Science Newsletter

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Contents

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Introduction:

There are 3 main elements in the Science Newsletter which is composed. In the first part, we list the most up to date papers about central issues for each discipline in our university, and they are provided with 5 subjects for a time. In the second part, there are papers from the top journals last month, and most of them are from Nature and Science. In the third part, we post information about calling papers for international conferences. Hopefully, some of the information in this manuscript may be useful for those who are dedicating to scientific career. Besides, the journals are also posted on the website of our library, and they are available to be accessed any time at https://lib.jsut.edu.cn/2025/0228/c5474a193334/page.htm.If there are any questions or suggestions, please send e-mails to ccy@jsut.edu.cn in no hesitate.

Ⅰ Topics

The keywords of this month is **Mechanical Enigeering**:
We post several papers which are related to the top concerned topics of researches on Mechanical Enigeering. The papers are classified in 5 categories, and they are: **Autonomous driving, Production Optimization, Mechatronics, Robotics** and **Circuits and systems**. 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.

AUTONOMOUS DRIVING

Adv Mater (impact factor: 27.4) 1 区 TOP

Guideline of Dynamic Tunnel Structural Evolution for Durable Sodium-Ion Oxide Cathodes.

Xiao, Sun, et. al

Abstract:
Mn-based oxide cathodes hold great promise for sodium-ion batteries (SIBs) due to their cost-effectiveness and environmental compatibility. In this study, using tunnel-type Na0.44MnO2 as a prototype, a systematic investigation is conducted to examine

how different element substitutions affect structural evolution and found that these element substitutions alter the total energy of the pristine system, driving the structure to evolve gradually from a tunnel to a different crystal configuration. Notably, using advanced scanning transmission electron microscopy (STEM), the transition zone is captured from tunnel to layered structure for the first time, providing direct evidence of phase evolution. Density functional theory (DFT) calculations reveal that Mg substitution uniquely facilitates the formation of layered/spinel heterostructures, enabling intimate interfacial integration that reduces Na^+ transport barriers and enhances structural integrity. COMSOL simulations further demonstrate that the layered/spinel configuration effectively mitigates stress accumulation, achieving high rate and long cycle performance. These findings provide comprehensive design principles of dynamic tunnel structural evolution of Mn-based oxide cathodes, thereby advancing the design of high-performance SIBs.

Nat Commun (impact factor: 14.7) 1 ☒

Lightweight error-tolerant edge detection using memristor-enabled stochastic computing

Lekai Song, Pengyu Liu, et. al

Abstract:

The demand for efficient edge computer vision has spurred the development of stochastic computing for image processing. Memristors, by introducing their inherent switching stochasticity into computation, readily enable stochastic image processing. Here, we present a lightweight, error-tolerant edge detection approach based on memristor-enabled stochastic computing. By integrating memristors into compact logic circuits, we realise lightweight stochastic logics for stochastic number encoding and processing with well-regulated probabilities and correlations. This stochastic and probabilistic computational nature allows the stochastic logics to perform edge detection in edge visual scenarios characterised by high-level errors. As a demonstration, we implement a hardware edge detection operator using the stochastic logics, and prove its exceptional performance with 95% less energy consumption while withstanding 50% bit-flips. The results underscore the potential of our stochastic edge detection approach for developing efficient edge visual hardware for autonomous driving, virtual and augmented reality, medical imaging diagnosis, and beyond.

Proc Natl Acad Sci U S A (impact factor: 9.4) 1 ☒ TOP

Empowering safer socially sensitive autonomous vehicles using human-plausible cognitive encoding.

Lu, Zhu, Lu, et. al

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

Abstract:
Autonomous vehicles (AVs) will soon cruise our roads as a global undertaking. Beyond completing driving tasks, AVs are expected to incorporate ethical considerations into their operation. However, a critical challenge remains. When multiple road users are involved, their impacts on AV ethical decision-making are distinct yet interrelated. Current AVs lack social sensitivity in ethical decisions, failing to enable both differentiated consideration of road users and a holistic view of their collective impact. Drawing on research in AV ethics and neuroscience, we propose a scheme based on social concern and human-plausible cognitive encoding. Specifically, we first assess the individual impact that each road user poses to the AV based on risk. Then, social concern can differentiate these impacts by weighting the risks according to road user categories. Through cognitive encoding, these independent impacts are holistically encoded into a behavioral belief, which in turn supports ethical decisions that consider the collective impact of all involved parties. A total of two thousand benchmark scenarios from CommonRoad are used for evaluation. Empirical results show that our scheme enables safer and more ethical decisions, reducing overall risk by 26.3%, with a notable 22.9% decrease for vulnerable road users. In accidents, we enhance self-protection by 8.3%, improve protection for all road users by 17.6%, and significantly boost protection for vulnerable road users by 51.7%. As a human-inspired practice, this work renders AVs socially sensitive to overcome future ethical challenges in everyday driving.

PRODUCTION OPTIMIZATION

Small Methods (impact factor: 10.7) 2 ☒

Nanoscopic Parylene Layer: Enhancing Perovskite Solar Cells Through Parylene-D Passivation.

Kim, Noh, et. al

Abstract:
The development of eco-friendly energy sources has advanced photovoltaic technologies, with perovskite solar cells (PSCs) emerging as promising alternatives owing to their high efficiency, low fabrication costs, and excellent optical and electronic properties. However, their commercialization is hindered by stability issues, such as ion migration, defect-induced degradation, and nonuniformity of the solution process over large areas, particularly at the perovskite/hole-transporting layer (HTL) interface. To address these challenges, chemical vapor deposition (CVD) is employed to introduce an ultrathin, uniform parylene-D layer at the perovskite/HTL interface. Parylene-D, containing additional chlorine functional groups compared to parylene-C, supports bidentate chelation, enabling effective interaction with uncoordinated $Pb2^{+}$ and

perovskite surface defects. This passivation layer significantly reduces nonradiative recombination and suppresses ion migration without affecting the morphology or electrical properties of large-area perovskites. The optimized parylene-D treatment yields PSCs with 23.75% efficiency and enhanced open-circuit voltage and fill factor. Stability tests demonstrate that the parylene-D-treated devices retain their initial efficiency after 1500 h under 10% relative humidity at room temperature and maintain 80% efficiency after 1200 h at 65 °C in a nitrogen environment. Furthermore, the scalability of this approach is validated by fabricating a large-area module (25 cm2 aperture area), achieving module and active area efficiencies of 19.44% and 20.59%, respectively. These results highlight the potential of parylene-D passivation via CVD as a practical and scalable strategy to enhance PSC performance and stability.© 2025 Wiley‐VCH GmbH.

ChemSusChem (impact factor: 7.5) 2 区 TOP

Elemental trade-off in the selective Electrooxidation of Ethylene Glycol on Palladium-Silver/Nickel Electrodes.

Watson, Fehler, et al

Abstract:
We study the synthesis and properties of PdAg electrodes coated on Ni foam and their application in the selective electro-oxidation of ethylene glycol to glycolate. This reaction is a route to glycolic acid, which is a key component of biodegradable packaging. Using a combination of cyclic voltammetry, EDX and XRD analysis, we find that a 3:1 Pd:Ag ratio gives optimal results. We show that the oxidation of ethylene glycol on palladium occurs between 0.3 and 1.2 V vs. RHE, and depends on the presence of a Pd(0) active site. Electrochemical Impedance Spectroscopy experiments show that the charge-transfer resistance (RCT) follows the same trend as EGOPd activity, with the 3:1 Pd:Ag electrode having the lowest RCT. Electrolysis with this electrode at 0.705 V vs. RHE, where Pd is reduced, results in glycolate production with no overoxidation to formate or oxalate. We then move to a flow setup under industrial conditions, and show that the Pd-Ni electrode yields >80% FE to glycolate for over 140 h. Long-term electrode deactivation can be overcome in this system by a periodic self-refresh cycle.© 2025 Wiley‐VCH GmbH.

Crit Rev Food Sci Nutr (impact factor: 7.3) 2 区 TOP

Dielectric heating technology assisted for multi-objective processing of agricultural products: research progress, challenges, and future perspectives.

Li, Tian, et. al

Abstract:
Dielectric heating (DH) technology, including microwave and radio-frequency heating,

is a type of advanced heating achieved through electromagnetic fields at specific frequencies. DH technology is widely used in the processing of various agricultural products and industrial-scale production owing to its green, efficient, and low-carbon nature. This paper reviewed the principles, typical systems, and devices of the DH technology. The mechanism and application of the DH technology in the processing of agricultural products are described. The research progress, application prospects, future research strategies, and limitations of DH technology in the multi-objective processing of agro-products were highlighted. Compared with traditional heating methods, DH with rapid, volumetric, and selective heating achieves good performance in drying, pasteurization, disinfestation, enzyme deactivation, and improvement of seed germination while producing high-quality agricultural products. Studies have shown that DH technology can simultaneously achieve multi-objective processing, which reduces processing steps, costs, and carbon emissions and raises economic returns. DH technology assisted in multi-objective processing could extend the shelf life and avoid spoilage of products during storage. Future research needs to be conducted with the help of computer simulations and artificial intelligence for parameter optimization and quality improvement to realize multi-objective DH technology in industrial applications.

MECHATRONICS

ACS Nano (impact factor: 15.8) 1 区 TOP

Cathodoluminescence Saturation Imaging to Visualize Emitter-Resonator Coupling.

Saito, Kimura, et. al

Abstract:

Nanoscopic characterization of light-emitting materials is essential to realize nano-optical devices, which requires nanoscopic spatial resolution far beyond the diffraction limit of light. Cathodoluminescence (CL) is a powerful means to achieve such nano-optical characterization by combining with electron microscopy. However, discrimination between coherent and incoherent CL emissions, when a phosphor material is combined with a resonator, is not trivial. To solve this general problem in such coupled emitter-resonator systems, we take advantage of optical saturation in incoherent CL in the phosphor and propose a method to extract the incoherent component to distinguish the coherent components purely from the resonator. We demonstrate this CL saturation imaging approach using an integrated system of Zn2SiO4 phosphors and a plasmonic resonator array and visualize the resonator-modified luminescence at the nanoscale, which evidence the near-field coupling

between the phosphors and the plasmonic resonators.

J Colloid Interface Sci (impact factor: 9.4) 1 ☒

Thick 3D-Printed Hierarchical Li4Ti5O12@MOF anode and Grid-Lined micropores for High-Performance Lithium-Ion batteries.

Mwizerwa, Li, et. al

Abstract:
Li4Ti5O12 (LTO) anode is a promising candidate for high-energy-density lithium-ion batteries (LIBs), but achieving high mass loading, a porous structure, and efficient ion transport remains a challenge. Herein, we present a high-mass-loading, hierarchically porous LTO anode with a conductive network and grid-lined micropores, embedded with a metal-organic framework (MOF) as both an electrode additive and surface protective layer. This novel structure is fabricated using extrusion-based three-dimensional (3D) printing technology. The self-standing framework provides mechanical stability and high conductivity, enabling a thick (316 μm) 3D-printed LTO@UiO-66-MOF (3D-LTO@U) anode with a mass loading of 11 mg/cm2. It delivers a high-rate capability of 161 mAh/g at 5C, an areal specific capacity of 5.37 mAh/cm2, and 78.9 % areal capacity retention after 150 cycles. Additionally, it achieves a high specific energy density of 382.35 Wh/kg. The UiO-66 MOF provides strong binding affinity, suppressing side reactions and enhancing Li-ion/electron transport within the 3D-printed interconnected channels. This improves active material utilization during charge and discharge. Furthermore, a 3D-printed full cell integrating a grid-lined 3D-LTO@U anode and a 3D-printed LiFePO4 cathode exhibits enhanced electrochemical performance. This work demonstrates an effective strategy for designing thick, high-mass-loading, and porous conductive network anodes for advanced LIBs.

Sci Rep (impact factor: 3.8) 3 ☒

An ensemble deep learning framework for emotion recognition through wearable devices multi-modal physiological signals

Durgesh Nandini, Jyoti Yadav, et. al

Abstract:
The widespread availability of miniaturized wearable fitness trackers has enabled the monitoring of various essential health parameters. Utilizing wearable technology for precise emotion recognition during human and computer interactions can facilitate authentic, emotionally aware contextual communication. In this paper, an emotion recognition system is proposed for the first time to conduct an experimental analysis of both discrete and dimensional models. An ensemble deep learning architecture is

considered that consists of Long Short-Term Memory and Gated Recurrent Unit models to capture dynamic temporal dependencies within emotional data sequences effectively. The publicly available wearable devices EMOGNITION database is utilized to facilitate result reproducibility and comparison. The database includes physiological signals recorded using the Samsung Galaxy Watch, Empatica E4 wristband, and MUSE 2 Electroencephalogram (EEG) headband devices for a comprehensive understanding of emotions. A detailed comparison of all three dedicated wearable devices has been carried out to identify nine discrete emotions, exploring three different bio-signal combinations. The Samsung Galaxy and MUSE 2 devices achieve an average classification accuracy of 99.14% and 99.41%, respectively. The performance of the Samsung Galaxy device is examined for the 2D Valence-Arousal effective dimensional model. Results reveal average classification accuracy of 97.81% and 72.94% for Valence and Arousal dimensions, respectively. The acquired results demonstrate promising outcomes in emotion recognition when compared with the state-of-the-art methods.

ROBOTICS

Nanomicro Lett (impact factor: 31.6) 1 区

Near-Sensor Edge Computing System Enabled by a CMOS Compatible Photonic Integrated Circuit Platform Using Bilayer AlN/Si Waveguides

Zhihao Ren, Zixuan Zhang, et. al

Abstract

he rise of large-scale artificial intelligence (AI) models, such as ChatGPT, DeepSeek, and autonomous vehicle systems, has significantly advanced the boundaries of AI, enabling highly complex tasks in natural language processing, image recognition, and real-time decision-making. However, these models demand immense computational power and are often centralized, relying on cloud-based architectures with inherent limitations in latency, privacy, and energy efficiency. To address these challenges and bring AI closer to real-world applications, such as wearable health monitoring, robotics, and immersive virtual environments, innovative hardware solutions are urgently needed. This work introduces a near-sensor edge computing (NSEC) system, built on a bilayer AlN/Si waveguide platform, to provide real-time, energy-efficient AI capabilities at the edge. Leveraging the electro-optic properties of AlN microring resonators for photonic feature extraction, coupled with Si-based thermo-optic Mach–Zehnder interferometers for neural network computations, the system represents a transformative approach to AI hardware design. Demonstrated through multimodal gesture and gait analysis, the NSEC system achieves high classification accuracies of 96.77% for gestures and 98.31%

for gaits, ultra-low latency (< 10 ns), and minimal energy consumption (< 0.34 pJ). This groundbreaking system bridges the gap between AI models and real-world applications, enabling efficient, privacy-preserving AI solutions for healthcare, robotics, and next-generation human–machine interfaces, marking a pivotal advancement in edge computing and AI deployment.

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

High-Efficiency Organic Mechanophosphorescence from A Phenoselenazine Phosphor for Multiple Applications.

Ding, Zhang, Lv, Dong, et. al

Abstract

Mechanoluminescence (ML) materials with phosphorescent characteristics hold significant potential for applications in pressure sensing and material damage inspection. However, currently reported mechanophosphorescence (MP) materials suffer from low luminescence efficiency and insufficient brightness. Herein, we report a piezoelectric material, p-BPM, with an exceptionally high phosphorescence efficiency of 61.4%, which is the highest value among reported pure organic MP materials. Benefiting from its excellent ML performance, we have developed a display device using crystals that allow for clear observation of the written letter paths (letters M and L), which have promising prospects in pressure-sensitive display. Amazingly, we also observed that the crystals produce bright ultrasound induced luminescence in the medium at a low ultrasonic operating frequency (40 kHz). The composite films of crystal and poly(butylene adipate-co-terephthalate) (PBAT) polymer exhibit significant tensile strength while maintaining effective MP. The composite films show good piezoelectric energy harvesting properties with a maximum open-circuit voltage of 0.47 V and short-circuit current of 0.046 μA, demonstrating promise for precise sonic location. This work will facilitate the development of highly efficient organic MP materials, expanding the potential in stress-monitoring, imaging, and marine robotics.

Int J Surg (impact factor: 12.5) 2 ☒

Laparoscopic radical hysterectomy-karez technique for stage IB3 and IIA2 cervical cancer: a multicenter retrospective cohort study.

Yang, Chen, Li, et. al

Abstract

Laparoscopic radical hysterectomy with Karez technique (LRH-Karez) is a practical method which is based on special space anatomy. This study investigates the efficacy and safety of LRH-Karez against traditional surgical methods including abdominal radical hysterectomy (ARH) and conventional minimally invasive surgery (MIS).A

multicenter retrospective cohort study was conducted, involving 413 eligible patients diagnosed with 2018 FIGO stage IB3 and IIA2 cervical cancer treated from January 2012 to January 2022. Among these, 66 patients underwent LRH-Karez, 56 patients underwent conventional laparoscopic or robotic surgery (Conventional MIS) and 291 patients received ARH. Patient data were obtained from three tertiary hospitals in China. Surgical outcomes, pathological results, and follow-up data were analyzed using SPSS and R statistical software. Kaplan-Meier survival analysis was performed alongside univariate and multivariate Cox regression analyses.LRH-Karez has less intraoperative blood loss but longer operative time. The five-year progression-free survival (PFS) rates were 85% for LRH-Karez, significantly higher than the 53.6% from conventional MIS (P = 0.002) and comparable to ARH (78.3%, P = 0.898). In terms of overall survival, the five-year overall survival (OS) rate for the LRH-Karez group was 92.2%, compared to 51.9% for the conventional MIS group and 78.3% for the ARH group. Patients who underwent conventional MIS had significantly lower OS compared to those in the LRH-Karez group (P < 0.001). The log-rank test indicated no significant difference in OS between the LRH-Karez group and the ARH group (P = 0.218). However, the Gehan-Breslow-Wilcoxon test revealed a significant difference between the two groups during the early follow-up period (P = 0.047).The LRH-Karez technique has demonstrated superior intraoperative safety and survival prognosis compared to conventional MIS in patients with locally advanced cervical cancer (FIGO stages IB3 and IIA2), with its long-term survival outcomes comparable to ARH. This practical technique, based on refined understanding of surgical space anatomy, may represent a valuable minimally invasive surgical option that warrants further exploration.

CIRCUITS AND SYSTEMS

Nucleic Acids Res (impact factor: 16.6) 2 区 TOP

Quantum-inspired logic for advanced Transcriptional Programming.

Milner, Kim, et. al

Abstract

The tenets of intelligent biological systems are (i) scalable decision-making, (ii) inheritable memory, and (iii) communication. This study aims to increase the complexity of decision-making operations beyond standard Boolean logic, while minimizing the metabolic burden imposed on the chassis cell. To this end, we present a new platform technology for constructing genetic circuits with multiple OUTPUT gene control using fewer INPUTs relative to conventional genetic circuits. Inspired by principles from quantum computing, we engineered synthetic bidirectional promoters,

regulated by synthetic transcription factors, to construct 1-INPUT, 2-OUTPUT logical operations-i.e. biological QUBIT and PAULI-X logic gates-designed as compressed genetic circuits. We then layered said gates to engineer additional quantum-inspired logical operations of increasing complexity-e.g. FEYNMAN and TOFFOLI gates. In addition, we engineered a 2-INPUT, 4-OUTPUT quantum operation to showcase the capacity to utilize the entire permutation INPUT space. Finally, we developed a recombinase-based memory operation to remap the truth table between two disparate logic gates-i.e. converting a QUBIT operation to an antithetical PAULI-X operation in situ. This study introduces a novel and versatile synthetic biology toolkit, which expands the biocomputing capacity of Transcriptional Programming via the development of compressed and scalable multi-INPUT/OUTPUT logical operations.

ACS Nano (impact factor: 15.8) 1 区 TOP

Lithography-Free Chalcogenide Canvas for Photonic Integrated Circuits.

Hu, Li, et. al

Abstract:

Chalcogenide integrated photonic devices have garnered widespread attention due to their excellent wideband transparency. However, current fabrication methods primarily rely on mature silicon-based CMOS processes, which are not readily adaptable to chalcogenides, significantly hindering their development. Here, we present a flexible fabrication approach that judiciously leverages the intrinsic oxidation susceptibility of chalcogenide materials, transforming chalcogenide thin films into a lithography-free canvas for versatile integrated photonic devices. Using antimony sulfide (Sb2S3) as an example, we demonstrate low-threshold laser-induced local oxidation using a continuous laser, achieving a refractive index modulation exceeding 0.7 and a spatial resolution of 0.6 μm in the near-infrared region. This technique enables flexible fabrication of various chalcogenide photonic devices. Based on this technique, we further fabricate a dynamic planar Fresnel zone plate, demonstrating dynamic beam focusing by exploiting the phase-change property of Sb2S3, as well as high-precision spatial-spectral reconstruction at near-infrared using a millimeter-scale chalcogenide metasurface array. Our findings reveal the potential of chalcogenide thin films as a promising canvas for advanced photonic applications, providing a simplified and versatile fabrication pathway that significantly advances the field of chalcogenide integrated photonic devices.

Sci Adv (impact factor: 11.7) 1 区

2D material exciton-polariton transport on 2D photonic crystals.

Xie, Li, Liu, et. al

Abstract:
Transport of elementary excitations is a fundamental property of two-dimensional (2D) semiconductors, essential for wide-ranging phenomena and device applications. Although exciton transport reported in 2D materials barely exceeds 1 to 2 micrometers, coherent coupling of excitons with photons to form polaritons enables extended transport lengths and offers opportunities to use photonic mode engineering for tailored transport. Conventional vertical cavity or waveguide polaritons, however, are challenging to tune and integrate into photonic circuits. We report the transport of transition metal dichalcogenide polaritons in 2D photonic crystals that are highly versatile for tuning, mode engineering, and integration. We achieve an order-of-magnitude enhancement in transport length compared to bare excitons and reveal transport dependence on polariton dispersion and population dynamics, which are controlled via photonic crystal design and pump intensity. Stimulated relaxation observed in the system suggests the potential for forming superfluid polaritons with frictionless transport. These findings establish 2D photonic crystal polaritons as a versatile platform for advancing photonic energy transport technologies.

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Ⅱ Concentration

PHYSICS

Pseudogap and Fermi arc induced by Fermi surface nesting in a centrosymmetric skyrmion magnet

Yuyang Dong, Yuto Kinoshita, et al.

Abstract

Skyrmions in noncentrosymmetric materials are believed to occur due to the Dzyaloshinskii-Moriya interaction. By contrast, the skyrmion formation mechanism in centrosymmetric materials remains elusive. Here, we reveal the intrinsic electronic structure of the centrosymmetric GdRu2Si2 by selectively measuring magnetic domains using angle-resolved photoemission spectroscopy (ARPES). We found robust Fermi surface (FS) nesting, consistent with the magnetic modulation q-vector detected by the previous resonant x-ray scattering measurements. The pseudogap opens at the nested FS portions, which vary for different magnetic domains. The anomalous pseudogap disconnects the FS to generate Fermi arcs with twofold symmetry. These results indicate that the Ruderman-Kittel-Kasuya-Yosida (RKKY) interaction plays a decisive role in generating the screw spin modulation responsible for the skyrmion formation in GdRu2Si2. Furthermore, we demonstrate the flexible nature of magnetism in GdRu2Si2 by manipulating magnetic domains with magnetic field and temperature cyclings, providing potential future applications for data storage and processing devices.

Imaging-guided deep tissue in vivo sound printing

Elham Davoodi, Jiahong Li, et al.

Abstract

Three-dimensional printing offers promise for patient-specific implants and therapies but is often limited by the need for invasive surgical procedures. To address this, we developed an imaging-guided deep tissue in vivo sound printing (DISP) platform. By incorporating cross-linking agent–loaded low-temperature–sensitive liposomes into bioinks, DISP enables precise, rapid, on-demand cross-linking of diverse functional biomaterials using focused ultrasound. Gas vesicle–based ultrasound imaging provides real-time monitoring and allows for customized pattern creation in live animals. We validated DISP by successfully printing near diseased areas in the mouse bladder and deep within rabbit leg muscles in vivo, demonstrating its potential for localized drug delivery and tissue replacement. DISP's ability to print conductive, drug-loaded, cell-laden, and bioadhesive biomaterials demonstrates its versatility for diverse biomedical

applications.

Water structure and electric fields at the interface of oil droplets

Shi, Lixue, LaCour, et al.

Abstract

Interfacial water exhibits rich and complex behaviour[1], playing an important part in chemistry, biology, geology and engineering. However, there is still much debate on the fundamental properties of water at hydrophobic interfaces, such as orientational ordering, the concentration of hydronium and hydroxide, improper hydrogen bonds and the presence of large electric fields[2,3,4,5]. This controversy arises from the challenges in measuring interfacial systems, even with the most advanced experimental techniques and theoretical approaches available. Here we report on an in-solution, interface-selective Raman spectroscopy method using multivariate curve resolution[6,7] to probe hexadecane-in-water emulsions, aided by a monomer-field theoretical model for Raman spectroscopy[8]. Our results indicate that oil–water emulsion interfaces can exhibit reduced tetrahedral order and weaker hydrogen bonding, along with a substantial population of free hydroxyl groups that experience about 95 cm^{-1} redshift in their stretching mode compared with planar oil–water interfaces. Given the known electrostatic zeta potential characteristic of oil droplets[9], we propose the existence of a strong electric field (about 50–90 MV cm^{-1}) emanating from the oil phase. This field is inferred indirectly but supported by control experiments and theoretical estimates. These observations are either absent or opposite in the molecular hydrophobic interface formed by small solutes or at planar oil–water interfaces. Instead, water structural disorder and enhanced electric fields emerge as unique features of the mesoscale interface in oil–water emulsions, potentially contributing to the accelerated chemical reactivity observed at hydrophobic–water interfaces[10,11,12,13].

MATERIALS

Spontaneous formation of robust two-dimensional perovskite phases

Shaun Tan, Meng-Chen Shih, et al.

Abstract

The two-dimensional on three-dimensional (2D/3D) perovskite bilayer heterostructure can improve the stability and performance of perovskite solar cells. We show that the 2D/3D perovskite stack in a device evolves dynamically during its end-of-life

decomposition. Initially phase-pure 2D interlayers can evolve differently, resulting in different device stabilities. We show that a robust 2D interlayer can be formed using mixed solvents to regulate its crystallinity and phase purity. The resulting 2D/3D devices achieved 25.9% efficiency and had good durability, retaining 91% of their initial performance after 1074 hours at 85°C using maximum power point tracking.

Sustainable nickel enabled by hydrogen-based reduction

Manzoor, U., Mujica Roncery, L., et al.

Abstract

Nickel is a critical element in the shift to sustainable energy systems, with the demand for nickel projected to exceed 6 million tons annually by 2040, largely driven by the electrification of the transport sector. Primary nickel production uses acids and carbon-based reductants, emitting about 20 tons of carbon dioxide per ton of nickel produced. Here we present a method using fossil-free hydrogen-plasma-based reduction to extract nickel from low-grade ore variants known as laterites. We bypass the traditional multistep process and combine calcination, smelting, reduction and refining into a single metallurgical step conducted in one furnace. This approach produces high-grade ferronickel alloys at fast reduction kinetics. Thermodynamic control of the atmosphere of the furnace enables selective nickel reduction, yielding an alloy with minimal impurities (<0.04 wt% silicon, approximately 0.01 wt% phosphorus and <0.09 wt% calcium), eliminating the need for further refining. The proposed method has the potential to be up to about 18% more energy efficient while cutting direct carbon dioxide emissions by up to 84% compared with current practice. Our work thus shows a sustainable approach to help resolve the contradiction between the beneficial use of nickel in sustainable energy technologies and the environmental harm caused by its production.

Structurally complex phase engineering enables hydrogen-tolerant Al alloys

Jiang, Shengyu, Xu, et al.

Abstract

Hydrogen embrittlement (HE) impairs the durability of aluminium (Al) alloys and hinders their use in a hydrogen economy[1,2,3]. Intermetallic compound particles in Al alloys can trap hydrogen and mitigate HE[4], but these particles usually form in a low number density compared with conventional strengthening nanoprecipitates. Here we report a size-sieved complex precipitation in Sc-added Al–Mg alloys to achieve a high-density dispersion of both fine Al_3Sc nanoprecipitates and in situ formed core-shell $Al_3(Mg, Sc)_2/Al_3Sc$ nanophases with high hydrogen-trapping ability. The two-step heat

treatment induces heterogeneous nucleation of the Samson-phase $Al_3(Mg, Sc)_2$ on the surface of Al_3Sc nanoprecipitates that are only above 10 nm in size. The size dependence is associated with Al_3Sc nanoprecipitate incoherency, which leads to local segregation of magnesium and triggers the formation of $Al_3(Mg, Sc)_2$. The tailored distribution of dual nanoprecipitates in our Al–Mg–Sc alloy provides about a 40% increase in strength and nearly five times improved HE resistance compared with the Sc-free alloy, reaching a record tensile uniform elongation in Al alloys charged with H up to 7 ppmw. We apply this strategy to other Al–Mg-based alloys, such as Al–Mg–Ti–Zr, Al–Mg–Cu–Sc and Al–Mg–Zn–Sc alloys. Our work showcases a possible route to increase hydrogen resistance in high-strength Al alloys and could be readily adapted to large-scale industrial production.

CHEMISTRY

1,2-Acyl transposition through photochemical skeletal rearrangement of 2,3-dihydrobenzofurans

Ryan T. Steele, Motohiro Fujiu, et. al

Abstract

Saturated heterocycles are commonly adorned with groups that influence their biological properties. Synthetic methods that transpose existing substituents on saturated heterocycles to multiple peripheral positions are therefore highly valuable. In this work, we report a formal 1,2-acyl transposition through the photochemical exchange of the C2–C3 positions of C2-acylated dihydrobenzofurans. This strategy relies on an unusual photochemical isomerization of the dihydrobenzofuran core to a highly electrophilic spiro-cyclopropane intermediate that is then intercepted by a halide nucleophile. A variety of aryl ketones are transposed using 370-nanometer centered irradiation. Additionally, carboxylic acids, esters, and amides can be transposed using 310-nanometer centered irradiation. This work highlights the power of a skeletal rearrangement to achieve a net peripheral modification.

Formation of hydrided Pt-Ce-H sites in efficient, selective oxidation catalysts

Ji Yang, Lorenz J. Falling, et. al

Abstract

Single-atom site catalysts can improve the rates and selectivity of many catalytic

reactions. We have modified Pt_1/CeO_2 single sites by combining them with molecular groups and with oxygen vacancies of the support. The new sites include hydrided (Pt^{2+}-$Ce^{3+}H^{\delta-}$) and hydroxylated (Pt^{2+}-$Ce^{3+}OH$) sites that exhibit higher reactivity and selectivity to previous single sites for several reactions, including a ninefold increase in the reaction rate for carbon monoxide oxidation and a 2.3-fold improvement of propylene selectivity for oxidative dehydrogenation of propane. The atomic structure and reaction steps of these sites were determined with in situ and ex situ spectroscopy techniques and theoretical methods.

A self-regenerating Pt/Ge-MFI zeolite for propane dehydrogenation with high endurance

Huizhen Hong, Zhikang Xu, et. al

Abstract

Supported noble metal cluster catalysts are typically operated under severe conditions involving switches between reducing and oxidizing atmospheres, causing irreversible transformation of catalyst structure and thereby leading to permanent deactivation. We discovered that various Pt precursors spontaneously disperse in Ge-MFI zeolite, which opposes the Ostwald ripening phenomenon, producing self-regenerating Pt/Ge-MFI catalysts for propane dehydrogenation. These catalysts reversibly switch between Pt clusters and Pt single-atoms in response to reducing reaction and oxidizing regeneration conditions. This environmental adaptability allows them to completely self-regenerate over 110 reaction-regeneration cycles in propane dehydrogenation. They exhibited unprecedented sintering-resistance when exposed to air at 800 °C for 10 days. Such spontaneous metal dispersion in Ge-zeolites is a robust and versatile methodology for fabricating various Rh, Ru, Ir and Pd cluster catalysts.

BIOLOGY

Pancreatic cancer–restricted cryptic antigens are targets for T cell recognition

Zackery A. Ely, Zachary J. Kulstad, et al.

Abstract

Translation of the noncoding genome in cancer can generate cryptic (noncanonical) peptides capable of presentation by human leukocyte antigen class I (HLA-I); however, the cancer specificity and immunogenicity of noncanonical HLA-I–bound peptides

(ncHLAp) are incompletely understood. Using high-resolution immunopeptidomics, we discovered that cryptic peptides are abundant in the pancreatic cancer immunopeptidome. Approximately 30% of ncHLAp exhibited cancer-restricted translation, and a substantial subset were shared among patients. Cancer-restricted ncHLAp displayed robust immunogenic potential in a sensitive ex vivo T cell priming platform. ncHLAp-reactive, T cell receptor–redirected T cells exhibited tumoricidal activity against patient-derived pancreatic cancer organoids. These findings demonstrate that pancreatic cancer harbors cancer-restricted ncHLAp that can be recognized by cytotoxic T cells. Future therapeutic strategies for pancreatic cancer, and potentially other solid tumors, may include targeting cryptic antigens.

Sedentary chromosomal integrons as biobanks of bacterial antiphage defense systems

Baptiste Darracq, Eloi Littner, et. al

Abstract

Integrons are genetic systems that drive bacterial adaptation by acquiring, expressing, and shuffling gene cassettes. While mobile integrons are well known for spreading antibiotic resistance genes, the functions of the hundreds of cassettes carried by sedentary integrons remain largely unexplored. We show that many of these cassettes encode small variants of known antiphage systems that favor their inclusion in the integron. We also demonstrate that nearly 10% of the integron cassettes in the pandemic Vibrio cholerae strain encode novel antiphage functions. Most of these novel systems have little or no similarity to previously known ones, with several providing defense through cell lysis or growth arrest. Our work highlights the stabilization and prevalence of small antiphage systems within integrons, making them an untapped biobank of defense mechanisms.

Mobile integrons encode phage defense systems

Nicolas Kieffer, Alberto Hipólito, et. al

Abstract

Integrons are bacterial genetic elements that capture, stockpile, and modulate the expression of genes encoded in integron cassettes. Mobile integrons (MIs) are borne on plasmids, acting as a vehicle for hundreds of antimicrobial resistance genes among key pathogens. These elements also carry gene cassettes of unknown function (gcus) whose role and adaptive value remain unexplored. In this work, we show that gcus encode phage resistance systems, many of which are newly discovered. Bacteriophage resistance integron cassettes (BRiCs) can be combined and mixed with resistance

cassettes to produce multiphage or drug and phage resistance. The fitness costs of BRiCs are variable and dependent on the genetic context and can be modulated by changing the order of cassettes in the array. Hence, MIs act as highly mobile, low-cost defense islands.

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Ⅲ Calling for papers

ICECTT 2025（EI）

Submission deadline: **May 30, 2025**
Conference date: **Jun 6, 2025 - Jun 8, 2025**
Full name: **International Conference on Electromechanical Control Technology and Transportation**
Location: **Guilin, China**

The conference will recommend a variety of publication types, including conference proceedings(EI), SCI journals. If you need translation and retouching services, please contact the conference secretary. Scholars are requested to strictly abide by academic norms and ethics, and not to publish repeatedly or submit more than one manuscript.
Papers submitted to ICECTT 2025 will be reviewed by technical committees of the conference. All accepted full papers will be published by Conference Proceedings and submitted to EI Compendex and Scopus for indexing.

Call for papers:

The topics of interest for submission include, but are not limited to:
◕ Mechanic Manufacturing System and Automation
(1) Optoelectronics Applications in Manufacturing Process Simulation
(2) CIMS and Photonics Enhanced Manufacturing System
(3) Optoelectronics and Computer Aided Design (CAD/CAM/CIM)
(4) Vibration Measurement Using Optoelectronic Devices
(5) Computer Aided Finite Element Analysis
(6) Fault diagnosis in mechatronic Systems
(7) Intelligent Mechatronics and Robotics
(8) Optoelectronic components in complex mechanical-electrical-hydraulic systems
(9) Computerized Logistics and ERP Systems
(10) Computer and Sensor Technology in Vehicle Engineering
.....

◕ Traffic and Transportation Technology
(1) Application of Photoelectric Technology for Intelligent Traffic Signal System
(2) Vehicle Detection and Classification Technology
(3) Photoelectric technology in road safety monitoring applications
(4) Intelligent Parking System
(5) Photoelectric sensors in traffic data collection and analysis of applications
(6) Pedestrian and Bicycle Detection System
.....

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ICCSSE 2025（IEEE）

Submission deadline: **May 30, 2025**
Conference date: **Oct 17, 2025 - Oct 19, 2025**
Full name: **International Conference on Control Science and Systems Engineering**
Location: **Beijing, China**

Following the success of previous ICCSSEs, ICCSSE 2025 is sponsored by National Space Science Center, CAS, Beijing Institute of Control Robotics and Intelligent Technology, take place in Beijing, China, during October 17-19, 2025. ICCSSE 2025 is supported by China Agricultural University, China, Guangdong University of Technology, China, and Concordia University, Canada.
ICCSSE 2025 allows the results of hard work and forward thinkers to be championed to our peers and the world. The depth of the research works presented is even greater than those in the previous conferences.
Control Science and Systems Engineering, an interdisciplinary field encompassing control theory, systems engineering, and automation, has garnered attention due to technological advancements and system complexity. It's been applied across aerospace, robotics, manufacturing, energy, and transportation. Advancements in adaptive, nonlinear, and robust control techniques, coupled with AI and machine learning, have led to the development of intelligent control systems. This field requires collaboration among electrical, mechanical, computer science, and mathematics experts. The interest in this field is growing, making it crucial in today's technological era. This international conference presents innovative and forward-thinking research to peers and the world, with the depth of works increasing annually.

Topics of Interest :

Complex Systems and Systems Engineering
Linear and non-linear systems
Large-scale systems
Multi-agent systems
Complex systems
Complex networks
Petri nets
Multidimensional systems
……

Control Theory and Control Techniques
Stability, controllability and observability
Adaptive control
Optimal control
Fuzzy control
Neuro control
Neuro-fuzzy control
Robust control
Perceptual control
……

Implementation and Applications
Bio-inspired control techniques
Robot and manipulator control
Power system control
Autonomous traffic and transport systems
Automatic control of chemical processes
Automotive control systems and autonomous vehicles
Thermal system control
Industrial control electronics
Aerospace control systems
Defense and military systems
……

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ICSSD 2025（EI）

Submission deadline: **May 31, 2025**
Conference date: **Jun 26, 2025 - Jun 28, 2025**
Full name: **International Conference on Smart Manufacturing, Structural Health Monitoring and Digital Twin**
Location: **Dongguan, China**

2025 International Conference on Smart Manufacturing, Structural Health Monitoring and Digital Twin (ICSSD 2025) will be held from June 26-28, 2025, in Dongguan, China. This event will gather top experts, scholars, and industry leaders from around the world. The conference aims to promote the development of smart manufacturing and structural health monitoring technologies, and to facilitate the application and innovation of digital twin technology. ICSSD 2025 will conduct in-depth discussions on cutting-edge technologies in smart manufacturing, methods and implementations of structural health monitoring, as well as the theories and practices of digital twins. Participants will have the opportunity to share their latest research findings, exchange groundbreaking ideas, and explore innovative applications across multiple disciplines. Additionally, the conference will feature keynote speeches and workshops to foster closer collaboration between academia and industry.

We sincerely invite researchers and engineers from around the world to attend and jointly explore the future development directions of smart manufacturing and structural health monitoring, promoting sustainable societal development. ICSSD 2025 looks forward to gathering with you to embrace the challenges and opportunities of the intelligent era!

Call for Papers:

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

◕ Smart Manufacturing and Production Optimization
Smart Manufacturing & Industry 4.0
Advanced Manufacturing Processes
CNC Machining & Automation
Flexible & Lean Manufacturing
Smart Factories & Digital Production
Green & Sustainable Manufacturing
.....

◕ Digital Twin and Intelligent Manufacturing Systems
Digital Twin in Smart Manufacturing
Virtual Manufacturing & Optimization
Digital Twin for Process Optimization
Digital Modeling in Smart Factories
Production Data Acquisition & Analysis
AI in Digital Production
.....

◕ Equipment Monitoring and Intelligent Maintenance
Health Monitoring & Predictive Maintenance
Smart Sensor Technologies
CNC Machine Monitoring
Big Data-Driven Life Prediction
ML for Intelligent Maintenance
Fault Diagnosis & Prediction
.....

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MMEAT 2025（EI）

Submission deadline: **May 31, 2025**
Conference date: **Jun 23, 2025 - Jun 25, 2025**
Full name: **International Conference on Mechanical Engineering, Materials and Automation Technology**
Location: **Shenzhen, China**

2025 11th International Conference on Mechanical Engineering, Materials and Automation Technology 2025 (MMEAT 2025), hosted by Southern University of Science and Technology, will be held in Shenzhen, China from June 23 to 25, 2025. The conference aims to bring together innovative scholars and industry experts in mechanical engineering, materials science and automation technology from around the world, providing them with an excellent platform for exchange and cooperation. With the increasing global demand for sustainable technologies and smart manufacturing, MMEAT 2025 will focus on the latest trends and future prospects in these areas. The main objective of the conference is to promote the cutting-edge research and innovative application of mechanical engineering, materials and automation technologies, and to promote the exchange of scientific information between domestic and foreign experts and scholars. We look forward to bringing together researchers, developers, engineers, students and industry practitioners from all over the world to share and discuss the latest research results and practical experience to promote technological progress and industrial upgrading. The conference will be held annually, making it an ideal platform for people to exchange views and experiences in materials, mechanical engineering and automation technologies and related fields.

***Call for papers:**

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

◕ Mechanical Automation
CNC technology and CNC system
Intelligent manufacturing technology
Test techniques and troubleshooting
Molding manufacturing and automation
Mechatronics
Automatic control and technology
.....

◕ Advanced Materials
Nanomaterials and Nanotechnology
Semiconductor Materials and Devices
Electronic Packaging and Interconnection Technology
Flexible electronics and smart wearable devices
High Frequency Electronic Materials and Applications
Electronic ceramics and catalytic materials
Photoelectric materials and LED technology
Thermoelectric materials and thermal management
Technology Battery Technology and Energy Storage
.....

◕ Control, Automation and Information Technology
Control System Modeling and Simulation technology
Intelligent Optimization Agorithms and Applications
Network Control
Electric Automation
Vehicle Control Systems
.....

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CCCE 2025（EI）

Submission deadline: **Jun 1, 2025**
Conference date: **Jun 13, 2025 - Jun 15, 2025**
Full name: **International Conference on Cloud Computing and Communication Engineering**
Location: **Kunming, China**

In 2025, the 2nd International Conference on Cloud Computing and Communication Engineering (CCCE 2025) will be held from June 13 to 15 in Kunming, China.

Topics of interest

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

Track 1 - Cloud Computing
Case studies and theories in cloud computing
Cloud applications in vertical industries
Cloud application, infrastructure and platforms
Cloud based, parallel processing
Cloud computing and semantic web technologies
Cloud computing models, simulations and designs
Cloud computing technologies
Cloud computing services
Cloud computing applications
Cloud slicing
Cloud storage and file systems
Cloud traffic engineering
Design tool for cloud computing
Data storage and Management in cloud computing
HPC on cloud
Maintenance and management of cloud computing
re in cloud computing
Social clouds (Social networks in the cloud)
The Open cloud: cloud computing and open source
Virtualization in the context of cloud computing platforms

Track 2 - Cognitive Radio and Cognitive Networks
High Performance Networks and Protocols
MEMS Technologies for Communications
MIMO Communications in Computer Networks
Network Simulation and Emulation
Optical Networks and Systems
QoS and Resource Management
RFID Networks and Protocols
Satellite and Space Communications
Sensor Networks and Embedded Systems
Smart Spaces and Personal Area Networks
Social Network Behaviors, Modeling, and Analysis
Wireless Communication
Radio-over-Fiber
Free Space and Fiber-Optic Communications
ocalization and navigation
Wireless, Mobile, Adhoc and Sensor Networks
Network Security
Multimedia Networking
Information Theory and Coding
Network Function Virtualization and Software-Defined Network Function Virtualization
Blockchain for Communication Networks
5G and Beyond Networks

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