Herein, with an integrated use of QSense Explorer and confocal laser scanning microscope techniques, self-cleaning foulant attachment on an activated and customized near-infrared responsive polymeric PNF (termed as nPNF) membrane with good service performance for continuous dynamic removing antibiotics in sewage effluent environment was firstly elucidated. Time-dependent changes in dissipation oscillation frequency, sensed mass and the visualized foulant spatial distribution all indicated that there were only sporadic foulant attachment, an extremely low fouling layer thickness

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and irreversible fouling rate on/of the activated nPNF membrane top surface, thereby endowing it with excellent self-cleaning characteristic. This is probably because the reactive oxygen species (mainly •O2- and •OH) concurrently destroys the integrity of fouling layer and its internal adhesion structure, transforming part of the irreversible fouling on nPNF membrane surface into reversible one that is easy to wash off. These new horizons provided useful insight on the fate of selected antibiotics in the to-be-removed stage and self-cleaning foulant attachment of PNF membrane.

Sci Total Environ (impact factor: 9.8) 2 ☒ TOP

Measurement and influencing factors of carbon emission efficiency based on the dual perspectives of water pollution and carbon neutrality.

Jiang, Li, et al

Abstract:

The achievement of the 'Carbon Dioxide Removal' vision has become a crucial strategic objective for national development. However, the carbon emissions produced during wastewater treatment processes hinder the attainment of the 'Carbon Dioxide Removal' targets. Addressing water pollution is not only essential for achieving the goal of 'carbon dioxide removal' but also for enhancing the carbon emission efficiency (CEE). In order to evaluate the CEE of five provinces in the Northwest of a certain developing country in East Asia from 2011 to 2020, this paper proposes a new method that calls the super-efficiency SBM model with unexpected output. Then, the study also analyzes the temporal and spatial evolution characteristics by generating kernel density curves. Furthermore, the Tobit panel regression model is used to examine the factors that influence CEE and analyze the internal mechanisms and reasons behind these factors. Finally, a tailored treatment policy is suggested based on the local water pollution situation. The results show that: Zhifang and Panpan (2023) (1) The CEE of the entire study area exhibited a consistent upward trend over time. By the conclusion of the study period, the efficiency value had not yet reached 1. Xihua et al. (2023) (2) Based on the year 2015 as a turning point, the overall gap in CEE of researched areas shows a tendency of first narrowing and then gradually widening. Wei et al. (2023) (3) The level of economic development, industrial structure, and green innovative technology are positively correlated with CEE. Conversely, there is an inverse relationship between CEE and the level of urbanization and energy consumption. Through the research conclusion and the reality of water pollution, the policy suggestions to improve the efficiency of urban carbon emission.

Sci Total Environ (impact factor: 9.8) 2 ☒ TOP

A systematic review of pharmaceutical and personal care products as emerging contaminants in waters: The panorama of West Africa.

Cangola, Abagale, et. al

Abstract:
Pharmaceutical and Personal Care Products (PPCPs) are widely used to prevent or treat human and animal diseases, thereby improving the quality of daily life. Poor management of post-consumer products is recognized worldwide, as they negatively affect the ecosystems where they are discharged. The first action to prevent negative impacts is the state of knowledge regarding their occurrence. This paper critically reports the panorama of West Africa in terms of PPCPs occurrence in different water sources. To achieve this objective, a systematic review was conducted on PPCPs in West Africa following the PRISMA guidelines. Databases, including African Journals Online, PubMed, Google Scholar, Scopus, and Dimensions, were used for this search. Thirty-five articles, representing 58 % of West African countries, were selected according to the inclusion and exclusion criteria. Of these articles, one included data from multiple West African countries, while the remaining 34 exclusively focused on Benin, Cameroon, Ghana, and Nigeria. The results revealed a variety of PPCPs investigated, about 27 groups and 112 compounds, with greater emphasis on antibiotics, analgesics and PSHXEs. HPLC was the predominant analytical method used, resulting in total concentrations of PPCPs in the range of 200,000 to 3,200,000 ng/L in drinking water, 12 to 700,000 ng/L in groundwater, 0.42 to 107,800,000 ng/L in surface water, 8.5 to 121,310,000 ng/L in wastewater, and 440 to 421,700 ng/L in tap water. Ghana, Nigeria and Cameroon reported the highest number of PPCPs investigated and consequently the highest concentration of cases. These compounds present a high potential ecological risk, with >50 % exceeding the risk quotient limit. Therefore, West Africa as a community needs integrated approaches and strategies to monitor water, especially transboundary resources. This review is timely and provides pertinent information to policymakers and researchers on PPCPs in water.

INDUSTRIAL WATER TREATMENT

Sci Total Environ (impact factor: 9.8) 2 ☒ TOP

Molecular-level insights into the transformation and degradation pathways of dissolved organic matter during full-scale swine wastewater treatment.

Li, Ai, et. al

Abstract:
The rapid development of swine farming has resulted in the generation of a large amount of swine wastewater (SW), and dissolved organic matter (DOM) has a crucial role in determining the efficiency and safety of SW treatment. In this study, the transformation and influential mechanisms of DOM on the quality of SW effluent during full-scale SW treatment in actual engineering were systematically investigated using multispectral analysis and the Fourier transform ion cyclotron resonance mass spectrometry (FT-ICR MS) technique. The results showed that S-containing, reduced, saturated, and less aromatic molecules were preferentially removed in the C-AF, while C-S preferentially removed reduced, unsaturated, and aromatic molecules, as well as molecules with large molecular weights. And in the two-stage A/O, the degradation of organic matter and DOM transformation occurred mainly in the A/O-1, with the A/O-2 acting as a supplement to further enhance the humification of DOM. Furthermore, the AOP preferentially removed lignin-like and highly unsaturated compounds, replacing them with a new generation of substances such as proteins and tannins with low aromaticity and unsaturation. More deeply, oxygen addition reactions dominate in both A/O and AOP. Specifically, the most common types of reactions in the A/O were the corresponding potential precursor-product pairs based on methyl to carboxylic acid (-H2 + O2) and alcohol to carboxylic acid (-H2 + O), while tri-hydroxylation (+O3) and di-hydroxylation (+H2O2) reactions were predominant in the AOP. Finally, the study's findings might suggest improving the actual engineering by prioritizing the AOP before the A/O-2 and using the C-S for safeguard treatment of the A/O-2 effluent. It is reliable that this kind of adjustment guarantees safe drainage indications and raises each process unit's efficiency in purifying.

ACS Appl Mater Interfaces (impact factor: 9.5) 2 区 TOP

Anti-Inflammatory Artificial Extracellular Vesicles with Notable Inhibition of Particulate Matter-Induced Skin Inflammation and Barrier Function Impairment.

Park, Lim, et. al

Abstract:
Particulate matter (PM) exposure disrupts the skin barrier, causing cutaneous inflammation that may eventually contribute to the development of various skin diseases. Herein, we introduce anti-inflammatory artificial extracellular vesicles (AEVs) fabricated through cell extrusion using the biosurfactant PEGylated mannosylerythritol lipid (P-MEL), hereafter named AEVP-MEL. The P-MEL has anti-inflammatory abilities with demonstrated efficacy in inhibiting the secretion of pro-inflammatory mediators. Mechanistically, AEVP-MEL enhanced anti-inflammatory response by inhibiting the mitogen-activated protein kinase (MAPK) pathway and decreasing the release of inflammatory mediators such as reactive oxygen species

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(ROS), cyclooxygenase-2 (COX-2), and pro-inflammatory cytokines in human keratinocytes. Moreover, AEVP-MEL promoted increased expression levels of skin barrier proteins (e.g., involucrin, IVL) and water-proteins (e.g., aquaporin 3, AQP3). In vivo studies revealed that repeated PM exposure to intact skin resulted in cutaneous inflammatory responses, including increased skin thickness (hyperkeratosis) and mast cell infiltration. Importantly, our data showed that the AEVP-MEL treatment significantly restored immune homeostasis in the skin affected by PM-induced inflammation and enhanced the intrinsic skin barrier function. This study highlights the potential of the AEVP-MEL in promoting skin health against PM exposure and its promising implications for the prevention and treatment of PM-related skin disorders.

Environ Pollut (impact factor: 8.9) 2 区 TOP

High-throughput experimentation for photocatalytic water purification in practical environments.

Yanagiyama, Takimoto, et. al

Abstract:

High-throughput screening instrument was developed for photocatalytic water purification, enabling the simultaneous testing of 132 photocatalytic reactions under uniform visible light irradiation, temperature control, and stirring. The instrument was used to investigate the effects of different catalysts (TiO2, ZnO, α-Fe2O3) and environmental waters (seawater, urban wastewater, and industrial wastewater) on dye degradation. It was observed environmental ions, particularly carbonate and phosphate ions, significantly reduced catalyst activity by inhibiting the adsorption of dye molecules. To develop effective catalysts for dye degradation in industrial wastewater, 15 types of noble metal nanoparticles (NPs) were supported on photocatalysts. The study found that noble metal NPs with high work functions and oxidation resistance, such as Au and Pt, exhibited higher activity even in the industrial wastewater, likely converting environmental ions into active species. These findings, based on 432 test results, demonstrate the effectiveness of the developed high-throughput screening instrument for optimizing photocatalytic water purification.

Proc Natl Acad Sci U S A (impact factor: 11.1) 1 区 TOP

The weekly cycle of photosynthesis in Europe reveals the negative impact of particulate pollution on ecosystem productivity.

He, Rosa, et. al

Abstract

Aerosols can affect photosynthesis through radiative perturbations such as scattering and absorbing solar radiation. This biophysical impact has been widely studied using field measurements, but the sign and magnitude at continental scales remain uncertain. Solar-induced fluorescence (SIF), emitted by chlorophyll, strongly correlates with photosynthesis. With recent advancements in Earth observation satellites, we leverage SIF observations from the Tropospheric Monitoring Instrument (TROPOMI) with unprecedented spatial resolution and near-daily global coverage, to investigate the impact of aerosols on photosynthesis. Our analysis reveals that on weekends when there is more plant-available sunlight due to less particulate pollution, 64% of regions across Europe show increased SIF, indicating more photosynthesis. Moreover, we find a widespread negative relationship between SIF and aerosol loading across Europe. This suggests the possible reduction in photosynthesis as aerosol levels increase, particularly in ecosystems limited by light availability. By considering two plausible scenarios of improved air quality-reducing aerosol levels to the weekly minimum 3-d values and levels observed during the COVID-19 period-we estimate a potential of 41 to 50 Mt net additional annual CO2 uptake by terrestrial ecosystems in Europe. This work assesses human impacts on photosynthesis via aerosol pollution at continental scales using satellite observations. Our results highlight i) the use of spatiotemporal variations in satellite SIF to estimate the human impacts on photosynthesis and ii) the potential of reducing particulate pollution to enhance ecosystem productivity.

Food Chem (impact factor: 8.8) 2 区 TOP

Novel competitive electrochemical impedance biosensor for the ultrasensitive detection of umami substances based on Pd/Cu-TCPP(Fe).

Kong, Hong, et. al

Abstract

The development of biosensors capable of assessing umami intensity has elicited significant attention. However, the detection range of these biosensors is constrained by the sensing components and strategies used. In this study, we introduce a novel competitive, ultra-high-sensitivity impedance biosensor by utilizing composite

nanomaterials and T1R1 as a composite signal probe. Pd/Cu-TCPP(Fe) had a substantial surface area, effectively enhancing the loading capacity of the T1R1 and thus augmenting the biosensor's recognition precision. Furthermore, the Pd/Cu-TCPP(Fe) elevated peroxidase-like activity catalyzed the formation of insoluble precipitates of 4-chloro-1-naphthol (4-CN), resulting in cascaded amplification of the impedance signal. The remarkable catalytic activity of the composite signal probe endowed the biosensor with exceptional analytical performance, featuring a limit of detection (LOD) of 0.86 pg/mL and a linear detection range spanning from 10 to 10,000 pg/mL. Successful application of the biosensor for umami detection in fish was demonstrated, signifying its substantial potential in food-flavor evaluation.

Acad Med (impact factor: 7.4) 2 区 TOP

Transition to Residency: National Study of Factors Contributing to Variability in Learner Milestones Ratings in Emergency Medicine and Family Medicine.

Park, Ryan, et. al

Abstract

The developmental trajectory of learning during residency may be attributed to multiple factors, including variation in individual trainee performance, program-level factors, graduating medical school effects, and the learning environment. Understanding the relationship between medical school and learner performance during residency is important in prioritizing undergraduate curricular strategies and educational approaches for effective transition to residency and postgraduate training. This study explores factors contributing to longitudinal and developmental variability in resident Milestones ratings, focusing on variability due to graduating medical school, training program, and learners using national cohort data from emergency medicine (EM) and family medicine (FM).Data from programs with residents entering training in July 2016 were used (EM: n=1,645 residents, 178 residency programs; FM: n=3,997 residents, 487 residency programs). Descriptive statistics were used to examine data trends. Cross-classified mixed-effects regression were used to decompose variance components in Milestones ratings.During postgraduate year (PGY)-1, graduating medical school accounted for 5% and 6% of the variability in Milestones ratings, decreasing to 2% and 5% by PGY-3 for EM and FM, respectively. Residency program accounted for substantial variability during PGY-1 (EM=70%, FM=53%) but decreased during PGY-3 (EM=62%, FM=44%), with greater variability across training period in patient care (PC), medical knowledge (MK), and systems-based practice (SBP). Learner variance increased significantly between PGY-1 (EM=23%, FM=34%) and PGY-3 (EM=34%, FM=44%), with greater variability in practice-based learning and improvement (PBLI), professionalism (PROF), and interpersonal communication skills (ICS).The greatest variance in Milestone ratings can be attributed to the residency program and to a lesser degree, learners, and medical school. The dynamic impact of

program-level factors on learners shifts during the first year and across the duration of residency training, highlighting the influence of curricular, instructional, and programmatic factors on resident performance throughout residency.

DESERTIFICATION

Sci Total Environ (impact factor: 9.8) 2 区 TOP

How do environmental flows impact on water availability under climate change scenarios in European basins?

Bianucci, Sordo-Ward, et. al

Abstract

Environmental flows (Qeco) facilitate a good ecological status of fluvial ecosystems, but they usually represent a constraint for water uses. Qeco flow regime should not only be based on the minimum flows, but it should also account their variability. It is expected that climate change impact on some hydrological systems diminishing the natural water resources and stressing the river ecosystems. In this context, the balance between ecosystems conservation and human water needs becomes even more difficult to manage. We performed a comprehensive analysis over European territory to assess the behaviour of basins regarding different criteria for environmental flow determination under climate change scenarios. We used a water allocation model, WAAPA, to estimate the water availability (WA). In this study, WA represents the maximum demand that can be supplied at a certain point of the river network with a given reliability criteria, considering drinking and irrigation water supply. We considered two methods for calculating Qeco, Qeco1 based on mean monthly flow (MMF) and Qeco2 based on mean annual runoff (MAF). We analyzed the current scenario (historical from 1960 to 2000) and 40 future projections, which combine short and long term (from 2020 to 2059, and from 2060 to 2099, respectively), four emission scenarios (RCP2.6 to RCP8.5) and five climate models. Expected changes on MAF due to climate change are not uniform through Europe and also vary regarding the specific climate scenario. >70 % of basins show a trend to reduce their MAF under severe emission scenarios. Conservative values of Qeco represent a heavy constraint for WA and stress the water systems similarly than climate change impacts. The study also highlights that regulation capacity helps on buffering the effects of both climate change and environmental requirements. This study provides a good insight for understanding basin response in terms of WA, regarding environmental criteria and climate change effects.

Sci Total Environ (impact factor: 9.8) 2 ☒ TOP

The impact of human activities on blue-green water resources and quantification of water resource scarcity in the Yangtze River Basin.

Wu, Yang, et. al

Abstract:

Under the influence of climate change and human activities, water scarcity and uneven spatial distribution have become critical factors constraining societal development and threatening ecological security. Accurately assessing changes in blue and green water resources (BW and GW) caused by human activities can reveal the actual situation of water scarcity. However, previous research often overlooked the calibration of GW and human water usage, and it rarely delved into the primary human factors leading to water scarcity and potential impact mechanisms. Therefore, based on the PCR-GLOBWB model that considers human impacts, and with reasonable calibration of B/GW and human water usage, hydrological processes were simulated under both human-influenced and natural conditions. A comprehensive assessment of the impact of human activities on BW and GW was conducted. The results show that: (1) BW and GW exhibit a spatial pattern of increasing from northwest to southeast in the basin. From 1961 to 2020, the proportion of BW showed an upward trend, while GW was decreasing; (2) The impact of human activities on changes in water resources is mainly concentrated in the midstream and dowmstream of the basin. Due to human influences, the green water flow (GWF) increased by 3-24.4 mm, and the BW volume increased by 67.2-146.4 mm. However, the green water storage (GWS) decreased by 5.6-75.4 mm; (3) The impact of human activities on blue water scarcity (BWscarcity) is significantly greater than green water scarcity (GWscarcity). The worsening of GWscarcity does not exceed 0.2, while areas where BW reaches significant deterioration (BWscarcity > 1.5) account for 1.3 %, 9.8 %, and 17 % of the upstream, midstream and downstream, respectively. (4) Irrigation activities are the main factor causing water resource scarcity. In the future, it is important to reasonably develop the potential for GW utilization and optimize BW management measures to address water resource crises.

Plant Biotechnol J (impact factor: 13.8) 1 ☒ TOP

Allelic variations of WAK106-E2Fa-DPb1-UGT74E2 module regulate fibre properties in Populus tomentosa.

Wang, Quan, et. al

Abstract:

Wood formation, intricately linked to the carbohydrate metabolism pathway, underpins the capacity of trees to produce renewable resources and offer vital ecosystem services. Despite their importance, the genetic regulatory mechanisms governing wood fibre properties in woody plants remain enigmatic. In this study, we identified a pivotal

module comprising 158 high-priority core genes implicated in wood formation, drawing upon tissue-specific gene expression profiles from 22 Populus samples. Initially, we conducted a module-based association study in a natural population of 435 Populus tomentosa, pinpointing PtoDPb1 as the key gene contributing to wood formation through the carbohydrate metabolic pathway. Overexpressing PtoDPb1 led to a 52.91% surge in cellulose content, a reduction of 14.34% in fibre length, and an increment of 38.21% in fibre width in transgenic poplar. Moreover, by integrating co-expression patterns, RNA-sequencing analysis, and expression quantitative trait nucleotide (eQTN) mapping, we identified a PtoDPb1-mediated genetic module of PtoWAK106-PtoDPb1-PtoE2Fa-PtoUGT74E2 responsible for fibre properties in Populus. Additionally, we discovered the two PtoDPb1 haplotypes that influenced protein interaction efficiency between PtoE2Fa-PtoDPb1 and PtoDPb1-PtoWAK106, respectively. The transcriptional activation activity of the PtoE2Fa-PtoDPb1 haplotype-1 complex on the promoter of PtoUGT74E2 surpassed that of the PtoE2Fa-PtoDPb1 haplotype-2 complex. Taken together, our findings provide novel insights into the regulatory mechanisms of fibre properties in Populus, orchestrated by PtoDPb1, and offer a practical module for expediting genetic breeding in woody plants via molecular design.

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Ⅱ Concentration

PHYSICS

Quantum control of trapped polyatomic molecules for eEDM searches

Loïc Anderegg, Nathaniel B. Vilas, et al.

Abstract

Ultracold polyatomic molecules are promising candidates for experiments in quantum science and precision searches for physics beyond the Standard Model. A key requirement is the ability to achieve full quantum control over the internal structure of the molecules. In this work, we established coherent control of individual quantum states in calcium monohydroxide (CaOH) and demonstrated a method for searching for the electron electric dipole moment (eEDM). Optically trapped, ultracold CaOH molecules were prepared in a single quantum state, polarized in an electric field, and coherently transferred into an eEDM-sensitive state where an electron spin precession measurement was performed. To extend the coherence time, we used eEDM-sensitive states with tunable, near-zero magnetic field sensitivity. Our results establish a path for eEDM searches with trapped polyatomic molecules.

A quantum ruler for orbital magnetism in moiré quantum matter

： M. R. Slot, Y. Maximenko, et al.

Abstract

For almost a century, magnetic oscillations have been a powerful “quantum ruler” for measuring Fermi surface topology. In this study, we used Landau-level spectroscopy to unravel the energy-resolved valley-contrasting orbital magnetism and large orbital magnetic susceptibility that contribute to the energies of Landau levels of twisted double-bilayer graphene. These orbital magnetism effects led to substantial deviations from the standard Onsager relation, which manifested as a breakdown in scaling of Landau-level orbits. These substantial magnetic responses emerged from the nontrivial quantum geometry of the electronic structure and the large length scale of the moiré lattice potential. Going beyond traditional measurements, Landau-level spectroscopy performed with a scanning tunneling microscope offers a complete quantum ruler that resolves the full energy dependence of orbital magnetic properties in moiré quantum matter.

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Transonic dislocation propagation in diamond

Kento Katagiri, Tatiana Pikuz., et al.

Abstract

The motion of line defects (dislocations) has been studied for more than 60 years, but the maximum speed at which they can move is unresolved. Recent models and atomistic simulations predict the existence of a limiting velocity of dislocation motion between the transonic and subsonic ranges at which the self-energy of dislocation diverges, though they do not deny the possibility of the transonic dislocations. We used femtosecond x-ray radiography to track ultrafast dislocation motion in shock-compressed single-crystal diamond. By visualizing stacking faults extending faster than the slowest sound wave speed of diamond, we show the evidence of partial dislocations at their leading edge moving transonically. Understanding the upper limit of dislocation mobility in crystals is essential to accurately model, predict, and control the mechanical properties of materials under extreme conditions.

MATERIALS

A solution-processed radiative cooling glass

Xinpeng Zhao, Tangyuan Li, et al.

Abstract

Passive daytime radiative cooling materials could reduce the energy needed for building cooling up to 60% by reflecting sunlight and emitting long-wave infrared (LWIR) radiation into the cold Universe (~3 kelvin). However, developing passive cooling structures that are both practical to manufacture and apply while also displaying long-term environmental stability is challenging. We developed a randomized photonic composite consisting of a microporous glass framework that features selective LWIR emission along with relatively high solar reflectance and aluminum oxide particles that strongly scatter sunlight and prevent densification of the porous structure during manufacturing. This microporous glass coating enables a temperature drop of ~3.5° and 4°C even under high-humidity conditions (up to 80%) during midday and nighttime, respectively. This radiative "cooling glass" coating maintains high solar reflectance even when exposed to harsh conditions, including water, ultraviolet radiation, soiling, and high temperatures.

Hierarchically structured passive radiative cooling ceramic with high solar reflectivity

Kaixin Lin, Siru Chen, et al.

Abstract

Passive radiative cooling using nanophotonic structures is limited by its high cost and poor compatibility with existing end uses, whereas polymeric photonic alternatives lack weather resistance and effective solar reflection. We developed a cellular ceramic that can achieve highly efficient light scattering and a near-perfect solar reflectivity of 99.6%. These qualities, coupled with high thermal emissivity, allow the ceramic to provide continuous subambient cooling in an outdoor setting with a cooling power of >130 watts per square meter at noon, demonstrating energy-saving potential on a worldwide scale. The color, weather resistance, mechanical robustness, and ability to depress the Leidenfrost effect are key features ensuring the durable and versatile nature of the cooling ceramic, thereby facilitating its commercialization in various applications, particularly building construction.

Large effective magnetic fields from chiral phonons in rare-earth halides

Jiaming Luo, Tong Lin, et al.

Abstract

Time-reversal symmetry (TRS) is pivotal for materials' optical, magnetic, topological, and transport properties. Chiral phonons, characterized by atoms rotating unidirectionally around their equilibrium positions, generate dynamic lattice structures that break TRS. Here, we report that coherent chiral phonons, driven by circularly polarized terahertz light pulses, polarize the paramagnetic spins in cerium fluoride in a manner similar to that of a quasi-static magnetic field on the order of 1 tesla. Through time-resolved Faraday rotation and Kerr ellipticity, we found that the transient magnetization is only excited by pulses resonant with phonons, proportional to the angular momentum of the phonons, and growing with magnetic susceptibility at cryogenic temperatures. The observation quantitatively agrees with our spin-phonon coupling model and may enable new routes to investigating ultrafast magnetism, energy-efficient spintronics, and nonequilibrium phases of matter with broken TRS.

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Observing the primary steps of ion solvation in helium droplets

Albrechtsen, Simon H., et. al

Abstract

Solvation is a ubiquitous phenomenon in the natural sciences. At the macroscopic level, it is well understood through thermodynamics and chemical reaction kinetics1,2. At the atomic level, the primary steps of solvation are the attraction and binding of individual molecules or atoms of a solvent to molecules or ions of a solute1. These steps have, however, never been observed in real time. Here we instantly create a single sodium ion at the surface of a liquid helium nanodroplet3,4, and measure the number of solvent atoms that successively attach to the ion as a function of time. We found that the binding dynamics of the first five helium atoms is well described by a Poissonian process with a binding rate of 2.0 atoms per picosecond. This rate is consistent with time-dependent density-functional-theory simulations of the solvation process. Furthermore, our measurements enable an estimate of the energy removed from the region around the sodium ion as a function of time, revealing that half of the total solvation energy is dissipated after four picoseconds. Our experimental method opens possibilities for benchmarking theoretical models of ion solvation and for time-resolved measurements of cation–molecule complex formation.

A crystalline doubly oxidized carbene

Loh, Ying Kai, et. al

Abstract

The chemistry of carbon is governed by the octet rule, which refers to its tendency to have eight electrons in its valence shell. However, a few exceptions do exist, for example, the trityl radical ($Ph_3C\cdot$) (ref. [1]) and carbocation (Ph_3C^+) (ref. [2]) with seven and six valence electrons, respectively, and carbenes (R_2C:)—two-coordinate octet-defying species with formally six valence electrons[3]. Carbenes are now powerful tools in chemistry, and have even found applications in material and medicinal sciences[4]. Can we undress the carbene further by removing its non-bonding electrons? Here we describe the synthesis of a crystalline doubly oxidized carbene (R_2C^{2+}), through a two-electron oxidation/oxide-ion abstraction sequence from an electron-rich carbene[5]. Despite a cumulenic structure and strong delocalization of the positive charges, the dicoordinate carbon centre maintains significant electrophilicity, and possesses two accessible vacant orbitals. A two-electron reduction/deprotonation sequence regenerates the parent carbene, fully consistent with its description as a doubly oxidized carbene. This work demonstrates that the use of bulky strong electron-donor

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substituents can simultaneously impart electronic stabilization and steric protection to both vacant orbitals on the central carbon atom, paving the way for the isolation of a variety of doubly oxidized carbenes.

Quinone-mediated hydrogen anode for non-aqueous reductive electrosynthesis

Twilton, Jack, et. al

Abstract

Electrochemical synthesis can provide more sustainable routes to industrial chemicals[1,2,3]. Electrosynthetic oxidations may often be performed 'reagent-free', generating hydrogen (H_2) derived from the substrate as the sole by-product at the counter electrode. Electrosynthetic reductions, however, require an external source of electrons. Sacrificial metal anodes are commonly used for small-scale applications[4], but more sustainable options are needed at larger scale. Anodic water oxidation is an especially appealing option[1,5,6], but many reductions require anhydrous, air-free reaction conditions. In such cases, H_2 represents an ideal alternative, motivating the growing interest in the electrochemical hydrogen oxidation reaction (HOR) under non-aqueous conditions[7,8,9,10,11,12]. Here we report a mediated H_2 anode that achieves indirect electrochemical oxidation of H_2 by pairing thermal catalytic hydrogenation of an anthraquinone mediator with electrochemical oxidation of the anthrahydroquinone. This quinone-mediated H_2 anode is used to support nickel-catalysed cross-electrophile coupling (XEC), a reaction class gaining widespread adoption in the pharmaceutical industry[13,14,15]. Initial validation of this method in small-scale batch reactions is followed by adaptation to a recirculating flow reactor that enables hectogram-scale synthesis of a pharmaceutical intermediate. The mediated H_2 anode technology disclosed here offers a general strategy to support H_2-driven electrosynthetic reductions.

BIOLOGY

Open science discovery of potent noncovalent SARS-CoV-2 main protease inhibitors

Melissa L. Boby, Daren Fearon, et al.

Abstract

We report the results of the COVID Moonshot, a fully open-science, crowdsourced, and structure-enabled drug discovery campaign targeting the severe acute respiratory

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syndrome coronavirus 2 (SARS-CoV-2) main protease. We discovered a noncovalent, nonpeptidic inhibitor scaffold with lead-like properties that is differentiated from current main protease inhibitors. Our approach leveraged crowdsourcing, machine learning, exascale molecular simulations, and high-throughput structural biology and chemistry. We generated a detailed map of the structural plasticity of the SARS-CoV-2 main protease, extensive structure-activity relationships for multiple chemotypes, and a wealth of biochemical activity data. All compound designs (>18,000 designs), crystallographic data (>490 ligand-bound x-ray structures), assay data (>10,000 measurements), and synthesized molecules (>2400 compounds) for this campaign were shared rapidly and openly, creating a rich, open, and intellectual property–free knowledge base for future anticoronavirus drug discovery.

Aster-dependent nonvesicular transport facilitates dietary cholesterol uptake

Alessandra Ferrari, Emily Whang, et. al

Abstract

Intestinal absorption is an important contributor to systemic cholesterol homeostasis. Niemann-Pick C1 Like 1 (NPC1L1) assists in the initial step of dietary cholesterol uptake, but how cholesterol moves downstream of NPC1L1 is unknown. We show that Aster-B and Aster-C are critical for nonvesicular cholesterol movement in enterocytes. Loss of NPC1L1 diminishes accessible plasma membrane (PM) cholesterol and abolishes Aster recruitment to the intestinal brush border. Enterocytes lacking Asters accumulate PM cholesterol and show endoplasmic reticulum cholesterol depletion. Aster-deficient mice have impaired cholesterol absorption and are protected against diet-induced hypercholesterolemia. Finally, the Aster pathway can be targeted with a small-molecule inhibitor to manipulate cholesterol uptake. These findings identify the Aster pathway as a physiologically important and pharmacologically tractable node in dietary lipid absorption.

Rapid bacteria-phage coevolution drives the emergence of multiscale networks

Joshua M. Borin, Justin J. Lee, et. al

Abstract

Interactions between species catalyze the evolution of multiscale ecological networks, including both nested and modular elements that regulate the function of diverse communities. One common assumption is that such complex pattern formation requires spatial isolation or long evolutionary timescales. We show that multiscale network structure can evolve rapidly under simple ecological conditions without spatial

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structure. In just 21 days of laboratory coevolution, Escherichia coli and bacteriophage Φ21 coevolve and diversify to form elaborate cross-infection networks. By measuring ~10,000 phage-bacteria infections and testing the genetic basis of interactions, we identify the mechanisms that create each component of the multiscale pattern. Our results demonstrate how multiscale networks evolve in parasite-host systems, illustrating Darwin's idea that simple adaptive processes can generate entangled banks of ecological interactions.

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Ⅲ Calling for papers

ICEEA 2024

Submission deadline:	**Nov 30, 2023**
Conference date:	**Apr 24, 2024 - Apr 26, 2024**
Full name:	**International Conference on Environmental Engineering and Applications**
Location:	**Madrid, Spain**
Website:	http://www.iceea.org

ICEEA 2024 Shining Points:

1. For papers submitted to ICEEA 2024, after the peer reviewing process by at least 2-3 experts, all the accepted papers will be published into International Journal of Environmental Science and Development (IJESD, ISSN:2010-0264), and all accepted papers will be indexed by Scopus and included in the Chemical Abstracts Services (CAS), CABI, Ulrich Periodicals Directory, Electronic Journals Library, Crossref, ProQuest.

2. Outstanding Professors :Prof. Vincenzo Belgiorno, University of Salerno, Italy; Prof. Aysegul Tanik, Istanbul Technical University, Turkey.

3. One-day Tour will be arranged on April 26, 2024 in Madrid, Spain.

Call for papers:

Topics include, but are not limited to:

Ecosystem Management and Sustainable Development
Environmental Monitoring and Management
Water Resources Management and Water Pollution Control
Atmospheric science and air pollution control
Solid Waste Pollution Control and Resource Utilization

ACM IEEA 2024

Submission deadline:	**Nov 30, 2023**
Conference date:	**Feb 21, 2024 - Feb 23, 2024**
Full name:	**ACM--2024 The 13th International Conference on Informatics, Environment, Energy and Applications**
Location:	**Tokyo, Japan**
Website:	http://ieea.org/

The 13th International Conference on Informatics, Environment, Energy and Applications

Editor: Chaoyi Chu（褚朝奕） TEL: 3548 Email: ccy@jsut.edu.cn

(IEEA 2024) will be held in Tokyo, Japan, during February 21-23, 2024. IEEA conference is initiated by Science and Engineering Institute, USA, assisted by National University of Ireland Galway, Ireland, University of Wollongong, Australia, Tokai University, Japan, Agriculture University, China, Chulalongkorn University, Thailand and German University in Cairo, Egypt. This is the annual conference started at 2012 in Singapore, 2013 in Bali, Indonesia, 2014 in Shanghai, China, 2015 in Pattaya, Thailand, 2016 in Hong Kong, 2017 in Jeju Island, Korea, 2018 in Beijing, 2019 in Osaka, Japan, 2020 in Amsterdam, The Netherlands, 2021-2022 via online, 2023 in Singapore. On behalf of the Organizing Committee, we warmly invite you, informatics, environment, energy and applications scientist, engineer or technician, graduate student, or simply interested by the technique, to take part in this unique and innovative conference with your enthusiasm to develop, your desire to apply and your willingness to mature the informatics, environment, energy and applications.

Topics of Interest :

●Informatics and Applications
●Environmental Informatics
●Energy Informatics
For more topics, please visit: http://ieea.org/cfp.html

IC3E 2024

Submission deadline: **Nov 30, 2023**
Conference date: **Mar 29, 2024 - Mar 31, 2024**
Full name: **2024 7th International Conference on Environmental and Energy Engineering**
Location: **Chengdu**
Website: https://www.ic3e.net/

2024 7th International Conference on Environmental and Energy Engineering (IC3E 2024). IC3E 2024 conference is co-organized by Asia Pacific Institute of Science and Engineering(APISE) and International Society for Environmental Information Sciences (ISEIS). The conference will be hosted in Chengdu, China from Mar.29 to 31, 2024! It is a leading forum for researchers, practitioners, developers, and users to explore cutting-edge ideas and to exchange techniques, tools, and experiences. We invite the submission of original research contributions.

Call for Papers:

Energy and Environment
Ecology and Biodiversity Conservation
Environmental Pollution & Management
Environmental Hydraulics
Sustainable Development
Environmental Ergonomics
Air pollution from Mobile and Stationary Sources
Climate change
Noise and Acoustics
Electromagnetic Waves and Telecommunication

Hazardous Waste and Waste Treatment
Industrial Waste Treatment
Water Pollution and Treatment
Solid Waste Management
Air Pollution Control and Equipment
Pollution Prevention in Industry
Environmental Management Systems
Climate Change and Global Warming
Remote Sensing and Environment
Emissions from ICE and their Control
Green Building
Advanced Energy Technologies
Renewable Energy Sources
Solar Electricity and PV Applications
Solar cell Technology, Solar Cell materials, Testing and Efficiency
Solar Thermal Applications
Wind Energy
Hydroelectric, Geothermal, Tides and Waves
Biogas and Biomass
Hybrid Energy Systems
Integrated Energy Systems
Rural Electrification
Alternative Fuels
NG as Fuel for Rural transportation
Hydrogen and Fuel Cells
Hybrid and Electric Vehicles
Bio-diesel Fuels
Fuel Additives
Nuclear Energy: Fission and Fusion
Nuclear Energy Application: Power Generation, Desalination
Nuclear Materials and Fuels
Energy from the Space, Dark Energy
Nanotechnology applications to RE
Computational Techniques
Energy Policy, Planning & Management
Regional Issues, Economics and Policy

ICFEE 2024

Submission deadline: **Dec 15, 2023**
Conference date: **Mar 15, 2024 - Mar 17, 2024**
Full name: **2024 14th International Conference on Future Environment and Energy**
Location: **Matsue City, Japan**
Website: http://www.icfee.org/

ICFEE 2024 Shining Points:
1. ICFEE 2024 presented and registered full papers will be included in digital conference proceedings of E3S Web of Conferences (Open Access proceedings in Environment, Energy and Earth Sciences) to be sent to Scopus, CPCI (Web of Science), CAS, DOAJ, EBSCO, ProQuest and other major databases for indexing.
2. ICFEE 2023 was successfully held hybrid conference during January 13-15, 2023 in Sophia University, Japan.
3. ICFEE 2024 is sponsored by Sophia University, Tokyo, Japan
4. ICFEE 2023 accepted papers have been published into E3S Web of Conferences (Open Access proceedings in Environment, Energy and Earth Sciences) and indexed by Scopus and other major databases . Previous ICFEE papers have been successfully published and indexed.

***Call for papers:**

Water Resources Management and Water Pollution Control
Atmospheric science and air pollution control
Solid Waste Pollution Control and Resource Utilization
Ecosystem Management and Sustainable Development
Environmental Monitoring and Management
Clean and Renewable Energy
Energy Policy, Planning & Management
More topics, please go to: http://www.acmme.org/cfp.html

ICEAE 2024

Submission deadline: **Feb 23, 2024**
Conference date: **Jun 7, 2024 - Jun 9, 2024**
Full name: **14th International Conference on Environmental and Agricultural Engineering**
Location: **Bangkok, Thailand**
Website: http://www.iceae.org/

Welcome to the official website of the 2024 14th International Conference on Environmental and Agricultural Engineering (ICEAE 2024). ICEAE 2024 will be held during June 7-9, 2024 in Bangkok, Thailand. It brings together innovative academics and industrial experts in the field of Environmental and Agricultural Engineering to a common forum.

The primary goal of the conference is to promote research and developmental activities in Environmental and Agricultural Engineering. Another goal is to promote scientific information interchange between researchers, developers, engineers, students, and practitioners working in Bangkok and abroad. The conference will be held every year to make it an ideal platform for people to share views and experiences in Environmental and Agricultural Engineering and related areas.

All accepted papers of ICEAE 2024 will be published

Option A: After reviewed by both conference committess and IJESD editorial team, accepted papers will be published under International Journal of Environmental Science and Development (IJESD ISSN: 2010-0264) to be indexed by Scopus (Since 2019) and included in the Chemical Abstracts Services (CAS), CABI, Ulrich Periodicals Directory, Electronic Journals Library, Crossref, ProQuest.

Option B: Journal of Agricultural Technologies, and all papers will be included in the Ulrich's Periodicals Directory, Google Scholar, Engineering & Technology Digital Library, Crossref and Electronic Journals Digital Library.

Based on authors' needs, whose works not suitable for publication can send us the abstract and give an oral presentation during the conference.

Publication Ethics - Penalty against Plagiarism

We firmly believe that ethical conduct is the most essential virtual of any academic. Hence any act of plagiarism is a totally unacceptable academic misconduct and cannot be tolerated.

Topics of interest

Environmental sustainability
Environmental dynamics
Meteorology
Hydrology
Geophysics
Atmospheric physics
Physical oceanography
Global environmental change and ecosystems management
Ozone layer depletion
Carbon capture and storage
Biofuels
Integrated ecosystems management
Satellite applications in the environment
Habitat reconstruction
Deforestation
Wetlands
Landscape degradation and restoration
Ground water remediation
Eco-technology
Resource management
Life cycle analysis
Environmental systems approach
Renewable sources of energy-energy savings
Clean technologies
Sustainable cities
Health related organisms
Hazardous substances and detection techniques
Quality guidelines, environmental regulation and monitoring
Indoor air pollution
Water resources and river basin management
Public participation
Agricultural sustainability
Farming and natural resources
Methods for agricultural sustainability
Agricultural management practices
Sustainable intensification
Soil treatment
Soil fertility and organic farming
Plant breeding strategies
Sustainable crop systems
Modeling for agricultural sustainability
Urban planning
Climate and climatic changes
Environmental restoration and ecological engineering
Soil decontamination
Toxicity assessment and epidemiological studies
Regulatory practice, water quality objectives standard setting, water quality classification

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