

Science Newsletter

2024 Volume 7 (Total 7) Website: <http://lib.jsut.edu.cn/2018/1015/c5474a113860/page.htm>,
May, 2024

Contents

INTRODUCTION:	2
I TOPICS	2
GENERAL MATERIALS SCIENCE	2
METALS AND ALLOYS	5
POLYMERS AND PLASTICS.....	7
SURFACES, COATINGS AND FILMS	10
ELECTRONIC, OPTICAL AND MAGNETIC MATERIALS	14
II CONCENTRATION	18
PHYSICS.....	18
MATERIALS	19
CHEMISTRY	21
BIOLOGY	22
III CALLING FOR PAPERS	25
ICEEI 2024	25
ICSCE 2024	27
ICBMM 2024	28
ICCME 2024	30

Introduction:

There are 3 main elements in the Science Newsletter is composed. In the first part, we provide articles about central issues for each discipline in this university, and they are provided with one subject for a time. In the second part, we select articles from the top journals in the whole science research. 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 <http://lib.jsut.edu.cn/2018/1015/c5474a113860/page.htm>. If there are any questions or suggestions, please send e-mails to 289595883@qq.com in no hesitate.

I Topics

The key word of this month is **Materials**. We list several articles which are related to the top concerned topics of computer science researches. The articles are classified in 5 categories, and they are: **General Materials Science, Metals and Alloys, Polymers and Plastics, Surfaces, Coatings and Films and Electronic, Optical and Magnetic Materials**. Also, the listed articles are all arranged in a descending sort of impact factor in order to make it convenient to read. There are also links to both official site and full text for each article.

GENERAL MATERIALS SCIENCE

Desalination 1


Electrically conductive membrane for fouling control: Its mechanisms and applications

Jung-Hyun Kim · Jaewon Lee · Seonkyu Lee. et.al

Abstract:

Membrane processes have attracted considerable attention in the field of water treatment because of their excellent compactness, convenient operation and management, and relatively low energy consumption. However, fouling is a significant technical challenge. Electrically conductive membrane (ECM) technology has recently

emerged as a promising alternative owing to its novel and effective mechanisms and outstanding fouling control efficiency. However, because ECM technology is still in the early stages of research, its maturity is low, and fundamental research on the mechanism is insufficient. In this critical review, the mechanisms of the ECM for fouling control were systematically elucidated and categorized as electrochemical oxidation and reduction, electrostatic interactions, and electrolysis. Subsequently, an extensive and comprehensive literature survey of ECM applications was conducted. The current state of the application and performance of ECM technology was evaluated. The operation and modification strategies of ECM research are discussed based on an accurate understanding and evaluation of the fundamental mechanisms and level of actual application of ECM technology for fouling control. Consequently, topics for future academic research and practical applications of the ECM are proposed.

Desalination 1 

Functionalized graphene oxide-modified sulfonated poly (2,6-dimethyl-1,4-phenylene oxide) based thermal-resistance anti-fouling bi-functional cation exchange membrane for electro-dialytic desalination

Sweety Suhag · Prashant Kumar · Jyoti Ranjan Mandal et.al

Abstract:


We report a sustainable strategy for fabricating thermal-resistance anti-fouling cation exchange membrane (CEM), using sulfonated poly (2,6-dimethyl-1,4-phenylene oxide) (SPPO), and phosphorylated graphene oxide (FGO). The GO was phosphorylated, and different CEMs (3.0–7.0 % weight ratio of FGO) were prepared to investigate their electro-dialysis (ED) performance. Structural features of SPPO-FGO composite CEMs such as ~ 21.51 % degree of sulphonation (SPPO), bi-functional (-SO₃H, and -PO₃H₂) nature, and balanced hydrophobic-hydrophilic segments, etc., were attributed for thermal-resistance and anti-fouling membrane nature of the membrane. The presence of FGO in the SPPO polymer matrix significantly improved mechanical, thermal, oxidative stabilities, ionic conductivity (κ m), and counter-ion transport number. Suitable optimized SPPO-FGO/7 % (7.0 % of FGO) showed excellent physicochemical properties (14.1 % water uptake, 3.2 % swelling ratio, and 1.76 m eq./g ion exchange capacity), along with 10.92×10^{-2} S cm⁻¹ conductivity, and 0.95 counter-ion transport number at 30 °C. Improved i-V curves and ED performance at 60 °C, showed relatively low energy consumption (0.72 k W hr/kg of NaCl removed), and high current efficiency (99.0 %) for SPPO-FGO/7 % CEM revealed, its potential candidature for electro-dialytic water desalination. Further, CEM also avoids any significant deterioration in ED performance due to the presence of cationic, anionic and zwitterionic foulants.

Progress in Materials Science 1 

Progress in ATRP-derived materials for biomedical applications

Abstract:

The continuing wave of technological breakthroughs and advances is critical for engineering well-defined materials, particularly biomaterials, with tailored microstructure and properties. Over the last few decades, controlled radical polymerization (CRP) has become a very promising option for the synthesis of precise polymeric materials with an unprecedented degree of control over molecular architecture. Atom transfer radical polymerization (ATRP), one of the most robust and efficient CRPs, has been at the forefront of the synthesis of well-defined polymers with controlled/predetermined molecular weights, polydispersity, topology, composition, and site-specific functionality. ATRP has been leveraged to prepare a wide range of polymers with properties tailored for a number of biomedical applications. Furthermore, ATRP can also be utilized to introduce stimuli-responsive properties into the chemical structure of polymers. Moreover, the degradation behavior of ATRP-derived polymers can be tailored by incorporating chemical bonds susceptible to hydrolysis or proteolysis. This strategy allows the design of degradable polymers for in vivo applications. This review summarizes the recent advances in ATRP for the design of functional materials and techniques implemented to advance the biomedical field, such as surface modification and functionalization. Additionally, the latest applications and progress of ATRP-derived materials in various biomedical arenas such as drug delivery, tissue engineering, bioimaging, and biosensing are reported. Lastly, the current limitations and future perspectives of ATRP-derived biomaterials are carefully discussed to support further improvement of their properties and performance for translatability into the clinic. Moving forward, there is a need for further development of ATRP to align with green chemistry principles. This entails exploring the use of renewable monomers, environmentally friendly and nontoxic solvents, as well as metal-free and biocompatible catalysts. Additionally, researchers should thoroughly investigate the bioactivity, biodegradation behavior, and in vivo fate of ATRP-derived polymers and polymer conjugates before considering their translation into clinical applications.

Materials Science and Engineering: R: Reports 1 

The art of controlled nanoscale lattices: A review on the self-assembly of colloidal metal–organic framework particles and their multifaceted architectures


Abdelkarim Chaouiki · Maryam Chafiq · Young Gun Ko

Abstract:

Nanoscale lattices formed through the art of controlled self-assembly hold a promise for the creation of advanced materials with diverse applications. These versatile particles, boasting exceptional attributes such as colloidal stability, tunable sizes, and

an array of sophisticated shapes, allow access to a vast multifunctionality. In this context, the controlled self-assembly of colloidal metal-organic framework (MOF) particles is a promising field that encourage scientists to continue exploring across the limits of what is possible. A thorough investigation of this new field of study reveals the possibility of influencing a future in which innovation and creativity converge to produce a wide range of applications. In this review, we present a comprehensive overview of the self-assembly of colloidal MOF (CMOF) particles into ordered superstructures, with a focus on the underlying principles governing the self-assembly of CMOF, design and synthetic strategies, as well as their self-assembly mechanisms. In addition, the stability of CMOF particles is highlighted, emphasizing efforts and strategies to ensure their reliability. Finally, we offer some insights and perspectives for the future development and the potential application of CMOF, reflecting the great potential and rapid development of this interdisciplinary research field. We aim to provide new insights into MOF particle self-assembly and further guide future research for large-scale applications.

Metals and Alloys


Journal of Materials Science & Technology 1 

Achieving large near-linear elasticity, low modulus, and high strength in a metastable β -Ti alloy by mild cold rolling

Yu Fu · Wenlong Xiao · Jian Rong et al

Abstract:

Simultaneously achieving high elasticity, low modulus, and high strength in Ti alloy has been a longstanding challenge. In this study, cold rolling was conducted to modulate the martensitic transformation of the Ti-15Nb-5Zr-4Sn-1Fe alloy to address this challenge. The 10% cold rolling process was primarily accommodated by a novel stress-induced sequential β -to- α' -to- α' martensitic transformation accompanied by the disappearance of ω phase, which was sufficient to induce adequate martensite and defects to suppress the initial rapid stress-induced martensitic transformation, without destroying the equiaxed shape of prior β grains. Consequently, the novel sequential phase transformation led to a substantial decrease in Young's modulus by 50.5% while increasing the strength, resulting in an excellent combination of large near-linear elasticity of 2.34%, low modulus of 45 GPa, and high strength of 1093 MPa. The obtained large near-linear elasticity was mainly contributed by the concurrent low modulus and high strength obeying Hooke's law. These findings provide valuable insights into the attainment of concurrent high elasticity and low modulus in Ti alloys by regulating the stress-induced sequential martensitic transformation.


Journal of Materials Science & Technology 1 

First-principle study on the segregation and strengthening behavior of solute elements at grain boundary in BCC iron

Feiyang Wang · Hong - Hui Wu · Xigeng Zhou

Abstract:

Grain boundary (GB) significantly influences the mechanical properties of metal structural materials, yet the effect of solutes on GB modification and the underlying atomic mechanisms of solute segregation and strengthening in iron-based alloys remain insufficiently explored. To address this research gap, we conducted a comprehensive investigation into the segregation and strengthening effect of 33 commonly occurring solutes in iron-based alloys, with a specific focus on the body-centered cubic (BCC) iron $\Sigma 5$ (310) GB, utilizing first-principle calculations. Our findings reveal a negative linear correlation between solute segregation energy and atomic radius, highlighting the crucial role of atomic radius and electronic structure in determining GB strength. Moreover, through analyzing the relationship between strengthening energy and segregation energy, it was found that the elements Ni, Co, Ti, V, Mn, Nb, Cr, Mo, W, and Re are significant enhancers of GB strength upon segregation. This study aims to provide theoretical guidance for selecting optimal doping elements in BCC iron-based alloys.


Journal of Materials Science & Technology 1 

Bioactivated polyetheretherketone scaffold able to generate mild heat for promoting bone regeneration via activating MAPK/ERK signaling pathway

Ce Zhu · Miaomiao He · Juehan Wang et.al

Abstract:

Photothermal therapy (PTT) is a desirable way to attain on-demand hyperthermia owing to the heat generated by photothermal materials absorbing near-infrared light. The mild heat (42 ± 0.5 °C) can not only accelerate bone tissue regeneration but also promote the release of bioactive ions from biomaterials. Based on this one-stone-two-birds strategy, a 3D printed PEEK-graphene composite scaffold (PG) with hydroxyapatite (HA) coating (PGH) for photothermally remote control of bone regeneration was well designed in this study. The results showed that the HA coating on PGH could release Ca^{2+} and PO_4^{3-} ions easily under NIR irradiation, which was ascribed to the mild heat generated from graphene in the composite scaffold. The mild heat and the boosted $\text{Ca}^{2+}/\text{PO}_4^{3-}$ release could synergistically enhance the bone regeneration ability both in vitro and in vivo. The underlying mechanism was further explored and confirmed to be closely related to the upregulation of HSP 70, by which the MAPK/ERK signaling pathway was activated selectively. The favorable results demonstrate that the 3D-printed PEEK/graphene composite scaffold is promising in the applications of bone defect repair.

Journal of Materials Science & Technology 1 

High-precision colorimetric-fluorescent dual-mode biosensor for detecting acetylcholinesterase based on a trimetallic nanozyme for efficient


peroxidase-mimicking

Meie Zheng · Mingxing Liu · Zichen Song et. al

Abstract:

Highly sensitive and stable acetylcholinesterase detection is critical for diagnosing and treating various neurotransmission-related diseases. In this study, a novel colorimetric-fluorescent dual-mode biosensor based on highly dispersive trimetal-modified graphite-phase carbon nitride nanocomposites for acetylcholinesterase detection was designed and synthesized by phosphorus doping and a mixed-metal MOF strategy. The specific surface area of trimetal-modified graphite-phase carbon nitride nanocomposites increased from 15.81 to 96.69 g m⁻², and its thermal stability, interfacial charge transfer, and oxidation-reduction capability were enhanced compared with those of graphite-phase carbon nitride. First-principles density functional theory calculations and steady-state kinetic analysis are applied to investigate the electronic structures and efficient peroxidase-mimicking properties of trimetal-modified graphite-phase carbon nitride nanocomposites. The oxidation of 3,3',5,5'-tetramethylbenzidine was inhibited by thiocholine, which originates from the decomposition of thiocholine iodide by Acetylcholinesterase (AChE), resulting in changes in fluorescence and absorbance intensity. Due to the independence and complementarity of the signals, a highly precise colorimetric-fluorescent dual-mode biosensor with a linear range for detecting AChE of 4–20 μU mL⁻¹ and detection limits of 0.13 μU mL⁻¹ (colorimetric) and 0.04 μU mL⁻¹ (fluorescence) was developed. The spiking recovery of AChE in actual samples was 99.0 %–100.4 %. Therefore, a highly accurate, specific, and stable dual-mode biosensor is available for AChE detection, and this biosensor has the potential for the analysis of other biomarkers.

POLYMERS AND PLASTICS

Journal of Materials Science & Technology 1 


Fabrication of a novel Z-S-scheme photocatalytic fuel cell with the Z-scheme TiO₂/GO/g-C₃N₄ photoanode and S-scheme BiOAc₁-Br /BiOBr photocathode for TC degradation

Tingting Yu · Nana Zhang · Rong Zhang et.al

Abstract:

The upsurge of interest in the emergence of photocatalytic fuel cell systems (PFC) presents an efficient and environmentally friendly approach to wastewater treatment. In this work, a Z-scheme coupled with an S-scheme heterojunction electrode was used in the PFC, utilizing TiO₂/GO/g-C₃N₄ as the photoanode and BiOAc_{1-x}Br_x/BiOBr as

the photocathode. We systematically align the band structures between the anode and cathode, which facilitates the electron transfer between the electrodes. Our attempt successfully demonstrates that collaborative power generation facilitates the high efficiency of tetracycline hydrochloride (TC) degradation at both electrodes. The photoanode achieved a 94.87 % degradation rate for TC, while the photocathode exhibited a 96.33 % degradation rate after 2 h, surpassing pristine BiOBr and BiOAc by factors of ~ 5.3 and ~ 3.8 , respectively. Furthermore, this work proposed a mechanism for electron generation, transport, and pollutant degradation mechanism in the PFC. Intermediate substances generated during the degradation of TC were analyzed through high-performance liquid chromatography-mass spectrometry (HPLC-MS) and ultraviolet photoelectron spectroscopy (UPS), while the optimal degradation pathway was confirmed using density functional theory (DFT). The findings of this work establish the feasibility of efficiently degrading pollutants through PFC treatment, introducing a novel system where various heterojunctions in bipolar materials collaborate with photocatalysis to effectively generate electricity and enhance pollutant removal.

Journal of Materials Science & Technology 1 


Quasi-in-situ investigation on complete lamellar fragmentation of β -solidified TiAl alloy during uniaxial isothermal compression

Yonghao Yu · Hongchao Kou · Xiaoxuan Xu et.al

Abstract:

The coarse as-cast lamellar microstructure in TiAl alloys is difficult to be broken completely by thermomechanical processing. Some remnant lamellar colonies in the deformed microstructure seriously affect the microstructural homogeneity and deteriorate the properties. In this study, it is found that by isothermal compression at 1230 °C and 1250 °C, the lamellar colonies of Ti-43.5Al-4Nb-1Mo-0.1B (TNM) alloys can be completely broken. This is attributed to the weakened anisotropic deformation behavior of the lamellar colonies due to the isothermal holding treatment before deformation. The deformation behavior at 1230 °C was investigated by quasi-in-situ experiments. It is observed that the regions near lamellar colony boundaries first undergo dynamic recrystallization at small strain, while the lamellar colonies gradually break down with increasing strain. The adequate fragmentation of lamellar colonies mainly depends on the recrystallization of α lamellae (α_L). The isothermal holding at 1230 °C leads to an increase in the content and thickness of α_L , which allows it to assume more deformation and promotes its recrystallization by reaching critical strain. The interrupted γ lamellae (γ_L) formed by decomposition during isothermal holding facilitates the occurrence of α recrystallization within the lamellar colonies by hindering dislocation movement. In addition, recrystallized γ grains (γ_R) are gradually dissolved by the formation of α precipitates inside them through the $\gamma \rightarrow \alpha$ phase transformation and the subsequent consumption of α

precipitates by the recrystallized α grains.


Journal of Materials Science & Technology 1 

Low-temperature bonding of Si and polycrystalline diamond with ultra-low thermal boundary resistance by reactive nanolayers

Yijun Zhong · Shuchao Bao · Rongxing He et.al

Abstract:

Thermal management is a critical challenge in modern electronics and recent key innovations have focused on integrating diamond directly onto semiconductors for efficient cooling. However, the connection of diamond/semiconductor that can simultaneously achieve low thermal boundary resistance (TBR), minimal thermal budget, and sufficient mechanical robustness remains a formidable challenge. Here, we propose a collective wafer-level bonding technique to connect polycrystalline diamonds and semiconductors at 200 °C by reactive metallic nanolayers. The resulting silicon/diamond connections exhibited an ultra-low TBR of 9.74 m² K GW⁻¹, drastically outperforming conventional die-attach technologies. These connections also demonstrate superior reliability, withstanding at least 1000 thermal cycles and 1000 h of high temperature/humidity torture. These properties were affiliated with the recrystallized microstructure of the designed metallic interlayers. This demonstration represents an advancement for low-temperature and high-throughput integration of diamonds on semiconductors, potentially enabling currently thermally limited applications in electronics.

Journal of Materials Science & Technology 1 


Non-negligible role of gradient porous structure in superelasticity deterioration and improvement of NiTi shape memory alloys

Yintao Zhang · Daixiu Wei · Yang Chao et.al

Abstract

Bone-mimicking gradient porous NiTi shape memory alloys (SMAs) are promising for orthopedic implants due to their distinctive superelastic functional properties. However, premature plastic deformation in weak areas such as thinner struts, nodes, and sharp corners severely deteriorates the superelasticity of gradient porous NiTi SMAs. In this work, we prepared gradient porous NiTi SMAs with a porosity of 50% by additive manufacturing (AM) and achieved a remarkable improvement of superelasticity by a simple solution treatment regime. After solution treatment, phase transformation temperatures dropped significantly, the dislocation density decreased, and partial intergranular Ti-rich precipitates were transferred into the grain. Compared to as-built samples, the strain recovery rate of solution-treated samples was nearly doubled at a pre-strain of 6% (up to 90%), and all obtained a stable recoverable strain of more than

4%. The remarkable superelasticity improvement was attributed to lower phase transformation temperatures, fewer dislocations, and the synergistic strengthening effect of intragranular multi-scale Ti-Ni precipitates. Notably, the gradient porous structure played a non-negligible role in both superelasticity deterioration and improvement. The microstructure evolution of the solution-treated central strut after constant 10 cycles and the origin of the stable superelastic response of gradient porous NiTi SMAs were revealed. This work provides an accessible strategy for improving the superelastic performance of gradient porous NiTi SMAs and proposes a key strategy for achieving such high-performance architected materials.

Journal of Materials Science & Technology 1 


Phytic acid-assisted hybrid engineering of MOF-derived composites for tunable electromagnetic wave absorption

Zhang Xiang · Kai Yao · Xiao Wang et.al

Abstract

Hybrid engineering is gradually deemed as a powerful approach to solving the bottleneck problem of metal-organic framework (MOF) derived absorbers for practical application. Herein, a new type of semiconductor/carbon-based hybrid material was successfully prepared by phytic acid (PA) modification and carbonization of MOF/bacterial cellulose (BC) precursors, which remedied the drawbacks of structural instability, lethal byproducts and complicated steps reported previously. Specifically, the obtained Fe(PO₃)₂@C/phosphorus-doped carbon foam (Fe(PO₃)₂@C/PCF) had a 3D hybrid micro-nanostructure that integrated spatial microcurrent network, multi-level pores, heterogeneous interfaces and lattice defects, showing its unique advantages of low filler content (15 wt.%), moderate surface reflectivity, multi-band microwave absorption and radar stealth. The experimental analysis and CST simulation further revealed that PA dosage can precisely adjust the hybrid phase content, pore texture and electromagnetic parameters of the final product to achieve synergistic enhancement of multiple dielectric response, impedance matching and attenuation capacity. As a result, an effective bandwidth (EAB) of 6 GHz and a minimum reflection loss (RL_{min}) of -57.0 dB were obtained in the Ku- and C-bands, respectively. These encouraging results may advance the development of novel MOF-derived absorbents based on the hybridization principle.

Surfaces, Coatings and Films

Sensors and Actuators B: Chemical 1 

Oxygen plasma treatment-enhanced humidity sensing performance of MoS₂ nanoparticles-anchored nitrogen-doped laser-induced graphene

Chen Li · Jijun Xiong · Jiang Zhao

Abstract

The monitoring of humidity has elicited considerable interest in diverse fields. Nevertheless, the intricate nature of preparatory procedures employed for humidity sensors poses a formidable challenge in the pursuit of a streamlined, expeditious, and highly efficient technique for fabricating humidity-sensitive materials. Herein, the fundamental formation principle of polyimide (PI) film serves as the underpinning for the application of a swift and effective laser direct writing technique in creating a composite integrating MoS₂ nanoparticles anchored within nitrogen-doped laser-induced graphene (MoS₂@NLIG). Subsequently, a rapid low-temperature oxygen plasma treatment is administered to enhance humidity sensing capabilities of the MoS₂@NLIG composite. The oxygen plasma treatment-enhanced MoS₂@NLIG humidity sensor exhibits exceptional capability in detecting relative humidity (RH) with a significant sensitivity of 61,219.97 Ω /%RH across an extensive range from 11% to 95%RH, while maintaining a hysteresis as minimal as 3.72%. Moreover, the sensor exhibits outstanding response and recovery times with respective values of 9 s and 15.5 s. Additionally, the humidity sensor demonstrates the capacity to identify human exhalation, potentially serving as a valuable electronic device for monitoring clinical respiration.

Sensors and Actuators B: Chemical 1 ☒

A sub-second QCM humidity sensor with low hysteresis base on Nafion thin film

Xing Ding · Haochi Ying · Xinpeng Chen

Abstract

In this paper, we developed a QCM humidity sensor with Nafion thin film coated on its electrode. An impedance-based QCM measurement system proposed in our previous work was used for measurement without oscillators. The experimental results indicate that the obtained QCM sensor has an ultrafast response speed (0.6/0.9 s) and very low hysteresis (1.61% RH). This may be related to the low amount of Nafion on the QCM electrode and the thin enough film generated on it.

Introduction

Humidity sensors play an important role in various fields, such as industry, agriculture, and health care. In recent years, humidity sensors based on quartz crystal microbalance (QCM) have attracted much research attention because of their portability and high accuracy [1], [2], [3]. Depending on the different hydrophilic materials coated on the surface of the QCM electrodes, humidity sensors can be obtained with varying properties [4], [5], [6]. However, as the viscoelasticity of the membrane increases, the quality factor of the QCM shrinks, thus making the widely used oscillator-based QCM easily stop vibrating, which significantly restricts the choice of membrane materials [7],

[8], [9].

Nafion is a common membrane material, presenting high hydrophilicity, thermal and mechanical stability, and conductivity. The hydrophilic sulfonic acid terminal groups in Nafion provide great water absorption ability. Therefore, the Nafion films have been utilized as humidity sensing films in many works and achieve good performance, particularly in terms of response time, such as capacitive sensors, SAW sensors, and fiber optic sensors [10], [11], [12], [13], [14], [15], [16]. However, due to the swelling process of Nafion films when absorbing water, the unstable change in viscoelasticity makes it challenging to apply in QCM sensing. Fortunately, the impedance-based QCM measurement systems can effectively address these issues, and reducing the amount of Nafion and its film thickness is also a viable optimization direction.

In this paper, we used Nafion as the thin-film material on QCM electrodes for humidity sensing. To limit the reduction of the quality factor, we decreased the amount of Nafion and employed the impedance-based QCM measurement system developed in our previous work, which does not rely on oscillators [17]. It is worth noting that the proposed system is capable of quickly detecting the dynamic response of the QCM sensor. According to the experimental results, the obtained QCM sensor has achieved sub-second response speed and has low hysteresis.

These performance enhancements may be attributed to the trade-off between sensor sensitivity and response speed by controlling the thickness and mass of the Nafion film deposited on the QCM electrode surface. The thin enough Nafion sensing film reduces the transport and permeation of water molecules between the multiple layers of Nafion, while a low enough amount of Nafion makes the film easier to reach solvation balance. Both of which accelerate the sensor response speed. However, a lower amount of Nafion means less water content of the film in the same humidity environment, typically making the sensor less sensitive. But given the significant swelling effect of Nafion which introduce equivalent mass via viscoelastic change, it may still have usable sensitivity.

Nature Reviews Materials 1 

AV3Sb5 kagome superconductors

Stephen D. Wilson · Brenden R. Ortiz

Abstract

The recent discovery of the AV3Sb5 (A = K, Rb, Cs) kagome superconductors launched a growing field of research investigating the interplay between superconductivity and charge-density wave order in kagome metals. Specifically, the AV3Sb5 family of materials naturally exhibits a Fermi level close to the Van Hove singularities associated with the saddle points formed from the prototypical kagome band structure. The charge-density wave and superconducting states that form within the kagome networks of these

compounds exhibit a number of anomalous properties reminiscent of theoretical predictions of exotic states in kagome metals tuned close to their Van Hove fillings. In this Review, we discuss the key structural and electronic features of AV₃Sb₅ compounds and survey the status of investigations of their unconventional electronic phase transitions.


Nature Reviews Materials 1 

Design principles for strong and tough hydrogels

Xueyu Li · Jian Ping Gong

Abstract

Hydrogels are crosslinked polymer networks swollen with water. Owing to their soft and water-containing nature, hydrogels are promising materials for applications in many fields, such as biomedical engineering, soft robotics and environmental studies. One of the main obstacles to the practical application of hydrogels is their low mechanical strength and toughness. Since the 2000s, many breakthroughs in the development of mechanically strong and tough hydrogels have led to enormous advances in the study of soft materials and our understanding of their failure mechanisms. Research has also been conducted on long-term mechanical stability — that is, the cyclic fatigue resistance and self-strengthening properties of hydrogels — to enable their application as load-bearing materials. This Review provides a comprehensive overview of the design principles for tough hydrogels. Strategies to obtain self-growing and reinforced hydrogels that can adapt to their surrounding mechanical environment are also presented.

Friction 1 

Anisotropic tribology and electrification properties of sliding-mode triboelectric nanogenerator with groove textures


Yang Wangyue · J.C. Wang · Xiaoli Wang et al

Abstract

Sliding-mode triboelectric nanogenerator (S-TENG) is based on the coupling of triboelectrification and electrostatic induction, converting electrical energy from sliding motion. Introducing micro-textures into the sliding surface, and adjusting the angle between the texture and sliding direction (direction angle) may achieve performance anisotropy, which provides novel ideas for optimizing the tribology and electrification performance of S-TENG. To guide the performance optimization based on the anisotropy, in this paper, groove micro-textures were fabricated on the surface of S-TENG, and anisotropic tribology and electrification performance were obtained through changing the direction angle. Based on the surface analysis and after-cleaning tests, the mechanism of the anisotropy was explained. It is shown that the anisotropy of friction coefficient can be attributed to the changes of texture edge induced resistance

and groove captured wear debris, while the voltage anisotropy is due to the variations of debris accumulated on the sliding interface and the resulting charge neutralization. Among the selected 0° – 90° direction angles, S-TENG at angle of 90° exhibits relatively small stable friction coefficient and high open-circuit voltage, and thus it is recommended for the performance optimization. The open-circuit voltage is not directly associated with the friction coefficient, but closely related to the wear debris accumulated on the sliding interface. This study presents a simple and convenient method to optimize the performance of S-TENG, and help understand the correlation between its tribology and electrical performance.

ELECTRONIC, OPTICAL AND MAGNETIC MATERIALS


Journal of Advanced Ceramics 1 

Ultra-high temperature application of MXene: Stabilization of 2D Ti₃C₂T_x for cross-scale strengthening and toughening of 3D TiC

Lu Lu · Guobing Ying · Quanguo Jiang et.al

Abstract


Transition metal carbide/nitride cores within MXenes make them considerably useful for ultra-high-temperature reinforcement. However, extensive research on Ti₃C₂T_x MXene has revealed its tendency to undergo a phase transition to TiC_y at temperatures above 800 °C due to high activity of a superficial Ti atomic layer. Herein, spark plasma sintering of Ti₃C₂T_x and TiC is performed to prevent the Ti₃C₂T_x phase transition at temperatures up to 1900 °C through the fabrication of composites at a pressure of 50 MPa. Using a focused ion beam scanning electron microscope to separate layered substances in the composites and examining selected area diffraction spots in a transmission electron microscope enabled identification of non-phase-transitioned MXene. First-principles calculations based on density functional theory indicated the formation of strong chemical bonding interfaces between Ti₃C₂T_x and TiC, which imposed a stability constraint on the Ti atomic layer at the Ti₃C₂T_x surface. Mechanical performance tests, such as three-point bending and fracture toughness analysis, demonstrated that the addition of Ti₃C₂T_x can effectively improve the cross-scale strengthening and toughening of the TiC matrix, providing a new path for designing and developing two-dimensional (2D) carbides cross-scale-enhanced three-dimensional (3D) carbides with the same elements relying on a wide variety of MXenes.

Journal of Advanced Ceramics 1 

High strength mullite-bond SiC porous ceramics fabricated by digital light processing

Abstract:

Fabricating SiC ceramics via the digital light processing (DLP) technology is of great challenge due to strong light absorption and high refractive index of deep-colored SiC powders, which highly differ from those of resin, and thus significantly affect the curing performance of the photosensitive SiC slurry. In this paper, a thin silicon oxide (SiO₂) layer was in-situ formed on the surface of SiC powders by pre-oxidation treatment. This method was proven to effectively improve the curing ability of SiC slurry. The SiC photosensitive slurry was fabricated with solid content of 55 vol% and viscosity of 7.77 Pa·s (shear rate of 30 s⁻¹). The curing thickness was 50 μm with exposure time of only 5 s. Then, a well-designed sintering additive was added to completely convert low-strength SiO₂ into mullite reinforcement during sintering. Complex-shaped mullite-bond SiC ceramics were successfully fabricated. The flexural strength of SiC ceramics sintered at 1550 °C in air reached 97.6 MPa with porosity of 39.2 vol%, as high as those prepared by spark plasma sintering (SPS) techniques.

Sensors and Actuators B: Chemical 1 

A sub-second QCM humidity sensor with low hysteresis base on Nafion thin film

Xing Ding · Haochi Ying · Xinpeng Chen

Abstract:

In this paper, we developed a QCM humidity sensor with Nafion thin film coated on its electrode. An impedance-based QCM measurement system proposed in our previous work was used for measurement without oscillators. The experimental results indicate that the obtained QCM sensor has an ultrafast response speed (0.6/0.9 s) and very low hysteresis (1.61% RH). This may be related to the low amount of Nafion on the QCM electrode and the thin enough film generated on it.

Introduction


Humidity sensors play an important role in various fields, such as industry, agriculture, and health care. In recent years, humidity sensors based on quartz crystal microbalance (QCM) have attracted much research attention because of their portability and high accuracy [1], [2], [3]. Depending on the different hydrophilic materials coated on the surface of the QCM electrodes, humidity sensors can be obtained with varying properties [4], [5], [6]. However, as the viscoelasticity of the membrane increases, the quality factor of the QCM shrinks, thus making the widely used oscillator-based QCM easily stop vibrating, which significantly restricts the choice of membrane materials [7], [8], [9].

Nafion is a common membrane material, presenting high hydrophilicity, thermal and

mechanical stability, and conductivity. The hydrophilic sulfonic acid terminal groups in Nafion provide great water absorption ability. Therefore, the Nafion films have been utilized as humidity sensing films in many works and achieve good performance, particularly in terms of response time, such as capacitive sensors, SAW sensors, and fiber optic sensors [10], [11], [12], [13], [14], [15], [16]. However, due to the swelling process of Nafion films when absorbing water, the unstable change in viscoelasticity makes it challenging to apply in QCM sensing. Fortunately, the impedance-based QCM measurement systems can effectively address these issues, and reducing the amount of Nafion and its film thickness is also a viable optimization direction.

In this paper, we used Nafion as the thin-film material on QCM electrodes for humidity sensing. To limit the reduction of the quality factor, we decreased the amount of Nafion and employed the impedance-based QCM measurement system developed in our previous work, which does not rely on oscillators [17]. It is worth noting that the proposed system is capable of quickly detecting the dynamic response of the QCM sensor. According to the experimental results, the obtained QCM sensor has achieved sub-second response speed and has low hysteresis.

These performance enhancements may be attributed to the trade-off between sensor sensitivity and response speed by controlling the thickness and mass of the Nafion film deposited on the QCM electrode surface. The thin enough Nafion sensing film reduces the transport and permeation of water molecules between the multiple layers of Nafion, while a low enough amount of Nafion makes the film easier to reach solvation balance. Both of which accelerate the sensor response speed. However, a lower amount of Nafion means less water content of the film in the same humidity environment, typically making the sensor less sensitive. But given the significant swelling effect of Nafion which introduce equivalent mass via viscoelastic change, it may still have usable sensitivity.

PRX quantum 1 

Simulating Open Quantum Systems Using Hamiltonian Simulations

Zhiyan Ding, Xiantao Li, and Lin Lin

Abstract:

We present a novel method to simulate the Lindblad equation, drawing on the relationship between Lindblad dynamics, stochastic differential equations, and Hamiltonian simulations. We derive a sequence of unitary dynamics in an enlarged Hilbert space that can approximate the Lindblad dynamics up to an arbitrarily high order. This unitary representation can then be simulated using a quantum circuit that involves only Hamiltonian simulation and tracing out the ancilla qubits. There is no need for additional postselection in measurement outcomes, ensuring a success probability of one at each stage. Our method can be directly generalized to the time-dependent setting.

We provide numerical examples that simulate both time-independent and time-dependent Lindbladian dynamics with accuracy up to the third order.

Advanced Fiber Materials 1 

On-Site Electrospinning Nanofiber Membranes Incorporating V-Shaped Organic Semiconductors for Multifunctional Diabetic Wound Dressing

Liang Hong · Pu Qiu · Shiwei Niu et al

Abstract:

Personalized wound dressings with on-site deposition, exudate suction, and reproducible sterilization are urged for treating diabetic wounds. Herein, we have developed nanofiber membranes incorporating a V-shaped photosensitizer (VPS), a donor-acceptor-donor type organic semiconductor with indacenodithienothiophene (IDTT) as the electron-donor and triphenyleno[1,2-c:7,8-c']bis([1,2,5]-thiadiazole) (TPTz) as the electron-acceptor, for multifunctional wound dressing. The VPS-incorporated nanofiber membranes are in situ deposited on rough wounds by using a handheld electrospinning device, which offers full coverage and better affinity than gauze to stop bleeding and suck exudate rapidly. They are breathable, waterproof, and have bacteria repelling capacity due to their hydrophobicity and negative charges. Upon light irradiation, the VPS in nanofibers undergoes low aggregation-caused quenching and retains high fluorescence and reproducible photodynamic sterilization towards both Gram-positive and Gram-negative bacteria. The nanofiber dressing also promotes cell adhesion and proliferation and exhibits high security in blood biochemistry and hematology. With the above merits, the nanofiber membranes greatly reduce the expression of tumor necrosis factor α and interleukin 6 in serum and wound tissues, expediting the wound healing process. These wound dressings combine the benefits of in situ electrospinning, fiber membrane, and VPS, and will provide strategies for emergency medical operations.

II Concentration

PHYSICS

Probing single electrons across 300-mm spin qubit wafers

Neyens, Samuel, Zietz, Otto K., Watson, Thomas F., Luthi, Florian, Nethwewala, Aditi, George, Hubert C., Henry, Eric, Islam, Mohammad, Wagner, Andrew J., Borjans, Felix, Connors, Elliot J., Corrigan, J., Curry, Matthew J., Keith, Daniel, Kotlyar, Roza, Lampert, Lester F., Mądzik, Mateusz T., Millard, Kent, Mohiyaddin, Fahd A., Pellerano, Stefano, Pillarisetty, Ravi, Ramsey, Mick, Savytsky, Rostyslav, Schaal, Simon, Zheng, Guoji, Ziegler, Joshua, Bishop, Nathaniel C., Bojarski, Stephanie, Roberts, Jeanette, Clarke, James S.

Abstract

Building a fault-tolerant quantum computer will require vast numbers of physical qubits. For qubit technologies based on solid-state electronic devices^{1,2,3}, integrating millions of qubits in a single processor will require device fabrication to reach a scale comparable to that of the modern complementary metal–oxide–semiconductor (CMOS) industry. Equally important, the scale of cryogenic device testing must keep pace to enable efficient device screening and to improve statistical metrics such as qubit yield and voltage variation. Spin qubits^{1,4,5} based on electrons in Si have shown impressive control fidelities^{6,7,8,9} but have historically been challenged by yield and process variation^{10,11,12}. Here we present a testing process using a cryogenic 300-mm wafer prober¹³ to collect high-volume data on the performance of hundreds of industry-manufactured spin qubit devices at 1.6 K. This testing method provides fast feedback to enable optimization of the CMOS-compatible fabrication process, leading to high yield and low process variation. Using this system, we automate measurements of the operating point of spin qubits and investigate the transitions of single electrons across full wafers. We analyse the random variation in single-electron operating voltages and find that the optimized fabrication process leads to low levels of disorder at the 300-mm scale. Together, these results demonstrate the advances that can be achieved through the application of CMOS-industry techniques to the fabrication and measurement of spin qubit devices.

Atomic physics on a 50-nm scale: Realization of a bilayer system of dipolar atoms

Li Du, Pierre Barral, Michael Cantara, Julius de Hond, Yu-Kun Lu, Wolfgang Ketterle

Abstract

Controlling ultracold atoms with laser light has greatly advanced quantum science. The wavelength of light sets a typical length scale for most experiments to the order of 500 nanometers (nm) or greater. In this work, we implemented a super-resolution technique that localizes and arranges atoms on a sub-50-nm scale, without any fundamental limit in resolution. We demonstrate this technique by creating a bilayer of dysprosium atoms and observing dipolar interactions between two physically separated layers through interlayer sympathetic cooling and coupled collective excitations. At 50-nm distance, dipolar interactions are 1000 times stronger than at 500 nm. For two atoms in optical tweezers, this should enable purely magnetic dipolar gates with kilohertz speed.

Demixing in Binary Mixtures with Differential Diffusivity at High Density

Erin McCarthy, Raj Kumar Manna, Ojan Damavandi, et al.

Abstract

Spontaneous phase separation, or demixing, is important in biological phenomena such as cell sorting. In particle-based models, an open question is whether differences in diffusivity can drive such demixing. While differential-diffusivity-induced phase separation occurs in mixtures with a packing fraction up to 0.7 [S. N. Weber et al. Binary mixtures of particles with different diffusivities demix, *Phys. Rev. Lett.* 116, 058301 (2016)], here we investigate whether demixing persists at even higher densities relevant for cells. For particle packing fractions between 0.7 and 1.0 the system demixes, but at packing fractions above unity the system remains mixed, exposing re-entrant behavior in the phase diagram that occurs when phase separation can no longer drive a change in entropy production at high densities. We also find that a confluent Voronoi model for tissues does not phase separate, consistent with particle-based simulations.

MATERIALS

Chemical short-range disorder in lithium oxide cathodes

Wang, Qidi, Yao, Zhenpeng, Wang, Jianlin, Guo, Hao, Li, Chao, Zhou, Dong, Bai, Xuedong, Li, Hong, Li, Baohua, Wagemaker, Marnix, Zhao, Chenglong

Abstract

Ordered layered structures serve as essential components in lithium (Li)-ion cathodes^{1,2,3}. However, on charging, the inherently delicate Li-deficient frameworks

become vulnerable to lattice strain and structural and/or chemo-mechanical degradation, resulting in rapid capacity deterioration and thus short battery life^{2,4}. Here we report an approach that addresses these issues using the integration of chemical short-range disorder (CSRD) into oxide cathodes, which involves the localized distribution of elements in a crystalline lattice over spatial dimensions, spanning a few nearest-neighbour spacings. This is guided by fundamental principles of structural chemistry and achieved through an improved ceramic synthesis process. To demonstrate its viability, we showcase how the introduction of CSRD substantially affects the crystal structure of layered Li cobalt oxide cathodes. This is manifested in the transition metal environment and its interactions with oxygen, effectively preventing detrimental sliding of crystal slabs and structural deterioration during Li removal. Meanwhile, it affects the electronic structure, leading to improved electronic conductivity. These attributes are highly beneficial for Li-ion storage capabilities, markedly improving cycle life and rate capability. Moreover, we find that CSRD can be introduced in additional layered oxide materials through improved chemical co-doping, further illustrating its potential to enhance structural and electrochemical stability. These findings open up new avenues for the design of oxide cathodes, offering insights into the effects of CSRD on the crystal and electronic structure of advanced functional materials.

Realizing Stable Perovskite Solar Cells with Efficiency Exceeding 25.6% Through Crystallization Kinetics and Spatial Orientation Regulation

Boxin Jiao, Yiran Ye, Liguo Tan, et al.

Abstract

Organic-inorganic hybrid perovskites have emerged as highly promising candidates for photovoltaic applications, owing to the exceptional optoelectronic properties and low cost. Nonetheless, the performance and stability of solar cells suffer from the defect states of perovskite films aroused by non-optically active phases and non-centralized crystal orientation. Herein, a versatile organic molecule, Hydantoin, to modulate the crystallization of perovskite, is developed. Benefiting from the diverse functional groups, more spatially oriented perovskite films with high crystallinity are formed. This enhancement is accompanied by a conspicuous reduction in defect density, yielding efficiency of 25.66% (certified 25.15%), with superb environmental stability. Notably, under the standard measurement conditions (ISOS-L-1I), the maximum power point (MPP) output maintains 96.8% of the initial efficiency for 1600 h and exhibits excellent ion migration suppression. The synergistic regulation of crystallization and spatial orientation offers novel avenues for propelling perovskite solar cell (PSC) development.

Geometry-Sensitive Protrusion Growth Directs Confined Cell Migration

Abstract

The migratory dynamics of cells can be influenced by the complex microenvironment through which they move. It remains unclear how the motility machinery of confined cells responds and adapts to their microenvironment. Here, we propose a biophysical mechanism for a geometry-dependent coupling between cellular protrusions and the nucleus that leads to directed migration. We apply our model to geometry-guided cell migration to obtain insights into the origin of directed migration on asymmetric adhesive micropatterns and the polarization enhancement of cells observed under strong confinement. Remarkably, for cells that can choose between channels of different size, our model predicts an intricate dependence for cellular decision making as a function of the two channel widths, which we confirm experimentally.

CHEMISTRY

Controlled dissolution of a single ion from a salt interface

Han, Huijun, Park, et al.

Abstract

Interactions between monatomic ions and water molecules are fundamental to understanding the hydration of complex polyatomic ions and ionic process. Among the simplest and well-established ion-related reactions is dissolution of salt in water, which is an endothermic process requiring an increase in entropy. Extensive efforts have been made to date; however, most studies at single-ion level have been limited to theoretical approaches. Here, we demonstrate the salt dissolution process by manipulating a single water molecule at an under-coordinated site of a sodium chloride film. Manipulation of molecule in a controlled manner enables us to understand ion–water interaction as well as dynamics of water molecules at NaCl interfaces, which are responsible for the selective dissolution of anions. The water dipole polarizes the anion in the NaCl ionic crystal, resulting in strong anion–water interaction and weakening of the ionic bonds. Our results provide insights into a simple but important elementary step of the single-ion chemistry, which may be useful in ion-related sciences and technologies.

Solvent effects in anion recognition

Abstract

Anion recognition is pertinent to a range of environmental, medicinal and industrial applications. Recent progress in the field has relied on advances in synthetic host design to afford a broad range of potent recognition motifs and novel supramolecular structures capable of effective binding both in solution and at derived molecular films. However, performance in aqueous media remains a critical challenge. Understanding the effects of bulk and local solvent on anion recognition by host scaffolds is imperative if effective and selective detection in real-world media is to be viable. This Review seeks to provide a framework within which these effects can be considered both experimentally and theoretically. We highlight proposed models for solvation effects on anion binding and discuss approaches to retain strong anion binding in highly competitive (polar) solvents. The synthetic design principles for exploiting the aforementioned solvent effects are explored.

A MOF-supported Pd1–Au1 dimer catalyses the semihydrogenation reaction of acetylene in ethylene with a nearly barrierless activation energy

Ballesteros-Soberanas, Jordi, Martín, et al.

Abstract

The removal of acetylene from ethylene streams is key in industry for manufacturing polyethylene. Here we show that a well-defined Pd1–Au1 dimer, anchored to the walls of a metal–organic framework (MOF), catalyses the selective semihydrogenation of acetylene to ethylene with $\geq 99.99\%$ conversion (≤ 1 ppm of acetylene) and $>90\%$ selectivity in extremely rich ethylene streams (1% acetylene, 89% ethylene, 10% H₂, simulated industrial front-end reaction conditions). The reaction proceeds with an apparent activation energy of ~ 1 kcal mol⁻¹, working even at 35 °C, and with operational windows (>100 °C) and weight hourly space velocities (66,000 ml g cat⁻¹ h⁻¹) within industrial specifications. A combined experimental and computational mechanistic study shows the cooperativity between both atoms, and between atoms and support, to enable the barrierless semihydrogenation of acetylene.

BIOLOGY

Cancer SLC6A6-mediated taurine uptake transactivates immune checkpoint genes and induces exhaustion in CD8+ T cells

Tianyu Cao, Wenyao Zhang, Qi Wang, et al.

Abstract

Taurine is used to bolster immunity, but its effects on antitumor immunity are unclear. Here, we report that cancer-related taurine consumption causes T cell exhaustion and tumor progression. The taurine transporter SLC6A6 is correlated with aggressiveness and poor outcomes in multiple cancers. SLC6A6-mediated taurine uptake promotes the malignant behaviors of tumor cells but also increases the survival and effector function of CD8⁺ T cells. Tumor cells outcompete CD8⁺ T cells for taurine by overexpressing SLC6A6, which induces T cell death and malfunction, thereby fueling tumor progression. Mechanistically, taurine deficiency in CD8⁺ T cells increases ER stress, promoting ATF4 transcription in a PERK-JAK1-STAT3 signaling-dependent manner. Increased ATF4 transactivates multiple immune checkpoint genes and induces T cell exhaustion. In gastric cancer, we identify a chemotherapy-induced SP1-SLC6A6 regulatory axis. Our findings suggest that tumoral-SLC6A6-mediated taurine deficiency promotes immune evasion and that taurine supplementation reinvigorates exhausted CD8⁺ T cells and increases the efficacy of cancer therapies.

Formation of memory assemblies through the DNA-sensing TLR9 pathway

Jovasevic, Vladimir, Wood, et al.

Abstract

As hippocampal neurons respond to diverse types of information¹, a subset assembles into microcircuits representing a memory². Those neurons typically undergo energy-intensive molecular adaptations, occasionally resulting in transient DNA damage^{3,4,5}. Here we found discrete clusters of excitatory hippocampal CA1 neurons with persistent double-stranded DNA (dsDNA) breaks, nuclear envelope ruptures and perinuclear release of histone and dsDNA fragments hours after learning. Following these early events, some neurons acquired an inflammatory phenotype involving activation of TLR9 signalling and accumulation of centrosomal DNA damage repair complexes⁶. Neuron-specific knockdown of Tlr9 impaired memory while blunting contextual fear conditioning-induced changes of gene expression in specific clusters of excitatory CA1 neurons. Notably, TLR9 had an essential role in centrosome function, including DNA damage repair, ciliogenesis and build-up of perineuronal nets. We demonstrate a novel cascade of learning-induced molecular events in discrete neuronal clusters undergoing dsDNA damage and TLR9-mediated repair, resulting in their recruitment to memory circuits. With compromised TLR9 function, this fundamental memory mechanism becomes a gateway to genomic instability and cognitive impairments implicated in accelerated senescence, psychiatric disorders and neurodegenerative disorders. Maintaining the integrity of TLR9 inflammatory signalling thus emerges as a promising preventive strategy for neurocognitive deficits.

Control of cell proliferation by memories of mitosis

Franz Meitinger, Hazrat Belal, Robert L. Davis, et al

Abstract

Mitotic duration is tightly constrained, and extended mitosis is characteristic of problematic cells prone to chromosome missegregation and genomic instability. We show here that mitotic extension leads to the formation of p53-binding protein 1 (53BP1)–ubiquitin-specific protease 28 (USP28)–p53 protein complexes that are transmitted to, and stably retained by, daughter cells. Complexes assembled through a Polo-like kinase 1–dependent mechanism during extended mitosis and elicited a p53 response in G1 that prevented the proliferation of the progeny of cells that experienced an approximately threefold extended mitosis or successive less extended mitoses. The ability to monitor mitotic extension was lost in p53-mutant cancers and some p53–wild-type (p53-WT) cancers, consistent with classification of TP53BP1 and USP28 as tumor suppressors. Cancers retaining the ability to monitor mitotic extension exhibited sensitivity to antimitotic agents.

III Calling for papers

ICEEI 2024

Submission deadline:	Jun 30, 2024
Conference date:	Dec 7, 2024 - Dec 9, 2024
Full name:	2024 6th International Conference on Engineering Education and Innovation
Location:	Da Nang, Vietnam
Website:	http://www.iceei.net/

2024 6th International Conference on Engineering Education and Innovation (ICEEI 2024) will take place in Da Nang, Vietnam on December 7-9, 2024, technical supported by Innovation Center for Engineering Education at Seoul National University.

We are very happy to welcome you all in Da Nang. Nevertheless, in view of the possible travel restrictions, the conference will be planned in the form of a hybrid conference with as many authors and participants as possible attending the conference in Da Nang in person, and others attending remotely.

Accepted and presented papers will be published into ICEEI Conference Proceedings, submitted for Scopus.

- Call for Papers:
- Civil Engineering Education
- Architectural Engineering Education
- Biomedical Engineering Education
- Chemical Engineering Education
- Energy Engineering Education
- Environmental Engineering Education
- Industry Engineering Education
- Material Engineering Education
- Mechanical Engineering Education
- Naval Engineering Education
- Ocean Engineering Education
- Power Engineering Education
- Production Engineering Education
- Industrial Internet & Industry 4.0
- Future Mobility & Smart Mobility
- Innovation for Smart City

- Sustainable Engineering Education
- Smart Services and Software Platforms
- Systems Engineering Education
- Women & STEM (Science, Technology, Engineering, Mathematics)
- Basic Engineering Education
- Innovative Engineering Education
- Engineering Education for Women
- Engineering Design
- Creative Thinking
- Design Thinking
- Distance Education
- Educational Methods
- More topics: <http://www.iceei.net/cfp.html>

ICSCE 2024

Submission deadline:	Jun 13, 2024
Conference date:	Sep 10, 2024 - Sep 12, 2024
Full name:	2024 8th International Conference on Structural and Civil Engineering (ICSCE 2024)
Location:	Madrid, Spain
Website:	http://www.icsce.org

Human beings have gone through millions of years of long road, building updated from burrowing, nesting, and palace to high-rises today, leaving a classic and long history of architectural culture. With the rapid development of science and technology, energy depletion, environmental degradation, opportunities and challenges both arise, the grim reality for us go deeply into what we need to build? What is the future of architecture and civil engineering?

ICSCE 2024 - The International Conference on Structural and Civil Engineering is organized to be held in Madrid, Spain during September 10-12, 2024. ICSCE will focus on green architecture, intelligent architecture, design of practicality and artistic. The conference aims to provide opportunities for the delegates to exchange new ideas and application experiences face to face, to establish business or research relations and to find global partners for future collaboration.

Topics are interested but not limited to the following:

*Civil and Structural Engineering:

Bridge Engineering; Building Structure and Bridge Engineering
Building Technology; Cartography and Geographic Information System
Coastal Engineering; Computational Mechanics
Computer Simulation and CAD/CAE; Concrete Structures
Construction and Control; Detection and Transformation
Disaster Prevention and Mitigation; Engineering Management

*Architecture and Urban Planning:

Architectural Design and Theories
Advanced Construction Materials
Aesthetics and Landscape
Architectural Design and Its Theory
Architectural Environment & Equipment Engineering

For more topics, please go to www.icsce.org/cfp.html

ICBMM 2024

Submission deadline:	Jun 13, 2024
Conference date:	Sep 10, 2024 - Sep 12, 2024
Full name:	2024 The 8th International Conference on Building Materials and Materials Engineering (ICBMM 2024)
Location:	Madrid, Spain
Website:	http://www.icbmm.org

Rapid development of modern technology needs the support of new material. New material together with information and energy are known as the three pillars of modern science and technology. The birth of new materials will lead rapid development of related industries and technologies. Architecture is one of the examples. The appearance of new building materials not only enhanced the original performance of the materials, such as durability, mechanical properties but also the performance of strength, energy conservation, insulation, waterproof, and appearance. Construction materials is developing towards the pursuit of functional diversity, life-cycle economy and recycling. With the change of living concepts and the demand of the multifarious building function, as the very basic elements of construction, building materials will face plenty of challenges.

ICBMM 2024 is organized after ICBMM 2023 (Porto, Portugal, September 14-16, 2023), ICBMM 2022 (Barcelona, Spain, September 15-17, 2022), ICBMM 2021 (Virtual, September 24-26, 2021), ICBMM 2020 (Virtual, September 24-26, 2020), ICBMM 2019 (NOVA University of Lisbon, Portugal, September 25-27, 2019), ICBMM 2018 (University of Lisbon, Portugal, September 26-28, 2018) and ICBMM 2017 (Lyon, France, September 21-23, 2017). ICBMM will focus on research hotspot like building materials, semiconducting materials, organic/polymer materials, nano-materials, composite materials, bio-materials and etc. The conference aims to provide opportunities for the delegates to exchange new ideas and application experiences face to face, to establish business or research relations and to find global partners for future collaboration.

Topics of ICBMM 2024:

~Environmental Materials Science and Engineering

Metallic Alloys, Tool Materials

Multifunctional Materials

Smart Materials

~Environmental Materials Properties, Measuring Methods and Applications

Fracture Mechanics, Mechanical Properties

Corrosion, Erosion, Wear Resistance

Working Properties of Materials and Products

~Environmental Materials Manufacturing and Processing

Welding, Sintering, Heat Treatment

Thin & Thick Coatings

Automation Engineering Processes

~Civil and Structural Engineering

Construction and Control;Detection and Transformation

Safety and Monitoring;Sanitary and Ground Water Engineering

Transportation Engineering;Tunnel, Subway and Underground Facilities

~Architecture and Urban Planning

Building Technology Science

Advanced Construction Materials

Green Building Materials

More topics, please go to: <https://www.icbmm.org/cfp.html>

ICCME 2024

Submission deadline: Jul 10, 2024
Conference date: Nov 22, 2024 - Nov 24, 2024
Full name: 2024 the 11th International Conference on Chemical and Material Engineering (ICCME 2024)
Location: Nagoya, Japan
Website: <http://www.iccme.org>

ICCME2024 provides an international forum for presentation of original research results, as well as exchange and dissemination of innovative, practical development experiences. ICCME draws researchers and application developers from a wide range of Chemical and Material Engineering. By promoting novel, high quality research findings, and innovative solutions to challenging Chemical and Material Engineering problems, the conference seeks to continuously advance the state-of-the-art in Chemical and Material Engineering.

★Call for Paper

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

Material Science and Engineering
Materials for Energy Harvesting and Storage
Materials for Data Storage
Materials for Electronic and Optical Applications
Concrete
Masonry Materials
Structural Materials
Building Materials
Biomaterials
Nanomaterials
Polymers
Composites
Synthesis, Properties or Applications of Materials
Heat Treatment Processes
Testing, Evaluation and Characterization of Materials
Geochemistry and Health
Chemical Engineering Fundamentals
Chemical Engineering Educational Challenges and Development
Physical, Theoretical and Computational Chemistry
Chemical Reaction Engineering
Chemical Engineering Equipment Design and Process Design
Catalysis & Reaction