Science Newsletter

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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/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 **Materials**:
We post several papers which are related to the top concerned topics in researches on materials. The papers are classified in 5 categories, and they are: **Biomaterials, Composite materials, Energy materials, Renewable Material,** and **Functional materials**. 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.

BIOMATERIALS

Adv Mater (impact factor: 29.4) 1 区 TOP

Piezoelectricity, Pyroelectricity and Ferroelectricity in Biomaterials and Biomedical Applications.

Yuan, Shi, et. al

Abstract:

Piezoelectric, pyroelectric, and ferroelectric materials are considered unique biomedical materials due to their dielectric crystals and asymmetric centers that allow them to directly convert various primary forms of energy in the environment, such as sunlight, mechanical energy, and thermal energy, into secondary energy, such as

electricity and chemical energy. These materials possess exceptional energy conversion ability and excellent catalytic properties, which have led to their widespread usage within biomedical fields. Numerous biomedical applications have demonstrated great potential with these materials, including disease treatment, biosensors, and tissue engineering. For example, piezoelectric materials have been used to stimulate cell growth in bone regeneration, while pyroelectric materials have been applied in skin cancer detection and imaging. Ferroelectric materials have even found use in neural implants that record and stimulate electrical activity in the brain. This paper reviews the relationship between ferroelectric, piezoelectric, and pyroelectric effects and the fundamental principles of different catalytic reactions. It also highlights the preparation methods of these three materials and the significant progress made in their biomedical applications. The review concludes by presenting key challenges and future prospects for efficient catalysts based on piezoelectric, pyroelectric, and ferroelectric nanomaterials for biomedical applications. This article is protected by copyright. All rights reserved.

Nano Lett (impact factor: 10.8) 1 区 TOP

Reversible, Covalent DNA Condensation Approach Using Chemical Linkers for Enhanced Gene Delivery.

Wang, Tasset, et. al

Abstract:

Nonviral gene delivery has emerged as a promising technology for gene therapy. Nonetheless, these approaches often face challenges, primarily associated with lower efficiency, which can be attributed to the inefficient transportation of DNA into the nucleus. Here, we report a two-stage condensation approach to achieve efficient nuclear transport of DNA. First, we utilize chemical linkers to cross-link DNA plasmids via a reversible covalent bond to form smaller-sized bundled DNA (b-DNA). Then, we package the b-DNA into cationic vectors to further condense b-DNA and enable efficient gene delivery to the nucleus. We demonstrate clear improvements in the gene transfection efficiency in vitro, including with 11.6 kbp plasmids and in primary cultured neurons. Moreover, we also observed a remarkable improvement in lung-selective gene transfection efficiency in vivo by this two-stage condensation approach following intravenous administration. This reversible covalent assembly strategy demonstrates substantial value of nonviral gene delivery for clinical therapeutic applications.

Adv Healthc Mater (impact factor: 10) 1 区 TOP

Silicon-based Biomaterials Modulate The Adaptive Immune Response of T Lymphocytes to Promote Osteogenesis/angiogenesis via Epigenetic Regulation.

Abstract:
Silicon (Si)-based biomaterials have been widely applied for bone regeneration. However, the underlying mechanisms of the materials function remain largely unknown. T lymphocyte-mediated adaptive immune response plays a vital role in the process of bone regeneration. In the current study, mesoporous silica (MS) was used as a model material of Si-based biomaterials. It showed that the supernatant of CD4+ T lymphocytes pretreated with MS extract significantly promoted the vascularized bone regeneration. The potential mechanism is closely related to the fact that MS extract could reduce the expression of regulatory factor X-1 (RFX-1) in CD4+ T lymphocytes. This might result in the overexpression of interleukin-17A (IL-17A) by boosting histone H3 acetylation and lowering DNA methylation and H3K9 trimethylation. Importantly, the in vivo experiments further revealed that MS particles significantly enhanced bone regeneration with improved angiogenesis in the critical-sized calvarial defect mouse model accompanied by upregulation of IL-17A in peripheral blood and the proportion of Th17 cells. Our study suggests that modulation of the adaptive immune response of T lymphocytes by Silicate-based biomaterials plays an important role for bone regeneration. This article is protected by copyright. All rights reserved.

COMPOSITE MATERIALS

Adv Mater (impact factor: 29.4) 1 区 TOP

Dual-effect Coupling for Superior Dielectric and Thermal Conductivity of Polyimide Composite Films Featuring "Crystal-like Phase" Structure.

Dong, Wan, et. al

Abstract:
To match the increasing miniaturization and integration of electronic devices, higher requirements are put on the dielectric and thermal properties of the dielectrics to overcome the problems of delayed signal transmission and heat accumulation. Here, a 3D thermal conductivity network has been successfully constructed inside the PI matrix by the combination of ionic liquids (IL) and calcium fluoride (CaF2) nanofillers, motivated by the bubble-hole forming orientation force. Benefiting from the 3D thermal network formed by IL as a porogenic template and "crystal-like phase" structures induced by CaF2 - polyamide acid charge transfer, IL-10 vol% CaF2 /PI porous film exhibits a low permittivity of 2.14 and a thermal conductivity of 7.22 W·m-1 ·K-1 . This design strategy breaks the bottleneck that low permittivity and high thermal conductivity in microelectronic systems are difficult to be jointly controlled,

and provides a feasible solution for the development of intelligent microelectronics.
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J Am Chem Soc (impact factor: 15) 1 区 TOP

Directing Molecular Weaving of Covalent Organic Frameworks and Their Dimensionality by Angular Control.

Han, Neumann, et al

Abstract:

Although reticular chemistry has commonly utilized mutually embracing tetrahedral metal complexes as crossing points to generate three-dimensional molecularly woven structures, weaving in two dimensions remains largely unexplored. We report a new strategy to access 2D woven COFs by controlling the angle of the usually linear linker, resulting in the successful synthesis of a 2D woven pattern based on chain-link fence. The synthesis was accomplished by linking aldehyde-functionalized copper(I) bisphenanthroline complexes with bent 4,4'-oxydianiline building units. This results in the formation of a crystalline solid, termed COF-523-Cu, whose structure was characterized by spectroscopic techniques and electron and X-ray diffraction techniques to reveal a molecularly woven, twofold-interpenetrated chain-link fence. The present work significantly advances the concept of molecular weaving and its practice in the design of complex chemical structures.

Bioconjug Chem (impact factor: 4.7) 2 区

Surface Hybridization Chain Reaction of Binary Mixture DNA-PEG Corona Nanostructures Produced by Low-Volume RAFT-Mediated Photopolymerization-Induced Self-Assembly.

Chaimueangchuen, Frommer, et. al

Abstract:

DNA-polymer hybrids have been attracting interest as adaptable functional materials by combining the stability of polymers with DNA nanotechnology. Both research fields have in common the capacity to be precise, versatile, and tunable, a prerequisite for creating powerful tools which can be easily tailored and adapted for bio-related applications. However, the conjugation of hydrophilic DNA with hydrophobic polymers remains challenging. In recent years, polymerization-induced self-assembly (PISA) has attracted significant attention for constructing nano-objects of various morphologies owing to the one-step nature of the process, creating a beneficial method for the creation of amphiphilic DNA-polymer nanostructures. This process not only allows pure DNA-polymer-based systems to be produced but also enables the mixture of other polymeric species with DNA conjugates. Here, we present the first

report of a DNA-PEG corona nano-object's synthesis without the addition of an external photoinitiator or photocatalyst via photo-PISA. Furthermore, this work shows the use of DNA-macroCTA, which was first synthesized using a solid-support method resulting in high yields, easy upscaling, and no need for HPLC purification. In addition, to the formation of DNA-polymer structures, increasing the nucleic acid loading of assemblies is of great importance. One of the most intriguing phenomena of DNA is the hybridization of single-stranded DNA with a second strand, increasing the nucleic acid content. However, hybridization of DNA in a particle corona may destabilize the nanomaterial due to the electrostatic repulsive force on the DNA corona. Here, we have investigated how changing the DNA volume fraction in hybrid DNA-polymer self-assembled material affects the morphology. Moreover, the effect of the corona composition on the stability of the system during the hybridization was studied. Additionally, the hybridization chain reaction was successfully applied as a new method to increase the amount of DNA on a DNA-based nano-object without disturbing the morphology achieving a fluorescence signal amplification.

ENERGY MATERIALS

ACS Nano (impact factor: 17.1) 1 区 TOP

Omnidirectional Configuration of Stretchable Strain Sensor Enabled by the Strain Engineering with Chiral Auxetic Metamaterial.

Hu, Pan, et. al

Abstract:

An electromechanical interface plays a pivotal role in determining the performance of a stretchable strain sensor. The intrinsic mechanical property of the elastomer substrate prevents the efficient modulation of the electromechanical interface, which limits the further evolution of a stretchable strain sensor. In this study, a chiral auxetic metamaterial (CAM) is incorporated into the elastomer substrate of a stretchable strain sensor to override the deformation behavior of the pristine device and regulate the device performance. The tunable isotropic Poisson's ratio (from 0.37 to -0.25) achieved by the combination of CAM and elastomer substrate endows the stretchable strain sensor with significantly enhanced sensitivity (53-fold improvement) and excellent omnidirectional sensing ability. The regulation mechanism associated with crack propagation on the deformed substrate is also revealed with finite element simulations and experiments. The demonstration of on-body monitoring of human physiological signals and a smart training assistant for trampoline gymnastics with the CAM-incorporated strain sensor further illustrates the benefits of omnidirectionally enhanced performance.

J Am Chem Soc (impact factor: 15) 1 区 TOP

Excited-Multimer Mediated Supramolecular Upconversion on Multicomponent Lanthanide-Organic Assemblies.

Duan, Zhou, et. al

Abstract:

Upconversion (UC) is a fascinating anti-Stokes-like optical process with promising applications in diverse fields. However, known UC mechanisms are mainly based on direct energy transfer between metal ions, which constrains the designability and tunability of the structures and properties. Here, we synthesize two types of Ln8L12-type (Ln for lanthanide ion; L for organic ligand L1 or L2R/S) lanthanide-organic complexes with assembly induced excited-multimer states. The Yb8(L2R/S)12 assembly exhibits upconverted multimer green fluorescence under 980 nm excitation through a cooperative sensitization process. Furthermore, upconverted red emission from Eu3+ on the heterometallic (Yb/Eu)8L12 assemblies is also realized via excited-multimer mediated energy relay. Our findings demonstrate a new strategy for designing UC materials, which is crucial for exploiting photofunctions of multicomponent lanthanide-organic complexes.

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

Ferromagnetic ordering correlated strong metal-oxygen hybridization for superior oxygen reduction reaction activity.

Li, Zheng, et. al

Abstract:

The efficiency of transition-metal oxide materials toward oxygen-related electrochemical reactions is classically controlled by metal-oxygen hybridization. Recently, the unique magnetic exchange interactions in transition-metal oxides are proposed to facilitate charge transfer and reduce activation barrier in electrochemical reactions. Such spin/magnetism-related effects offer a new and rich playground to engineer oxide electrocatalysts, but their connection with the classical metal-oxygen hybridization theory remains an open question. Here, using the MnxVyOz family as a platform, we show that ferromagnetic (FM) ordering is intrinsically correlated with the strong manganese (Mn)-oxygen (O) hybridization of Mn oxides, thus significantly increasing the oxygen reduction reaction (ORR) activity. We demonstrate that this enhanced Mn-O hybridization in FM Mn oxides is closely associated with the generation of active Mn sites on the oxide surface and obtaining favorable reaction thermodynamics under operating conditions. As a result, FM-Mn2V2O7 with a high degree of Mn-O hybridization achieves a record high ORR activity. Our work highlights the potential applications of magnetic oxide materials with strong metal-oxygen

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hybridization in energy devices.

RENEWABLE MATERIAL

Chem Mater (impact factor: 8.6) 1 区 TOP

Synthesis of High Entropy and Entropy-Stabilized Metal Sulfides and Their Evaluation as Hydrogen Evolution Electrocatalysts.

Xiao, Li, et. al

Abstract

High entropy metal chalcogenides are materials containing five or more elements within a disordered sublattice. These materials exploit a high configurational entropy to stabilize their crystal structure and have recently become an area of significant interest for renewable energy applications such as electrocatalysis and thermoelectrics. Herein, we report the synthesis of bulk particulate HE zinc sulfide analogues containing four, five, and seven metals. This was achieved using a molecular precursor cocktail approach with both transition and main group metal dithiocarbamate complexes which are decomposed simultaneously in a rapid (1 h) and low-temperature (500 °C) thermolysis reaction to yield high entropy and entropy-stabilized metal sulfides. The resulting materials were characterized by powder XRD, SEM, and TEM, alongside EDX spectroscopy at both the micro- and nano-scales. The entropy-stabilized (CuAgZnCoMnInGa)S material was demonstrated to be an excellent electrocatalyst for the hydrogen evolution reaction when combined with conducting carbon black, achieving a low onset overpotential of (∼80 mV) and η10 of (∼255 mV).© 2023 The Authors. Published by American Chemical Society.

Int J Biol Macromol (impact factor: 8.2) 2 区

Recent advances in sustainable preparation of cellulose nanocrystals via solid acid hydrolysis: A mini-review.

Wang, Liu, et. al

Abstract

As a green and renewable nanomaterial, cellulose nanocrystals (CNC) have received numerous attention due to the unique structural features and superior physicochemical properties. Conventionally, CNC was isolated from lignocellulosic biomass mostly depending on sulfuric or hydrochloric acid hydrolysis. Although this approach is effective, some critical issues such as severe equipment corrosion, excessive cellulose

degradation, serious environmental pollution, and large water usage are inevitable. Fortunately, solid acid hydrolysis is emerging as an economical and sustainable CNC production technique and has achieved considerable progress in recent years. Herein, the preparation of CNC by solid acid hydrolysis was summarized systematically, including organic solid acids (citric, maleic, oxalic, tartaric, p-toluenesulfonic acid) and inorganic solid acids (phosphotungstic, phosphoric, and Lewis acid). The advantages and disadvantages of organic and inorganic solid acid hydrolysis methods were evaluated comprehensively. Finally, the challenges and opportunities in the later exploitation and application of solid acid hydrolysis to prepare CNC in the industrial context are discussed. Considering the future development of this technology in the large-scale CNC production, much more efforts should be made in lowering CNC processing cost, fabricating high-solid-content and re-dispersible CNC, developing value-added applications of CNC, and techno-economic analysis and life cycle assessment on the whole process.

Ind Eng Chem Res (impact factor: 4.2) 3 ☒ TOP

Highly Efficient Conversion of Greenhouse Gases Using a Quadruple Mixed Oxide-Supported Nickel Catalyst in Reforming Process.

Phichairatanaphong, Yigit, et. al

Abstract

The greenhouse gas reduction as well as the utilization of more renewable and clean energy via a dry reforming reaction is of interest. The impact of a CeMgZnAl oxide quad-blend-supported Ni catalyst on performance and anticoking during dry reforming reactions at 700 °C was studied. A high Ce-Mg/Zn ratio, as seen in the CeMg0.5ZnAl-supported nickel catalyst, enhances lattice oxygen, and the presence of strong basic sites, along with the creation of the carbonate intermediate species, is accompanied by the production of gaseous CO through a gasification reaction between the carbon species and Ni-COads-lin site. The phenomena caused the outstanding performance of the Ni/CeMg0.5ZnAl catalyst-CH4 (84%),CO2 (83%) conversions, and the H2/CO (0.80) ratio; moreover, its activity was also stable throughout 30 h.© 2023 The Authors. Published by American Chemical Society.

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

Reaction Chemistry at Discrete Organometallic Fragments on Black Phosphorus.

Walz-Mitra, Riehs, et. al

Abstract

Black phosphorus (bP) is a two-dimensional van der Waals material unique in its potential to serve as a support for single-site catalysts due to its similarity to molecular phosphines, ligands quintessential in homogeneous catalysis. However, there is scarcity of synthetic methods to install single metal centers on the bP lattice. Here we demonstrate the functionalization of bP nanosheets with molecular Re and Mo complexes. A suite of characterization techniques, including infrared, X-ray photoelectron and X-ray absorption spectroscopy as well as scanning tunneling electron microscopy corroborate that the functionalized nanosheets contain a high density of discrete metal centers directly bound to the bP surface. Moreover, the supported metal centers are chemically accessible and can undergo ligand exchange transformations without detaching from the surface. The steric and electronic properties of bP as a ligand are estimated with respect to molecular phosphines. Sterically, bP resembles tri(tolyl)phosphine when monodentate to a metal center, and bis(diphenylphosphino)propane when bidentate, whereas electronically bP is a σ-donor as strong as a trialkyl phosphine. This work is foundational in elucidating the nature of black phosphorus as a ligand and underscores the viability of using bP as a basis for single-site catalysts.© 2023 Wiley-VCH GmbH.

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

An intact pituitary vasopressin system is critical for building a robust circadian clock in the suprachiasmatic nucleus.

Yamaguchi, Maekawa, et. al

Abstract:

The circadian clock is a biological timekeeping system that oscillates with a circa-24-h period, reset by environmental timing cues, especially light, to the 24-h day-night cycle. In mammals, a "central" clock in the hypothalamic suprachiasmatic nucleus (SCN) synchronizes "peripheral" clocks throughout the body to regulate behavior, metabolism, and physiology. A key feature of the clock's oscillation is resistance to abrupt perturbations, but the mechanisms underlying such robustness are not well understood. Here, we probe clock robustness to unexpected photic perturbation by measuring the speed of reentrainment of the murine locomotor rhythm after an abrupt advance of the

light-dark cycle. Using an intersectional genetic approach, we implicate a critical role for arginine vasopressin pathways, both central within the SCN and peripheral from the anterior pituitary.

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

Viral nanoparticle vaccines against S100A9 reduce lung tumor seeding and metastasis.

Chung, Ortega-Rivera, et. al

Abstract:

Metastatic cancer accounts for 90% of all cancer-related deaths and continues to be one of the toughest challenges in cancer treatment. A growing body of data indicates that S100A9, a major regulator of inflammation, plays a central role in cancer progression and metastasis, particularly in the lungs, where S100A9 forms a premetastatic niche. Thus, we developed a vaccine against S100A9 derived from plant viruses and virus-like particles. Using multiple tumor mouse models, we demonstrate the effectiveness of the S100A9 vaccine candidates in preventing tumor seeding within the lungs and outgrowth of metastatic disease. The elicited antibodies showed high specificity toward S100A9 without cross-reactivity toward S100A8, another member of the S100A family. When tested in metastatic mouse models of breast cancer and melanoma, the vaccines significantly reduced lung tumor nodules after intravenous challenge or postsurgical removal of the primary tumor. Mechanistically, the vaccines reduce the levels of S100A9 within the lungs and sera, thereby increasing the expression of immunostimulatory cytokines with antitumor function [(interleukin) IL-12 and interferonγ] while reducing levels of immunosuppressive cytokines (IL-10 and transforming growth factorβ). This also correlated with decreased myeloid-derived suppressor cell populations within the lungs. This work has wide-ranging impact, as S100A9 is overexpressed in multiple cancers and linked with poor prognosis in cancer patients. The data presented lay the foundation for the development of therapies and vaccines targeting S100A9 to prevent metastasis.

Ⅱ Concentration

PHYSICS

An atomic-scale multi-qubit platform

Yu Wang, Yi Chen, et al.

Abstract

Individual electron spins in solids are promising candidates for quantum science and technology, where bottom-up assembly of a quantum device with atomically precise couplings has long been envisioned. Here, we realized atom-by-atom construction, coherent operations, and readout of coupled electron-spin qubits using a scanning tunneling microscope. To enable the coherent control of "remote" qubits that are outside of the tunnel junction, we complemented each electron spin with a local magnetic field gradient from a nearby single-atom magnet. Readout was achieved by using a sensor qubit in the tunnel junction and implementing pulsed double electron spin resonance. Fast single-, two-, and three-qubit operations were thereby demonstrated in an all-electrical fashion. Our angstrom-scale qubit platform may enable quantum functionalities using electron spin arrays built atom by atom on a surface.

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

Diverse functional polyethylenes by catalytic amination

Nicodemo R. Ciccia, Jake X. Shi, et al.

Abstract

Functional polyethylenes possess valuable bulk and surface properties, but the limits of current synthetic methods narrow the range of accessible materials and prevent many envisioned applications. Instead, these materials are often used in composite films that are challenging to recycle. We report a Cu-catalyzed amination of polyethylenes to form mono- and bifunctional materials containing a series of polar groups and substituents. Designed catalysts with hydrophobic moieties enable the amination of linear and branched polyethylenes without chain scission or cross-linking, leading to polyethylenes with otherwise inaccessible combinations of functional groups and architectures. The resulting materials possess tunable bulk and surface properties, including toughness, adhesion to metal, paintability, and water solubility, which could unlock applications for functional polyethylenes and reduce the need for complex composites.

3D printing of inorganic nanomaterials by photochemically bonding colloidal nanocrystals

Abstract

3D printing of inorganic materials with nanoscale resolution offers a different materials processing pathway to explore devices with emergent functionalities. However, existing technologies typically involve photocurable resins that reduce material purity and degrade properties. We develop a general strategy for laser direct printing of inorganic nanomaterials, as exemplified by more than 10 semiconductors, metal oxides, metals, and their mixtures. Colloidal nanocrystals are used as building blocks and photochemically bonded through their native ligands. Without resins, this bonding process produces arbitrary three-dimensional (3D) structures with a large inorganic mass fraction (~90%) and high mechanical strength. The printed materials preserve the intrinsic properties of constituent nanocrystals and create structure-dictated functionalities, such as the broadband chiroptical responses with an anisotropic factor of ~0.24 for semiconducting cadmium chalcogenide nanohelical arrays.

Solid-solvent processing of ultrathin, highly loaded mixed-matrix membrane for gas separation

Guining Chen, Cailing Chen, et al.

Abstract

Mixed-matrix membranes (MMMs) that combine processable polymer with more permeable and selective filler have potential for molecular separation, but it remains difficult to control their interfacial compatibility and achieve ultrathin selective layers during processing, particularly at high filler loading. We present a solid-solvent processing strategy to fabricate an ultrathin MMM (thickness less than 100 nanometers) with filler loading up to 80 volume %. We used polymer as a solid solvent to dissolve metal salts to form an ultrathin precursor layer, which immobilizes the metal salt and regulates its conversion to a metal-organic framework (MOF) and provides adhesion to the MOF in the matrix. The resultant membrane exhibits fast gas-sieving properties, with hydrogen permeance and/or hydrogen–carbon dioxide selectivity one to two orders of magnitude higher than that of state-of-the-art membranes.

CHEMISTRY

The oscillating Fischer-Tropsch reaction

Rui Zhang, Yong Wang, et. al

Abstract

The mechanistic steps that underlie the formation of higher hydrocarbons in catalytic carbon monoxide (CO) hydrogenation at atmospheric pressure over cobalt-based catalysts (Fischer-Tropsch synthesis) have remained poorly understood. We reveal nonisothermal rate-and-selectivity oscillations that are self-sustained over extended periods of time (>24 hours) for a cobalt/cerium oxide catalyst with an atomic ratio of cobalt to cerium of 2:1 (Co_2Ce_1) at 220°C and equal partial pressures of the reactants. A microkinetic mechanism was used to generate rate-and-selectivity oscillations through forced temperature oscillations. Experimental and theoretical oscillations were in good agreement over an extended range of reactant pressure ratios. Additionally, phase portraits for hydrocarbon production were constructed that support the thermokinetic origin of our rate-and-selectivity oscillations.

Aromatic nitrogen scanning by ipso-selective nitrene internalization

Tyler J. Pearson, Ryoma Shimazumi, et. al

Abstract

Nitrogen scanning in aryl fragments is a valuable aspect of the drug discovery process, but current strategies require time-intensive, parallel, bottom-up synthesis of each pyridyl isomer because of a lack of direct carbon-to-nitrogen (C-to-N) replacement reactions. We report a site-directable aryl C-to-N replacement reaction allowing unified access to various pyridine isomers through a nitrene-internalization process. In a two-step, one-pot procedure, aryl azides are first photochemically converted to 3*H*-azepines, which then undergo an oxidatively triggered C2-selective cheletropic carbon extrusion through a spirocyclic azanorcaradiene intermediate to afford the pyridine products. Because the *ipso* carbon of the aryl nitrene is excised from the molecule, the reaction proceeds regioselectively without perturbation of the remainder of the substrate. Applications are demonstrated in the abbreviated synthesis of a pyridyl derivative of estrone, as well as in a prototypical nitrogen scan.

Hydrogen-bond-acceptor ligands enable distal C(sp3)–H arylation of free alcohols

Strassfeld, Daniel A., et. al

Abstract

The functionalization of C–H bonds in organic molecules is one of the most direct approaches for chemical synthesis. Recent advances in catalysis have allowed native chemical groups such as carboxylic acids, ketones and amines to control and direct C(sp^3)–H activation[1,2,3,4]. However, alcohols, among the most common functionalities in organic chemistry[5], have remained intractable because of their low affinity for late transition-metal catalysts[6,7]. Here we describe ligands that enable alcohol-directed arylation of δ-C(sp^3)–H bonds. We use charge balance and a secondary-coordination-sphere hydrogen-bonding interaction—evidenced by structure–activity relationship studies, computational modelling and crystallographic data—to stabilize L-type hydroxyl coordination to palladium, thereby facilitating the assembly of the key C–H cleavage transition state. In contrast to previous studies in C–H activation, in which secondary interactions were used to control selectivity in the context of established reactivity[8,9,10,11,12,13], this report demonstrates the feasibility of using secondary interactions to enable challenging, previously unknown reactivity by enhancing substrate–catalyst affinity.

BIOLOGY

PIM1 controls GBP1 activity to limit self-damage and to guard against pathogen infection

Daniel Fisch, Moritz M. Pfleiderer, et al.

Abstract

Disruption of cellular activities by pathogen virulence factors can trigger innate immune responses. Interferon-γ (IFN-γ)–inducible antimicrobial factors, such as the guanylate binding proteins (GBPs), promote cell-intrinsic defense by attacking intracellular pathogens and by inducing programmed cell death. Working in human macrophages, we discovered that GBP1 expression in the absence of IFN-γ killed the cells and induced Golgi fragmentation. IFN-γ exposure improved macrophage survival through the activity of the kinase PIM1. PIM1 phosphorylated GBP1, leading to its sequestration by 14-3-3σ, which thereby prevented GBP1 membrane association. During Toxoplasma gondii infection, the virulence protein TgIST interfered with IFN-

γ signaling and depleted PIM1, thereby increasing GBP1 activity. Although infected cells can restrain pathogens in a GBP1-dependent manner, this mechanism can protect uninfected bystander cells. Thus, PIM1 can provide a bait for pathogen virulence factors, guarding the integrity of IFN-γ signaling.

Mapping SARS-CoV-2 antigenic relationships and serological responses

Samuel H. Wilks, Barbara Mühlemann, et. al

Abstract

During the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic, multiple variants escaping preexisting immunity emerged, causing reinfections of previously exposed individuals. Here, we used antigenic cartography to analyze patterns of cross-reactivity among 21 variants and 15 groups of human sera obtained after primary infection with 10 different variants or after messenger RNA (mRNA)–1273 or mRNA-1273.351 vaccination. We found antigenic differences among pre-Omicron variants caused by substitutions at spike-protein positions 417, 452, 484, and 501. Quantifying changes in response breadth over time and with additional vaccine doses, our results show the largest increase between 4 weeks and >3 months after a second dose. We found changes in immunodominance of different spike regions, depending on the variant an individual was first exposed to, with implications for variant risk assessment and vaccine-strain selection.

Hormone-mediated neural remodeling orchestrates parenting onset during pregnancy

Rachida Ammari, Francesco Monaca, et. al

Abstract

During pregnancy, physiological adaptations prepare the female body for the challenges of motherhood. Becoming a parent also requires behavioral adaptations. Such adaptations can occur as early as during pregnancy, but how pregnancy hormones remodel parenting circuits to instruct preparatory behavioral changes remains unknown. We found that action of estradiol and progesterone on galanin (Gal)–expressing neurons in the mouse medial preoptic area (MPOA) is critical for pregnancy-induced parental behavior. Whereas estradiol silences $MPOA^{Gal}$ neurons and paradoxically increases their excitability, progesterone permanently rewires this circuit node by promoting dendritic spine formation and recruitment of excitatory synaptic inputs. This $MPOA^{Gal}$-specific neural remodeling sparsens population activity in vivo and results in persistently stronger, more selective responses to pup stimuli. Pregnancy hormones thus remodel parenting circuits in anticipation of future behavioral need.

Ⅲ Calling for papers

ICANM 2024

Submission deadline:	**Nov 15, 2023**
Conference date:	**Jan 19, 2024 - Jan 21, 2024**
Full name:	**2024 3rd International Conference on Advanced Nanomaterials**
Location:	**Okinawa, Japan**
Website:	http://www.icanm.net

2024 3rd International Conference on Advanced Nanomaterials (ICANM 2024) will be held in Okinawa, Japan during January 19-21, 2024.

We welcome you to Okinawa and hope that the ICANM 2024 Conference will serve as an excellent international platform for an engaging and informal exchange of ideas, that provides opportunities to strengthen existing collaborations and catalyze new partnerships, and thus ultimately accelerating the application of advanced nanomaterials to address the most urgent societal needs.

Call for papers:

Topics include, but are not limited to:

Nano-porous Materials
Nanocatalysis
Nanocomposites
Nanocrystals
Nanodevices
Nanoelectronics
Nanofluids
Nanomagnetics

For more topics, please visit: http://icanm.net/cfp.html

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WMMM 2024

Submission deadline:	**Dec 5, 2023**
Conference date:	**Apr 24, 2024 - Apr 26, 2024**
Full name:	**2024 Workshop on Materials, Mechanical and Manufacturing Engineering**
Location:	**Cape Town, South Africa**
Website:	http://www.wmmm.net/

On behalf of the Organizing Committee of 2024 Workshop on Materials, Mechanical and Manufacturing Engineering (WMMM 2024), we cordially invite you to participate in this event to be held in Cape Town, South Africa from April 24-26, 2024, conjunction with ICRoM 2024 as the workshop. It's organized with the support of the Faculty of Engineering and Technology, The Vaal University of Technology (VUT).

Topics of Interest :

Topic 1. Material Science and Engineering
Composites
Micro / Nano Materials
Steel and Iron
Polymer Materials
New Functional Materials
Materials Physics and Chemistry
Biomaterials and Biomedical Materials
Optical/Electronic/Magnetic Materials
Thin Films
Earthquake Resistant Structures, Materials and Design
Hydrogen and Fuel Cell Science, Engineering and Technology

Topic 2. Mechanical and Manufacturing Engineering
Aerodynamics
Aerospace Structures: Analysis and Design
Aerospace Materials and Manufacturing Processes
Gas Turbine Propulsion Systems
Aircraft Performance, Dynamics, and Design
Robotics and Computer Numerical Control
Introduction to Optimization
Manufacturing Automation
Manufacturing Planning and Quality Control
Simulation Modeling and Facilities Planning
Mechatronics Systems Design

More Topics, please visit at http://www.wmmm.net/

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ICIEA 2024

Submission deadline: **Dec 20, 2023**
Conference date: **Apr 17, 2024 - Apr 19, 2024**
Full name: **2024 11th International Conference on Industrial Engineering and Applications**
Location: **Hiroshima, Japan**
Website: http://www.iciea.org

2024 11th International Conference on Industrial Engineering and Applications (ICIEA 2024)
Hiroshima, Japan / April 17-19, 2024
2024 11th International Conference on Industrial Engineering and Applications (ICIEA 2024), is to be held in Hiroshima, Japan during April 17-19, 2024. Conference official website: http://www.iciea.org
Accepted and presented papers will be published by ICIEA 2024 Proceedings-Advances in Transdisciplinary Engineering by IOS Press, which can be indexed EI Compendex and SCOPUS.

Call for Papers:

Included but not limited to:
Advanced Manufacturing Technology and Application
Advanced Design and Manufacturing (Methods)
Manufacturing Systems and Management
Lean Manufacturing
3D Print
Reliability and Maintenance Engineering
Manufacturing Process Optimization
Manufacturing System Control
Smart Production
Machining and Forging Technology
Additive Manufacturing and Process
Machine Learning for Manufacturing
Artificial Intelligence for Manufacturing
Manufacturing Systems and Automation
Industry 4.0 and IoT
Production Planning and Control
Quality Control and Risk Management
Reliability and Maintenance Engineering
Production and Operation Management
Workflow Technologies and Applications
Virtual Engineering and Digital Twin
Hybrid Products, Multidisciplinary Product Development
Industrial Robotic
Sensoring and Inference for Manufacturing
Automation and Discrete Event Systems
Applications for Smart Production Systems
Information Industry and Management
Engineering Economy and Cost Analysis
Engineering Education and Training
Global Manufacturing and Management
Project Management
Safety, Security and Risk Management
Supply Chain Management
Logistics Engineering and Management
Work Space Design and Equipment Management
Ergonomics and Its Applications
Industrial Internet of Things
Block chain for Manufacturing and Management
Product Lifecycle Management
http://iciea.org/cfp.html

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ACMME 2024

Submission deadline:	**Jan 25, 2024**
Conference date:	**Jun 14, 2024 - Jun 17, 2024**
Full name:	**2024 12th Asia Conference on Mechanical and Materials Engineering**
Location:	**Kyoto, Japan**
Website:	http://www.acmme.org

Good news! The 12th Asia Conference on Mechanical and Materials Engineering (ACMME 2024) will be held in Kyoto University of Advanced Science, Kyoto, Japan during June 14-17, 2024. Since 2013, ACMME has been successfully held for 11 years in multiple countries and areas. ACMME had cooperated with top universities and had gained good reputation among researchers and scholars.

We warmly welcome you to attend ACMME 2024! Both VIRTUAL and ONSITE participation are available. May we get together in ACMME 2024! Look forward to meeting all of you! Hope all you have a good harvest during coming conference and have wonderful journey in Kyoto!

***Call for papers:**

Materials Science
New Materials and Advanced Materials
Environmental Friendly Materials
Manufacturing Processes and Mechanical Engineering
Waste-to-Energy, Waste Management and Waste Disposal
Virtual Manufacturing, and Simulation
Microwave Processing of Materials
Biomaterials
Virtual Manufacturing, and Simulation
More topics, please go to: http://www.acmme.org/cfp.html

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ICAMM 2024

Submission deadline: **Feb 23, 2024**
Conference date: **Jul 10, 2024 - Jul 12, 2024**
Full name: **2024 8th International Conference on Advanced Manufacturing and Materials**
Location: **Edinburgh, United Kingdom**
Website: http://www.icamm.org

2023 7th International Conference on Advanced Manufacturing and Materials (ICAMM 2023) was successfully held in Cambridge, England during July 11-13, 2023. Sincere appreciation express to everyone for your participation and support! To get more details, please visit: http://www.icamm.org/2023.html

Now, it's my great honor to be the behalf of the Conference Committee to announce that 2024 8th International Conference on Advanced Manufacturing and Materials (ICAMM 2024) will be held in Edinburgh, United Kingdom during July 10-12, 2024.

**We sincerely welcome you to attend ICAMM 2024 and wish all of you have a good harvest in period of conference.

Topics of interest

~ Materials
Composite Materials
New Materials
Materials Properties, Measuring Methods and Applications
Superconducting Materials and technology
Nanotechnology, Nano-Materials and Nano-Composites

~ Manufacturing
Materials Manufacturing and Processing
Casting, Powder Metallurgy
Welding, Sintering, Heat Treatment
Thin & Thick Coatings
Surface Treatment, Machining

*More topics, please go to: http://www.icamm.org/cfp.html

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