HARBIN INSTITUTE OF TECHNOLOGY
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HIT TIMES

HIT RANKED 6TH OF BEST GLOBAL UNIVERSITIES FOR ENGINEERING

GLOBAL HIGHLY CITED RESEARCHERS 2018

HIT TIMES
Harbin Institute of Technology Newsletter
2018 Issue 2

HIT TIMES is a publication for alumni and friends of Harbin Institute of Technology, which is produced by the HIT Editorial Department of Journal.
If you have any suggestions, please do not hesitate to contact us.
We sincerely appreciate your wholehearted support.

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AWARDS & HONORS

HIT RANKED 6TH OF BEST GLOBAL UNIVERSITIES FOR ENGINEERING

U.S. News & World Report announced the Best Global Universities for Engineering in 2018. Harbin Institute of Technology (HIT) was ranked 6th on the list.

These well-regarded universities from around the world have shown strength in producing research related to a variety of engineering topics. They include aerospace engineering, mechanical engineering, electrical engineering and civil engineering. All rely on the basic engineering concept of using math and science to solve problems. These are the world's best universities for engineering.

Rank	University	Location	Best Global Universities	Subject Score
#1	Tsinghua University	China Beijing	#50 – Best Global Universities	100
#2	National University of Singapore	Singapore	#38 – Best Global Universities	94
#3	Massachusetts Institute of Technology	United States Cambridge, MA	#2 – Best Global Universities	93.6
#4	Aalborg University	Denmark Aalborg	#260 (tied) – Best Global Universities	92
#5	Nanyang Technological University	Singapore	#49 – Best Global Universities	91.8
#6	Harbin Institute of Technology	China Harbin, Heilongjiang	#280 (tied) – Best Global Universities	91.5
#7	University of California--Berkeley	United States Berkeley, CA	#4 – Best Global Universities	90.9

PROFESSOR LENG JINSONG ELECTED AS A FOREIGN MEMBER OF ACADEMIA EUROPAEA

Recently, the Academia Europaea (the Academy of Europe) announced the list of new members for 2018. Professor Leng Jinsong from Harbin Institute of Technology was elected as a Foreign Member of Academia Europaea. He is invited to accept membership in the section of physics and engineering after a sufficiently rigorous review process.

Academia Europaea, initiated by the UK Royal Society and other National Academies in Europe and sponsored by the science ministers from 35 European countries, was founded in 1988. It is one of the most extensive, academically advanced and influential international scientific organizations, with 20 departments covering the fields of humanities, social sciences, natural sciences and science and technology.

The criterion for the selection of membership is "sustained academic excellence in the candidate's field." The members of the Academia Europaea are mainly selected from among the academicians of European countries once a year, involving strict steps of peer group nomination, scrutiny, and communication review, and final acceptance by the Council of the Academia Europaea to confirm the eminence of the chosen individuals in their field. The number of memberships stands at around 4,000, and amongst them there are 73 Nobel Prize winners, 6 Turing Award winners and 15 Fields Prize winners, several of whom were elected to the Academia before they received the prize. It is a lofty international recognition for remarkable scientists who have made outstanding academic contributions and international achievements. Professor Leng has been honored as foreign member of Academia Europaea owing to achievements in stimulus responsive polymers (Shape Memory and Electro-Active Polymers) and their composites, structure design, soft robots, 4D printing technology and biomedical devices, structural health monitoring and multifunctional nanocomposites.

Professor Leng Jinsong is Director of the Center for Smart Materials and Structures, a Distinguished Professor of the Cheung Kong Scholars Program, and a winner of the National Outstanding Youth Fund. He currently serves as Vice Chairman of the International Committee on Composite Materials (ICCM) and Vice President of the Chinese Society for Composite Materials. He has been awarded as an Honorary Professor of Kingston University London (UK), the Second Prize of State Natural Science (China), and as a Research Giant by the University of Southern Queensland (Australia). He also is a Fellow of the SPIE, a Fellow of the Institute of Physics (IOP), a Fellow of the Institute of Materials, Minerals, and Mining (IMMM), an Associate Fellow of AIAA, a Fellow of the Royal Aeronautical Society (RAeS), an ICCM World Fellow, a Fellow of American Association for the Advancement of Science (AAAS) and a Member of the European Academy of Sciences and Arts.

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PROFESSOR HAN XIAOJUN ADMITTED AS A FELLOW OF THE ROYAL SOCIETY OF CHEMISTRY

Recently, Professor Han Xiaojun from the State Key Laboratory of Urban Water Resource and Environment, School of Chemistry and Chemical Engineering (SCCE) was admitted as a Fellow of the Royal Society of Chemistry (FRSC).

The Royal Society of Chemistry (RSC), founded in 1841 in the United Kingdom, is a chemical society with a long history. It is also one of the most influential international authoritative academic organizations. The designation FRSC is given to the scientist who has made distinguished achievements in chemical research and significant contributions to the chemical sciences.

Professor Han was awarded as the New Century Excellent Talents in 2009 and the Natural Science Foundation of Heilongjiang Province for Distinguished Young Scholars in 2018. He is currently the head of the Department of Biomolecular and Chemical Engineering in the SCCE. In recent years, Professor Han has made a series of progress in the artificial cell field with the publications in iScience, Journal of the American Chemical Society, Advanced Materials, ACS Nano, etc. He published more than 120 peer-reviewed journal papers, and has been granted with over 20 sources of funding, including 5 from the National Natural Science Foundation of China. He also wrote one book as the only author and an additional four book chapters. He holds 37 authorized national invention patents.

PROFESSOR LENG JINSONG ELECTED AS A FELLOW OF AAAS

On November 30, 2018, the American Association for the Advancement of Science (AAAS), a world-renowned academic organization, published a list of 416 Fellows of AAAS in the 6418 issue of Science. Professor Leng Jinsong from Harbin Institute of Technology was on the list because of his distinguished contributions to the field of smart composites and structures, especially for contributions to the development and engineering applications of new shape memory polymers. He is the only foreign scholar elected in the Department of Engineering, and one of two AAAS Fellows from mainland China.

AAAS, founded in 1848, is the largest scientific and engineering association in the world with the purpose of advancing science and serving the society. It has 24 professional branches covering natural science and social science. With over 120,000 members in 91 countries, it serves more than 10 million scientists and is also the sponsor and publisher of the famous Science magazine. "Fellow" is the highest honor awarded by AAAS to its members. Since 1874, it has selected outstanding scientists from various fields according to their academic influence and scientific contribution, and awarded them the lifelong honor to recognize their outstanding scientific or social achievements in the progress of scientific application. The AAAS states that, "these individuals have been elevated to this rank because of their efforts toward advancing science applications that are deemed scientifically or socially distinguished."

The Fellows, announced Nov. 27, will be recognized at the 2019 AAAS Annual Meeting in Washington, D.C. During a Fellows Forum on Feb. 16, they will be presented with an official certificate and the AAAS Fellows' gold and blue rosette pin, the colors of which represent the fields of science and engineering respectively.

Professor Leng Jinsong is Director of the Center for Smart Materials and Structures, a Distinguished Professor of the Cheung Kong Scholars Program, and a winner of the National Outstanding Youth Fund. He currently serves as Vice Chairman of the International Committee on Composite Materials (ICCM) and Vice President of the Chinese Society for Composite Materials. He has been awarded as an Honorary Professor of Kingston University London (UK), the Second Prize of the State Natural Science (China), and as a Research Giant by the University of Southern Queensland (Australia). He also is a Fellow of the SPIE, a Fellow of the Institute of Physics (IOP), a Fellow of the Institute of Materials, Minerals, and Mining (IMMM), an Associate Fellow of AIAA, a Fellow of the Royal Aeronautical Society (RAeS), an ICCM World Fellow, a Member of the European Academy of Sciences and Arts and a Foreign Member of Academia Europaea.

PROFESSOR HUANG ZHIWEI WON THE TAN JIAZHEN LIFE SCIENCE INNOVATION AWARD

On November 19th, the 11th Tan Jiazhen Life Science Award Ceremony was held at Central South University. Professor Huang Zhiwei from the School of Life Science and Technology of HIT won the Tan Jiazhen Life Science Innovation Award.

Launched by the Ministry of Science and Technology of the People's Republic of China, the Tan Jiazhen Life Science Award is awarded to scientists who made achievements in life science, young scholars who made innovative research results, and people who made outstanding contributions to the industrialization of scientific achievements in life science. It is regarded as the "Nobel Prize" in Chinese life science circles. The award is to commemorate Professor Tan Jiazhen, one of the founders of Chinese modern genetics.

Professor Huang's research interests focus on the mechanisms of pathogen-host interactions. His group has determined the structural basis on hijacking the human E3 ligase complex to target HIV restriction factors by HIV-1 Vif, which has plagued the AIDS field for 30 years. His work paved the way for rational designing novel anti-HIV drugs targeting Vif. In addition, CRISPR–Cas adaptive immune systems are encoded by bacteria and archaea to defend against phages infection. Phages have evolved anti-CRISPR systems to overcome CRISPR–Cas immunity. His lab determined the molecular mechanism of several bacterial adaptive immune systems including CRISPR-Cpf1, -C2c1 and -SpyCas9, and the inactivation mechanism of CRISPR-Cas9 by Anti-CRISPR, which greatly promoted understanding of the molecular mechanism of bacteria and phage co-evolution and provided the structural basis for developing specific, efficient and accurate genome editing tools.

GLOBAL HIGHLY CITED RESEARCHERS 2018

On November 27th, Clarivate Analytics, the global leader in providing trusted insights and analytics to enable researchers to accelerate discovery, published its annual Highly Cited Researchers (HCR) list. Now in its fifth year, the citation analysis identifies influential researchers as determined by their peers around the globe – those who have consistently won recognition in the form of high citation counts over a decade.

David Pendlebury, Senior Citation Analyst at Clarivate Analytics explained, "This year, a new cross-field category has been added to recognize researchers with substantial influence in several fields but who do not have enough highly cited papers in any one field to be chosen. For example, an immunologist today is likely both a biochemist and molecular biologist, and a chemist is also a materials scientist and even an engineer. Breaking through the artificial walls of conventional disciplinary categories by the introduction of the new cross-field category aims to keep the Highly Cited Researcher list contemporary and relevant."

Clarivate Analytics Highly Cited Researchers — Executive Summary | Cross-Field | Methodology | Resources | FAQ

Harbin Inst technol — Filter categories

Last Name ▲	First Name	Category	Primary Institution	Primary Region	Secondary affiliation	Profiles
Cecati	Carlo	Engineering	Univ L'Aquila	Italy	Harbin Inst Technol, China Mainland	
Franquelo	Leopoldo G.	Engineering	Univ Sevilla	Spain	Harbin Inst Technol, China Mainland	
Gao	Huijun	Engineering	Harbin Inst Technol	China Mainland		
Kaynak	Okyay	Engineering	King Fahd Univ Petr Minerals	Saudi Arabia	Harbin Inst Technol, China Mainland	
Liu	Ming	Engineering	Harbin Inst Technol	China Mainland		
Qiu	Jianbin	Engineering	Harbin Inst Technol	China Mainland	Beijing Univ Chem Technol, China Mainland	
Wang	Xiaolong	Cross-Field	Harbin Inst Technol	China Mainland		
Wu	Ligang	Engineering	Harbin Inst Technol	China Mainland		
Yin	Shen	Engineering	Harbin Inst Technol	China Mainland		
Zhang	Lixian	Engineering	Harbin Inst Technol	China Mainland		

Mainland China continues to march its way up the list and has overtaken Germany to reach the third spot on the top 10 country/region list. 7 researchers listing Harbin Institute of Technology as their primary institution were on the list, including Gao Huijun, Liu Ming, Qiu Jianbin, Wang Xiaolong, Wu Ligang, Yin Shen and Zhang Lixian. Moreover, 3 researchers listing Harbin Institute of Technology as their secondary affiliation were Professor Kaynak Okyay, Professor Cecati Carlo and Professor Franquelo Leopoldo G.

SCHOOL OF ARCHITECTURE (SHENZHEN) WON THE BEST TRACK AWARD IN IEEE EBL PACIFIC ASIA REGIONAL COMPETITION

The Asia-Pacific Final of the International Creative Design Competition "Seeking the Light of Creativity to Empower a Billion Lives" sponsored by the Institute of Electrical and Electronic Engineers (IEEE PELS) was held in Shenzhen from November 3rd to 6th.

More than 40 teams from North Carolina State University, Hong Kong University of Science and Technology, Tsinghua University, Fudan University, Harbin Institute of Technology (Shenzhen), Okra Solar Company, Hannon Mobile Energy Group, Delta Energy Technology Company and other world-renowned universities and enterprises participated in the competition. After fierce competition, GreenSpark, a team from the School of Architecture, won the Best Track Award in the Asia Pacific Region and successfully entered the global finals.


EMPOWER A BILLION LIVES
DELTA CUP - EBL PACIFIC ASIA
Delta Cup - IEEE Empower a Billion Lives - Pacific Asia Regional Competition
The Certificate is Proudly Presented for:
Best Track Award - 2B
to the Team GreenSpark from
Harbin Institute of Technology at Shenzhen

The GreenSpark team combined multi-disciplinary backgrounds and focused on the power shortage problem in sub-Saharan Africa. It aimed to improve poverty and sustainable energy development from the perspective of economy, society and culture and root causes of poverty.

They innovatively designed the operation mode of "distributed power generation in farmlands - centralized power storage in public spaces - fragmented power supply by batteries," and formulate the corresponding system model of "points exchanging for power." The two complement each other, thus constructing a systematic, economical and sustainable power supply system design scheme and a commercial operation plan.

The GreenSpark team is directed by Associate Professor Yang Biao from the School of Architecture (Shenzhen). Wu Jialu, a 2017 postgraduate student from the School of Architecture, serves as the team leader. Its members include Meng Yingying, Zhang Guanhua, Li Tianyu and Jiang Xin, with professional backgrounds in electrical engineering, architecture, civil engineering and mathematics.

In May 2018, the team participated in the online preliminary competition. After months of competition, it stood out from 43 teams in the Pacific-Asia competition area and successfully entered the final round of competition, competing with 10 teams. After the processes of project report, experts review and poster display, GreenSpark won the Best Track Award in the second track and a bonus of $4000. The team will go to the United States to participate in the worldwide final in September 2019.

It is reported that the International Creative Design Competition "Seeking the Light of Creativity to Empower a Billion Lives" has five competition zones in the world. Among them, the Asia-Pacific Regional Area solicits competition schemes from universities, enterprises, non-profit organizations and related institutions in the Asia-Pacific region.

The event aims to guide the whole society to pay attention to energy shortages, efficient use of energy and encourage innovation of related technologies, business management, market models and other fields. It has been supported by the World Bank and other institutions. Competition solicitation programs include energy supply technology solutions and commercial solutions. The emphasis is on assessing the ability and potential impact of solutions to quickly and sustainably solve the electricity problem of a billion target groups. ■

A PAPER PUBLISHED BY PROFESSOR WANG YOU'S TEAM SELECTED AS A KEY SCIENTIFIC ARTICLE IN "ADVANCES IN ENGINEERING"

Recently, Ph.D. student Zhou Feifei from the School of Materials Science and Engineering, Harbin Institute of Technology (HIT), published a paper titled "A Promising Non-Transformable Tetragonal YSZ Nanostructured Feedstocks for Plasma Spraying-Physical Vapor Deposition" in the journal Ceramics International, identified as a key scientific article contributing to excellence in science and engineering research by Advances in Engineering selection committee.

The Advances in Engineering (AIE) is mainly aimed at researchers working in the frontier of science and technology and developing new technologies in the future. Papers featured at AIE gain extensive exposure and increased citations. Engineering fields covered are Chemical Engineering, Mechanical Engineering, Materials Engineering, Electrical Engineering, Biomedical Engineering, Civil Engineering, Nanotechnology Engineering as well as General Engineering. AIE is highly selective and the invited articles are less than 0.1% of the whole published

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literature (that is 20 per week chosen by a team of advisers and experts). AIE is read almost 700,000 times each month by engineers, professors and scientists and it is linked to the top 40 engineering companies as well as major research institutions to track the current global breakthroughs in science and technology.

Thermal barrier coatings (TBCs) are widely used in aero engines and gas turbines engines due to their good thermal insulation performance. The mass fraction of 8% yttria stabilized zirconia (8YSZ) with the non-equilibrium tetragonal phase (t´-8YSZ) is the most popular thermal barrier coating material. The current preparation methods of thermal barrier coatings mainly include atmospheric plasma spraying (APS), electron beam physical vapor deposition (EB-PVD) and a new process, plasma spraying physical vapor deposition (PS-PVD) combining the advantages of APS and EB-PVD. The APS and PS-PVD are more widely applied than EB-PVD. For the advanced PS-PVD process, the lower particle size (less than 25 micron) is necessary to ensure a certain degree of gasification. At present, the commercial yttria stabilized zirconia powder used for PS-PVD is mainly composed of monoclinic zirconia and a small amount of cubic yttrium oxide. However, the remaining monoclinic zirconia in the raw powder will be found in the coating slightly, which will seriously reduce the thermal shock resistance of the coating. For APS, the commercial powder is mainly monoclinic zirconia. The properties of as-sprayed coatings prepared by APS or PS-PVD from these commercial yttria stabilized zirconia powders are not the optimum. In view of the limitation of commercial monoclinic zirconia powder and the relationship between the material composition, microstructure and properties, Zhou Feifei has successfully prepared high performance nanostructure spherical non-equilibrium tetragonal phase yttria partially stabilized zirconia powder by the nanopowder regranulation and rare earth modification technology (t´-8YSZ) under the guidance of Professor Wang You. The powder feedstock can be used for APS or PS-PVD to form thermal barrier coatings for aero engines and gas turbines engines. At present, the spherical t´-8YSZ feedstocks with nanostructure have been industrialized in Fujian Dilong Innovation Development Co., Ltd, Quanzhou, China.

Professor Wang has been conducting the research on tribology, surface engineering and nano-modified materials. So far, he has published more 290 papers in national and international journals, with more than 3000 SCI citations. He has obtained 4 US patents, 1 international patent and about 10 China patents.

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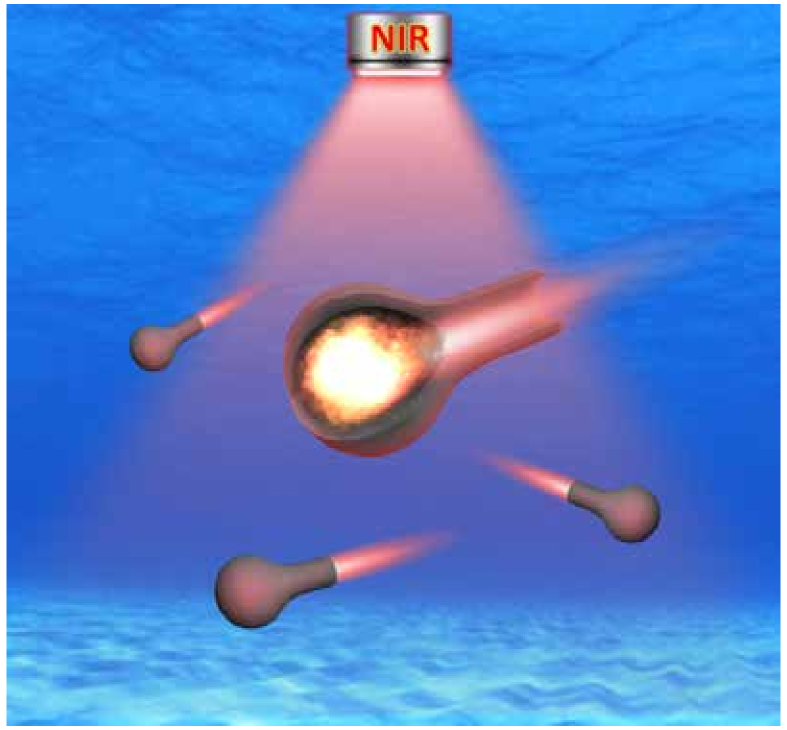
Feifei Zhou, You Wang, Yaming Wang, Liang Wang, Junfeng Guo, Wenlong Chen. A promising non-transformable tetragonal YSZ nanostructured feedstocks for plasma spraying-physical vapor deposition. Ceramics International, 2018, 1201-1204

NANOBOTTLE MOTORS RUSH LIKE JET ENGINES

Professor He Qiang from the Academy of Fundamental and Interdisciplinary Science, Micro/Nano Technology Research Center, Harbin Institute of Technology (HIT), recently published a paper titled "Noncontinuous Super-Diffusive Dynamics of a Light-Activated Nanobottle Motor" in the leading chemistry journal, Angewandte Chemie International Edition.

A self-propelled nanomotor, so named a nanomachine, is a type of nanosystem that can convert chemical energy or other types of energy into mechanical works. Due to its small size, self-propulsion, and strong delivery capability, nanomotors are of huge potential for biomedical applications, such as target drug delivery, thrombolysis, and precise tumor therapy. In the past decade, scientists have developed several types of synthetic micro/nanomotors fueled by chemical reactions. Although the usage of chemical fuels brings synthetic micro/nanomotors with desired motion, it is still difficult to apply them in the living organisms because of the toxicity of the used fuels. To address this embarrassing challenge, Professor He's group develops a light-activated carbon nanobottle-based motor (CNB motor) by using hydrothermal synthesis. This nanomotor with uniform size has pronounced absorbance in the region of infrared (NIR) light. Upon the illumination of NIR light, a localized photothermal effect on the carbon shell of CNB motor results that water inside of the cavity is heated rapidly and forms the hot flow to eject from the bottle neck, thus propel the CNB motor. The propulsion mechanism here is very similar to the operation method of aircraft jet engines. Meanwhile, the results of theoretical modulation further explain this mechanism and reveal the relationship between propulsion and the cavity structure of CNB motors. Furthermore, the regulated output power of the applied NIR light endows CNB motor with the adjustable velocity and controlled "switch on/off" motion. This NIR light-powered bottle-like motor can move without any chemical fuel, which exhibits a novel, bio-friendly way for the design and construction of nanomotors and has great potential in biomedical applications.



This paper was financially supported by the National Natural Science Foundation of China.■

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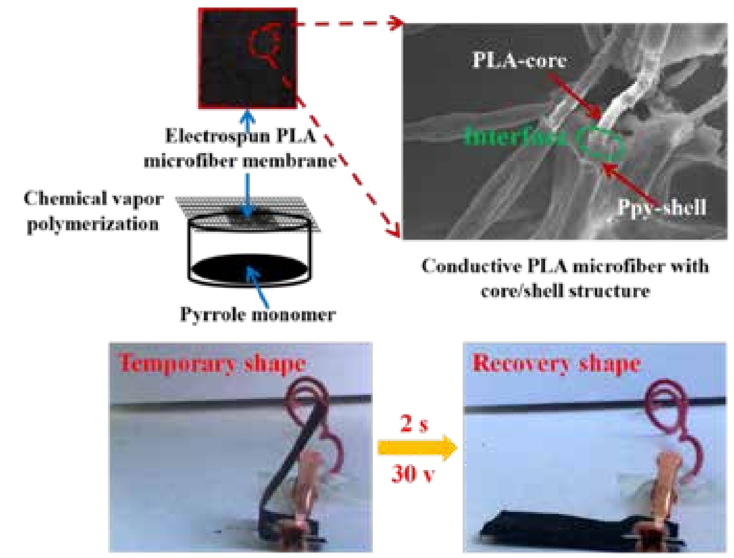
NEW PROGRESS IN RESEARCH ON CONDUCTIVE SMART COMPOSITE MICROFIBER MEMBRANE

In October 2018, a group led by Professor Leng Jinsong from the Centre for Composite Materials and Structures at Harbin Institute of Technology published a research paper titled "Conductive Shape Memory Microfiber Membranes with Core-Shell Structures and Electroactive Performance" in the international journal ACS Applied Materials and Interfaces. For many years, Professor Leng's group focuses on the systematically research of shape memory polymers (SMP) and their composites (SMPC), and has made important progress in the applications.

As a class of smart active materials, SMP and SMPC can be deformed into any shape when heated to a set transition temperature and yet can revert to the original shape when exposed to a variety of external stimuli, including heat, humidity, light, pressure, solvents, microwaves, electrical and magnetic fields.

SMPs and their composites have attracted increasing attention due to their deformation and shape changing properties allied with light weight, easy processing and low cost. To meet the real needs of practical applications, remote controlled actuation of SMPs is necessary, especially electrical actuation. Conductive shape memory polymers as a class of functional materials play a significant role in sensors and actuators. High conductivity and response speed are needed in practical applications.

In this work, a conductive shape memory polylactic acid (PLA) microfiber membrane was synthesized by combining electrospinning with chemical vapor polymerization. The shape memory PLA was electrospun into microfibers with different diameters and a conductive polypyrrole (PPy) coating was applied to the PLA microfiber membranes using vapor polymerization. The conductivity of the microfiber membrane was investigated as a function of different experimental parameters: $FeCl_3$ concentration, PPy evaporation time and PPy temperature. The maximum conductivity of the membrane prepared under a subzero environment is 0.5 S/cm which can sustain a heat-generating electric current sufficient to trigger the electro-actuated behaviors of the membrane within 2 s at 30 V. Thermographic imaging was used to assess the uniformity of the temperature distribution during the shape recovery process. The low surface temperature is compatible with potential applications in many fields.



Shape recovery behavior of conductive microfiber membrane

This paper was financially supported by the National Natural Science Foundation of China.

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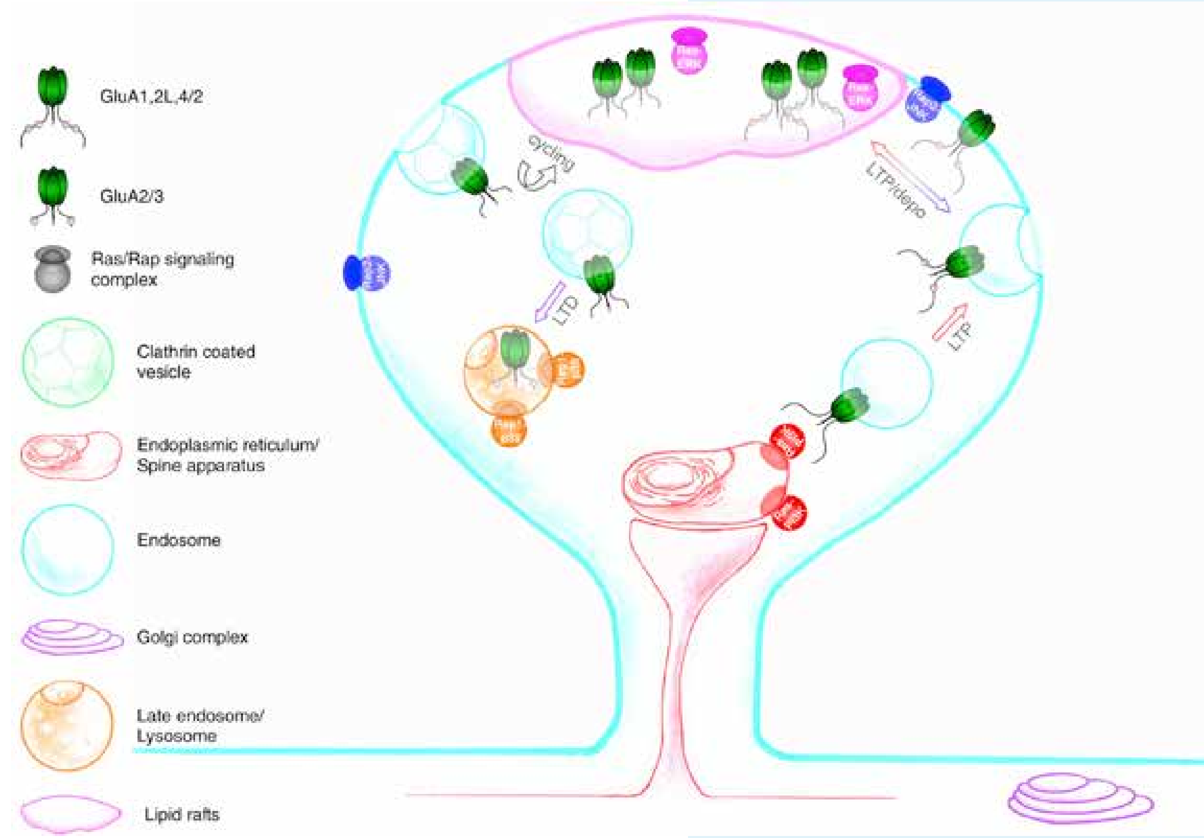
SUBCELLULAR MICRODOMAIN-SPECIFIC SIGNALING IN SYNAPTIC PLASTICITY

In May 2018, Dr. Wang Guangfu from the Center for Life Sciences, School of Life Science and Technology at Harbin Institute of Technology published a research paper titled "Ras and Rap Signal Bidirectional Synaptic Plasticity via Distinct Subcellular Microdomains" in the journal Neuron with his colleagues at the University of Virginia. The study reported the role that microdomain-selective targeting played in synaptic plasticity.

A synapse is the contact site between neurons at which electrical or chemical signal passes from one neuron to another. Synaptic plasticity is the ability of synapses to strengthen or weaken its transmission efficacy in response to environmental demands. In learning and memory, there are different forms of synaptic plasticity, including long-term potentiation (LTP), depotentiation, and long-term depression (LTD). Previous studies have identified Ras-family small GTPases (i.e., Ras, Rap2, and Rap1) as molecular switches of multiple signal transduction cascades that control synaptic plasticity. However, Ras and Rap proteins have a high degree of homology in sequence and structure and can be activated by the same upstream signals and/or stimulate the same downstream effectors. Therefore, a long-standing cell biology question is asked again: how do signaling molecules achieve signal diversity and specificity?

In this paper, through a microdomain-targeting approach, Ras or Rap proteins were specifically expressed in the five major subcellular microdomains in rodent hippocampal CA1 neurons, including the endoplasmic reticulum, lipid rafts, the bulk membrane, lysosomes, and the Golgi complex. Combining this technique with high-resolution multiple simultaneous patch-clamp recordings, Dr. Wang and colleagues found that although endogenous Ras and Rap were present in all five microdomains, endogenous Ras preferentially signaled synaptic potentiation via the endoplasmic reticulum PI3K and lipid raft ERK pathways, whereas endogenous Rap2 and Rap1 predominantly signaled synaptic depression via the bulk membrane JNK and lysosome p38MAPK pathways, respectively.

This study not only revealed that signaling molecules achieve signal diversity and specificity via different signaling platforms confined in distinct subcellular microdomains, but also provides a precision regulation toolbox and an effective strategy which should promote development of precision medications for treating various cancers and cognitive diseases.



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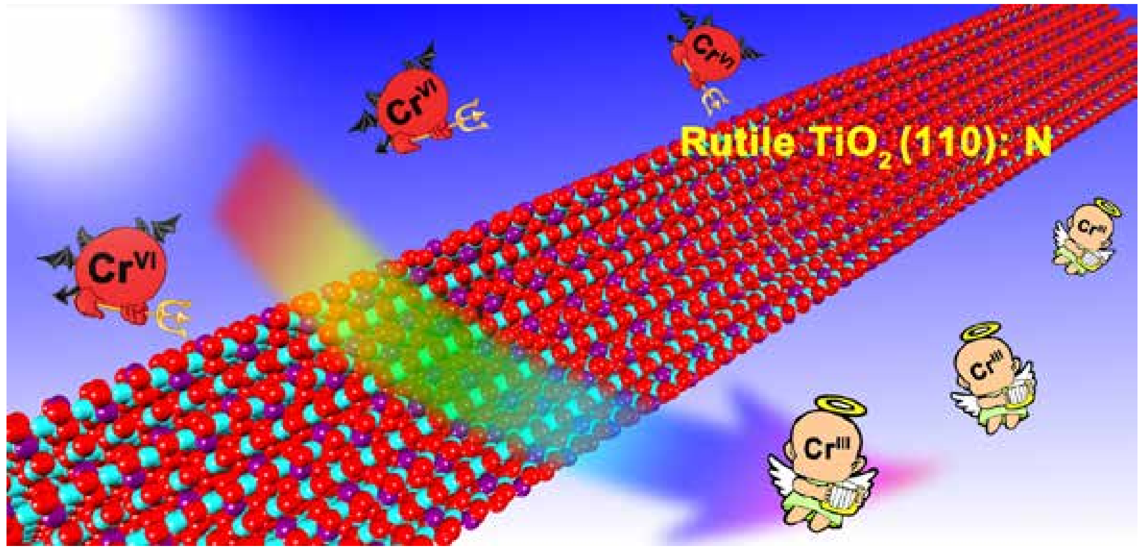
NEW FINDINGS ON ENGINEERING THE BAND GAP STATES OF TIO_2 SURFACE



Dr. Yu Yaoguang, et al. from the School of Chemistry and Chemical Engineering published a paper titled "Engineering the Band Gap States of the Rutile TiO_2 (110) Surface by Modulating the Active Heteroatom" in the internationally renowned journal Angewandte Chemie International Edition. This work was completed in collaboration with Professor Ruiqin Zhang from City University of Hong Kong.

Photocatalysts lie at the heart of a series of significant solar energy conversion and environmental cleaning technologies, whereas TiO_2 is usually the benchmark to evaluate the performance of new material. In order to overcome the limited coverage of the solar spectrum resulted by the wide bandgap of the pristine TiO_2 material, tremendous efforts have been devoted to this field. Introducing band gap states to TiO_2 photocatalysts is regards as an efficient strategy for expanding the range of accessible energy available in the solar spectrum. However, few approaches are capable of introducing band gap states and improve photocatalytic performance simultaneously. Introducing band gap states by creating surface disorder can incapacitate reactivity where unambiguous adsorption sites are a prerequisite.

In this work, an alternative method for the introduction of band gap states is demonstrated in which selected heteroatoms (nitrogen atoms) are implanted at preferred surface sites. Theoretical prediction and experimental verification reveal that the implanted heteroatoms not only introduce band gap states without creating surface disorder, but also function as active sites for the Cr^{VI} reduction reaction. Selective substitutional N doping of in-plane O maintains the surface structure of rutile TiO_2 (110), and further provides band gap states above the Fermi level to promote charge separation and photoinduced electron migration. At 400 nm, a greater than 15-fold enhancement of apparent quantum efficiency was achieved in comparison to N-doped Degussa P25, which is attributed to the unambiguous adsorption sites and efficient surface charge transfer of N-modified rutile TiO_2 (110). This finding provides band gap engineering principles for the design of photocatalysts that may be used to harvest solar energy.

This work was financially supported by the National Natural Science Foundation of China, China Postdoctoral Science Foundation funded project and the "Hong Kong Scholars Program."

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BREAKTHROUGHS IN ELECTROCHEMICAL REDUCTION OF CARBON DIOXIDE

Professor Chen Gang from the School of Chemistry and Chemical Engineering, recently published a paper titled "Dopant-Induced Electron Localization Drives CO_2 Reduction to C_2 Hydrocarbons" in Nature Chemistry as a co-corresponding author with Professor Ted Sargent from University of Toronto.

In this work, the research group demonstrate the first tunable and stable Cu^+ based catalyst by inducing boron dopants. When introducing boron into Cu, the Cu atoms transfer electrons to the nearby boron atoms, resulting in a positively charged $Cu^{\delta+}$ site. Based on theoretical DFT calculations, a combination of stable $Cu^{\delta+}$ and Cu^0 sites are introduced into the Cu catalyst after boron-doping. It was demonstrated that the ratio of $Cu^{\delta+}$ to Cu^0 active sites is finely controlled through the use of this new strategy, which is further experimentally proved by synchrotron spectroscopies. This directly translates to improved stability of $Cu^{\delta+}$ species under CO_2RR condition. Simulations further show that the ability to tune thereby the average oxidation state of Cu enables control over CO adsorption and dimerization and that engineering the $Cu^{\delta+}$ to Cu^0 ratio allows us to implement a preference for the electrosynthesis of C_2 products from CO_2RR. As a result, the productivity and selectivity of C_2 is greatly enhanced. Experimentally, the new catalyst enabled sustained high C_2 Faradaic efficiencies for lone time-operation. We demonstrate for Cu-based catalyst, a ~80% Faradaic efficiencies of C_2 without generation of C_1 and C_3 species. We further show that boron-doping leads to stable catalysts that provide CO_2RR to multi-carbon hydrocarbons with stability that exceeds ~40 hours operating time.

Professor Chen Gang's group focuses the development of advanced energy conversion functional materials, including photocatalysis, electrocatalysis and electrode materials. In recent two years, a series of breakthroughs were published on Nature Chemistry, Angewandte Chemie International Edition, Advanced Materials, etc. The H-index is 36.

The paper was financially supported by the National Natural Science Foundation of China.

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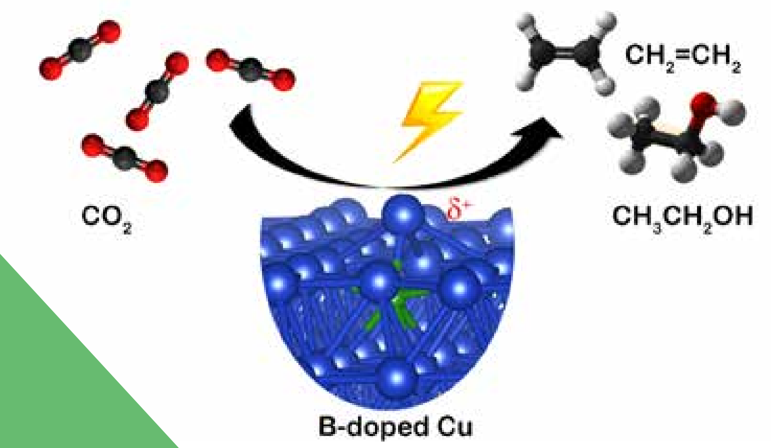

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HIT TIMES 2018

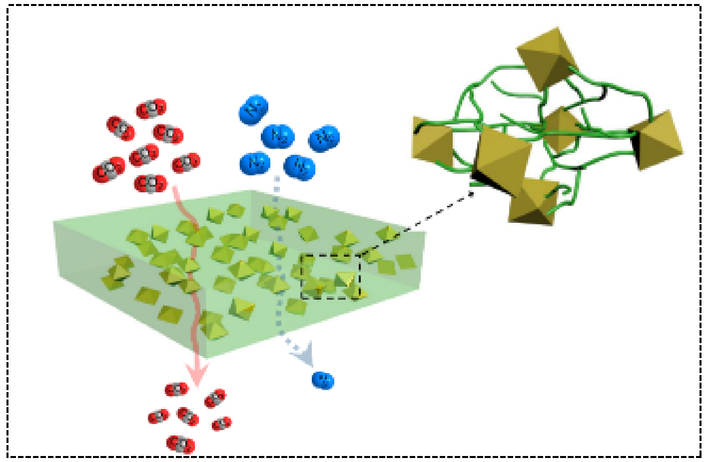
WEAVING MOF PARTICLES WITH POLYMER CHAINS: NOVEL HYBRID CO_2-PHILIC MEMBRANE OPENS NEW ERA FOR NANOCOMPOSITE INTERFACE MANIPULATION AND ASSESSMENT

In June 2018, a team led by Professor Shao Lu from the Department of Chemistry and Chemical Engineering at HIT published a research paper titled "Interface Manipulation of CO_2-Philic Composite Membranes Containing Designed UiO-66 Derivatives towards Highly-Efficient CO_2 Capture" in the Journal of Materials Chemistry A as back cover paper. In this study a novel MOF-polymer hybrid CO_2-philic membrane with exceptional high CO_2 separation was reported, and study on the MOF-polymer interface evaluation revealed the unprecedented relationship between plasticization behaviors and interfacial status of such composite materials. This research was accomplished independently and domestically by Professor Shao's team with the only signature of Harbin Institute of Technology.

As an economic technique for environmental remediation, mixed matrix membranes (MMMs) comprising a continuous polymer matrix and a dispersed (nanoporous) filler phase as emerging composite materials has sprung up as the state of the art approach to extend the potential of conventional polymer-based gas separation membranes, especially for CO_2 capture. However, in practice, the incidental unfavourable polymer-filler interaction may typically cause particle agglomerations and non-selective voids in polymer matrix, and in consequence, worsen the performance of MMMs. Therefore, it is extremely challenging to achieve solid interfacial interactions between fillers and polymers and evaluate the molecular-scale interface through bulky MMMs by conventional characterization methods, although the ubiquitously unfavorable polymer-filler interactions are crucial to design advanced composites for diverse applications, which can be ameliorated by filler surface modification or morphology control.

In this study, based on judicious material screening for CO_2 capture, Professor Shao's team incorporated two UiO-66 type MOFs (non-reactive amino-functionalized UiO-66-NH_2 and reactive isopropenyl-functionalized UiO-66-MA) into UV cross-linked CO_2-philic PEO matrix for clarifying the molecular-scale interface in MMMs. UiO-66-MA can be in-situ stitched together during UV-induced copolymerization of CO_2-philic polyethylene oxide (PEO) derivatives in order to generate highly-efficient gas transport passages in nanohybrid membranes with conceivably good interface, while non-reactive UiO-66-NH_2 exhibits no effective interaction with the polymer matrix. The CO_2 permeability of the hybrid membrane with good interface reached as high as 1450 Barrer with CO_2/N_2 selectivity of 45.8, surpassing Robeson's 2008 upper bound. More importantly, unexpected suppressed plasticization/swelling behavior in the UiO-66-MA containing membrane and exaggerated plasticization in the UiO-66-NH_2 containing membrane were observed through analyzing gas separation performance in the range of 1-20 atm. These phenomena first revealed the relationship between plasticization behaviors and the hybrid membranes' interfacial status, which might be utilized as a potential interface assessing tool for nanocomposites and instruct further right directions in nanohybrid membranes design.

This research was financially supported by the National Natural Science Foundation of China, Harbin Science and Technology Innovation Talent Funds, and HIT Environment and Ecology Innovation Special Funds.



Gas pathways through MMMs containing homogeneously dispersed UiO-66-MA

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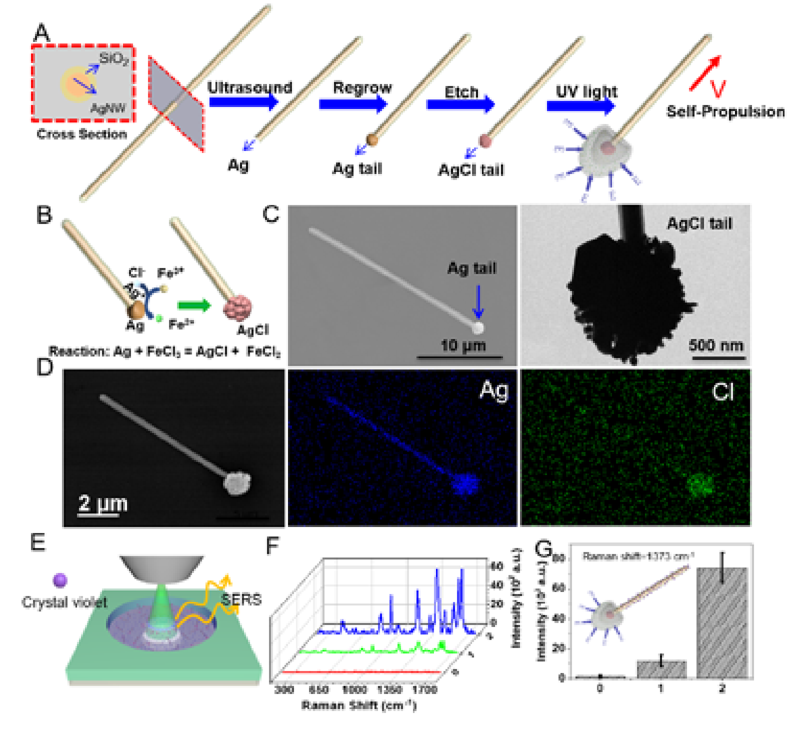
MAKING SERS PROBES INTELLIGENT

Professor Ma Xing from Harbin Institute of Technology (Shenzhen) recently published a paper titled "Photocatalytically Powered 'Match-Like' Nano-Motor for Light-Guided Active SERS Sensing" in the internationally renowned journal Angewandte Chemie International Edition.

The integration between light powered micro/nano-motors (MNM) and surface enhanced Raman technology (SERS) can result in an intelligent micro/nano- SERS probe that can propel themselves towards the target location for on-demand biochemical sensing. In the current work, a "match-like" one-dimensional SERS probe was fabricated. The nano-system is comprised of a long body made of silica-coated silver nanowire ($AgNW@SiO_2$) and a spherical AgCl tail. The silica shell coated Ag nanostructure can be used as SERS substrate by the effect of shell-isolated enhanced Raman spectroscopy (SHIERS). Meanwhile, the AgCl tail can work as an "nano-engine" to drive the nano-structure based on a photocatalytical reaction triggered self-diffusiophoresis mechanism. The nano-motors demonstrate positive phototaxis that can induce aggregation of the SERS probes for further enhancement of SERS signal. This work is a significant improvement over the previously reported passive SERS probes. For the first time, the current work successful utilizes light powered MNM as an intelligent biosensing system for light-guided SERS sensing in a positive manner.

This paper was financially supported by the State Key Laboratory of Advanced Welding and Joining, and Shenzhen Peacock Innovation Project.



Fabrication and characterization of the "match-like" nano-motor

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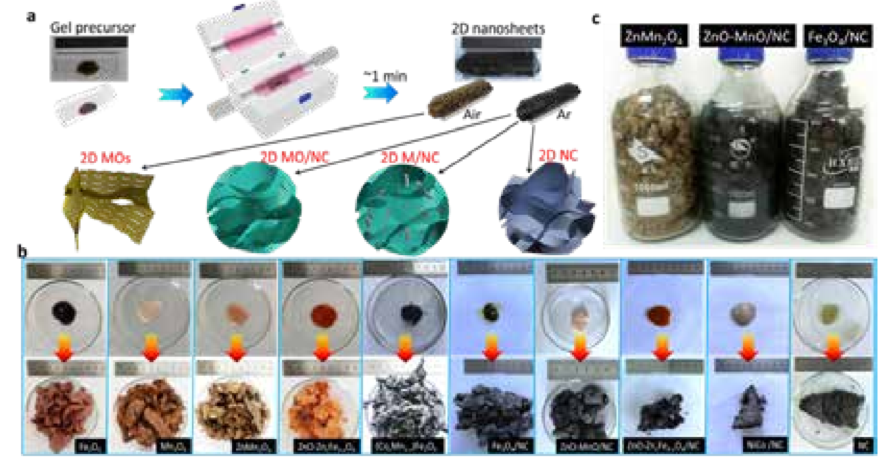
BREAKTHROUGHS IN MASS PRODUCTION OF LARGE-SIZED NONLAYERED 2D MATERIALS FOR ENERGY STORAGE AND CONVERSION APPLICATIONS

Professor Zhou Weiwei's group, from Harbin Institute of Technology (Weihai), has made important progress in the production of 2D nanomaterials. The paper titled "Mass Production of Large-Sized, Nonlayered 2D Nanosheets: Their Directed Synthesis by a Rapid 'Gel-Blowing' Strategy, and Applications in Li/Na Storage and Catalysis" was published in Advanced Materials (IF: 21.95). Zhou's research interests focus on the synthesis of transition metal oxides-based electrode materials for energy conversion and storage. In the past several years, her group has published many high-quality research papers in Energy & Environmental Science, Advanced Functional Materials, Journal of Materials Chemistry A, etc.

Recently, two-dimensional (2D) materials have aroused tremendous research interest because of their intriguing properties and broad range of applications such as optoelectronics, filed effect transistors, energy storage devices, catalysis, and so on. Current strategies for the preparation of 2D materials can be generally classified into gas-phase and liquid-phase syntheses. Gas-phase synthesis, including chemical vapour deposition (CVD), usually yields 2D nanosheets with high quality and large lateral size, but its large-scale application is restrained by the high cost and low throughput. Liquid-phase methods, such as chemical synthesis and liquid-exfoliation, are simple, scalable, and able to produce homogeneous samples. However, these processes always lead to small-sized particles which are easy to be contaminated during the course of preparation and thereafter need tedious purification procedures. An extra limit for exfoliation is that it is only applicable to layered compounds. In view of these unresolvable tradeoffs, developing a general and scalable strategy that can integrate both advantages of gas-phase and liquid-phase methods and has flexible capabilities for the synthesis of large-sized homogeneous 2D nanosheets, especially those with non-layered host materials, is extremely desirable.

Inspired by Chinese Sugar Figure Blowing Art, Zhou Weiwei and her co-authors reported a rapid "gel blowing" strategy for the mass production of 2D non-layered nanosheets by thermally expanding the viscous gel precursors within a short time (~ 1 min). A wide variety of 2D nanosheets including oxides, carbon, oxides/carbon and metal/carbon composites are synthesized on a large scale and with no impurity. Importantly, this method unifies both merits of liquid-phase and gas-phase syntheses, giving rise to 2D products with high uniformity, nanometer thickness, and large lateral sizes (up to hundreds of mircometers) simultaneously. The success



of this strategy highly relies on the speed of "blowing" and the amount of control of the reactants. The as-synthesized nanosheet electrodes manifest excellent electrochemical performance for alkali-ion batteries and electrocatalysis. This method opens up a new avenue for economical and massive preparation of good-quality non-layered 2D nanosheets for energy-related applications and beyond.

This paper was financially supported by the National Natural Science Foundation of China, the Taishan Scholar Project, and the Natural Science Foundation of Shandong Province, China.■

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Research & Academia
HIT TIMES 2018

BREAKTHROUGHS IN CYCLING STABILITY AND SELF-HEALING PROPERTY OF AQUEOUS ALKALINE BATTERIES ENABLED BY NOVEL PLYELECTROLYTE

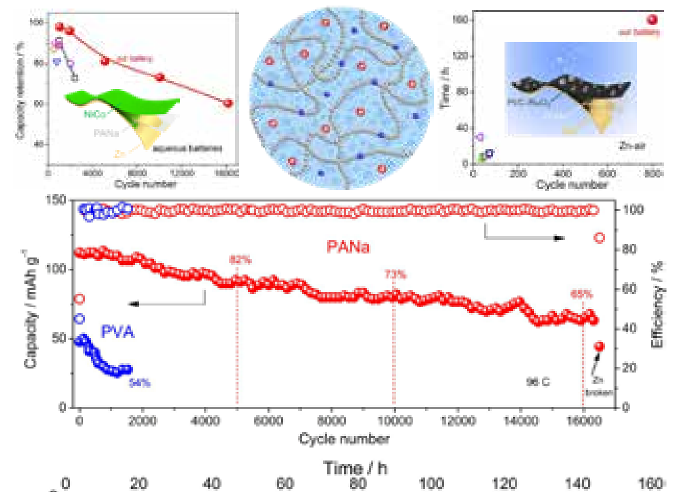
Professor Huang Yan from the School of Material Science and Engineering at Harbin Institute of Technology (Shenzhen) has made an amazing leap forward in the cycling stability and self-healing property of aqueous alkaline batteries. Her research papers were published in the internationally renowned journals Advanced Energy Materials (IF: 21.875) and Angewandte Chemie International Edition (IF: 12.102). The papers are titled "Solid-State Rechargeable Zn//NiCo and Zn-Air Batteries with Ultralong Lifetime and High Capacity: The Role of a Sodium Polyacrylate Hydrogel Electrolyte" and "An Intrinsically Self-Healing NiCo//Zn Rechargeable Battery with a Self-Healable Ferric-Ion-Crosslinking Sodium Polyacrylate Hydrogel Electrolyte" respectively.

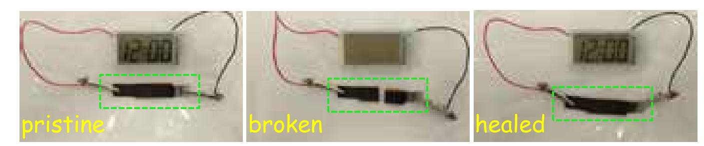
With water as the electrolyte solvent, aqueous batteries are promising alternatives for conventional lithium ion batteries which fundamentally resolve the safety risks caused by flammable organic electrolytes, and thus have attracted the attention of researchers in the field of flexible and wearable electronics. However, a quick loss of water during charging-discharging, which leads to a concomitantly significant reduction in the ionic conductivity and cycling stability, is still a big problem in aqueous batteries. Besides, flexible aqueous batteries tend to inevitably suffer from local stress during and under various deformations during their daily usage, severely limiting the lifespan and reliability of the battery, which ultimately results in the failure of the electronic system. To solve the above-mentioned problems, a new electrolyte comprising sodium polyacrylate hydrogel (PANa) was synthesized by Professor Huang Yan.

The combined chain superhydrophilicity with micropore-rich PANa network greatly facilitated the ionic transport with drastically increased ion conductivity with increasing water content to reach a remarkably high ionic conductivity, which is a value of two to three orders of magnitude higher than that of most conventional polymer electrolytes. Furthermore, the strong interaction between sodium polyacrylate and water molecules makes the PANa hydrogel electrolyte have a superb water retention capability. Moreover, electrostatic interaction between the negatively charged acrylate groups along the PANa electrolyte chain and positively charged zinc ions from the Zn anode oxidation immobilized the Zn ions to form the quasi-SEI on the PANa network, which greatly facilitated the ionic transport and eliminated the Zn dendrite formation. As a consequence, rechargeable Zn//NiCo and Zn–air batteries based on this newly developed PANa polyelectrolyte have shown the longest cycle stability performance compared with other batteries reported in all the current documents.

In addition, the sodium polyacrylate hydrogel chains are crosslinked by ferric ions to promote dynamic reconstruction of the overall electrolyte network. These crosslinkers can form ionic bonds to reconnect damaged surfaces when the hydrogel is cut off. Therefore, the rechargeable Zn//NiCo batteries with this hydrogel electrolyte can be autonomically self-healed with over 87% of capacity retained after 4 cycles of breaking/healing.

In brief, the innovative invention made by Professor Huang Yan has solved the problems related to the cycle stability and intrinsic self-healing property of aqueous alkaline batteries with an unprecedented success.





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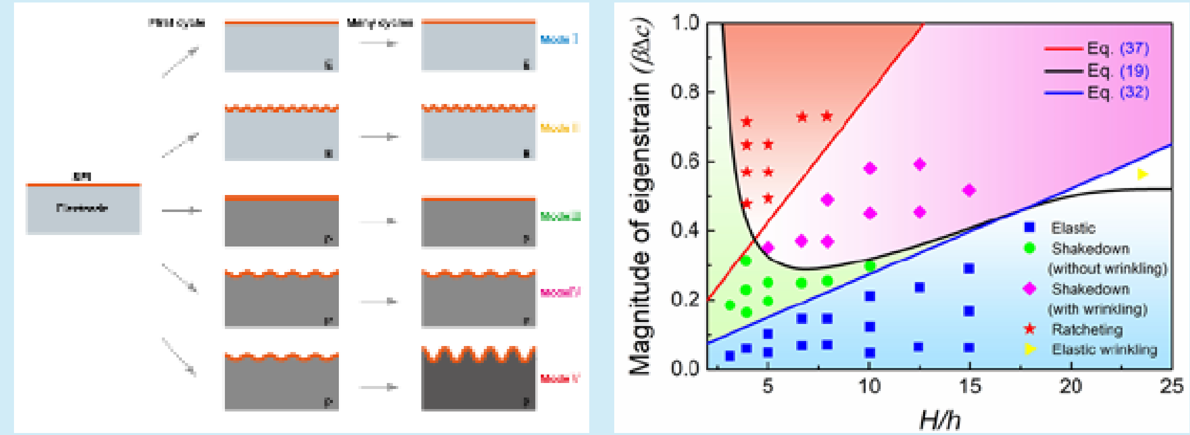
Research & Academia
HIT TIMES 2018

BREAKTHROUGHS IN MECHANICAL INSTABILITY OF SEI IN LI-ION BATTERIES

Professor Wang Changguo from the Center for Composite Materials at the School of Astronautics, in collaboration with Professor Gao Huajian, a member of the American National Academy of Sciences from Brown University, has made important progress in the field of mechanical instability of the solid-electrolyte interphase in Li-ion batteries. The research findings titled "Wrinkling and Ratcheting of a Thin Film on Cyclically Deforming Plastic Substrate: Mechanical Instability of the Solid-Electrolyte Interphase in Li-Ion Batteries" was published in Journal of the Mechanics and Physics of Solids, the top journal in mechanical field.

The paper successfully dealt with the instability issue in a thin film/plastic substrate system and revealed the mechanism of wrinkling and ratcheting for the first time. The first author is Ph.D Yuanpeng Liu. Both Professor Wang and Professor Gao are corresponding authors.



The analysis of the instability issue in a thin film/plastic substrate system is one of the difficult issues in wrinkling field. Here we present an analytical model to describe SEI wrinkling and ratcheting behaviors during cyclic lithiation and delithiation of LIBs. The SEI-electrode system is modeled as a bilayer structure consisting of a thin film resting on a plastic substrate. Surface instability and ratcheting behavior are found in such a system under cyclic plastic deformation induced by lithiation and delithiation. Closed-form solutions of critical wrinkling and ratcheting are obtained. The analysis suggests that the mechanical instabilities of the SEI, including wrinkling and ratcheting, can be prevented by several strategies, such as introducing an artificial SEI with a sufficiently large stiffness and thickness, and/or with tensile pre-stress in the SEI.

This work was supported by the National Natural Science Foundation of China.

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Research & Academia
HIT TIMES 2018

NEW REPORT REVEALS KEY MYSTERY OF UTERINE TUMOURS IN AGING C. ELEGANS

A new study from Professor Zhang Zhizhou's lab at the School of Chemistry and Chemical Engineering of HIT demonstrates how a recently proposed theory of aging can explain the origins of uterine tumors, one of the most prominent age-related diseases in C. elegans, and highlights similarities between these tumors and mammalian ovarian teratomas. This work, first-authored by Professor Zhang's PhD student Wang Hongyuan, was supported by the China Scholarship Council Program and Professor David Gems' lab at the University College London. The paper was published in a Nature partner journal npj Aging and Mechanisms of Disease.

Aging (senescence) is a deteriorative process involving diverse pathologies, many of which appear to arise from core senescent mechanisms (etiologies), whose nature remains unclear. In C. elegans, as in humans, various pathologies occur during aging, and we are studying their origins in order to understand aging. Ideas of G.C. Williams and M.V. Blagosklonny suggest that many senescent pathologies develop as the result of wild-type gene action in later life, due to non-adaptive action (or hyperfunction) of biological programs that promote fitness earlier in life. Here we use this framework of ideas to investigate aging in C. elegans. Accordingly, the authors have explored the role of such mechanisms in the etiology of a prominent senescent pathology in C. elegans, the large tumors that develop within the uterus.

In wild-type hermaphrodites, unfertilized oocytes accumulate within the uterus following sperm depletion and develop into large uterine tumors. To better characterize the internal anatomy of such tumors, the authors used light plane microscopy to reconstruct their 3D structure. A chromatin reporter (HIS-58::GFP) revealed nuclear hypertrophy that closely corresponded to DNA staining (DAPI), DNA copy number, and cellular hypertrophy, implicating mitotic endoreduplication as a driver of hypertrophy. Nuclear morphology and tumor size are positively correlated, and a positive correlation is also seen between tumor size and the number of oocytes within each tumor. Teratomas (from the Greek for "monster" and "swelling") are an unusual form of mammalian tumor with complex internal structure, often congenital rather than mutational in origin. C. elegans uterine tumors are similar to human ovarian teratomas (or dermoid cysts) in that both result from run-on of embryogenetic programs in unfertilized oocytes rather than mutations. Notably, expression of genes expressed in several embryonic tissues but not in oocytes was detected within uterine tumors in later life, revealing their teratoma-like character.

Tumor formation begins with ovulation of unfertilized oocytes immediately after exhaustion of sperm stocks. The authors show that the timing of this transition between program and quasi-program (i.e. the onset of senescence) and the onset of tumor formation depends upon the timing of sperm depletion. After that, RNAi of genes involved in protein synthesis, DNA replication and the cell cycle reduces tumor growth significantly, suggesting the formation of a uterine tumour is the result of run-on of embryogenetic quasi-program. Furthermore, quasi-programmed yolk uptake is another factor that contributes to tumor growth.

The authors therefore probed the relationship between tumor development and lifespan in a manner that did not involve any genetic or environmental intervention. Animals were cultured individually and examined serially during adulthood to monitor the development of their uterine tumors. This revealed a significant correlation between tumor size and lifespan at most days, whereas a week correlation between nuclear morphology and lifespan, suggesting a possible contribution of uterine tumors to mortality. Consistent with this, inhibition of tumor size also results in lifespan extension. However, intake of FUDR from different time points could reduce tumor size and cause opposite effects on the lifespan of C. elegans. From this we can know it is important to choose a suitable timepoint for tumor treatment, otherwise it could lead to a negative effect on health. The lifespan extension caused by supplementation of branched-chain amino acids (BCAAs) is not related with tumor formation.

These results imply that uterine tumors develop as the result of non-adaptive expression of embryogenetic and vitellogenic programs in unfertilized oocytes, i.e. they are the result of post-reproductive action of wild-type genes (rather than molecular damage). They also suggest a similarity in the underlying etiology of senescent pathologies and teratomas in that both result from non-adaptive action of wild-type biological programs. It provides a new strategy to understand aging. ■

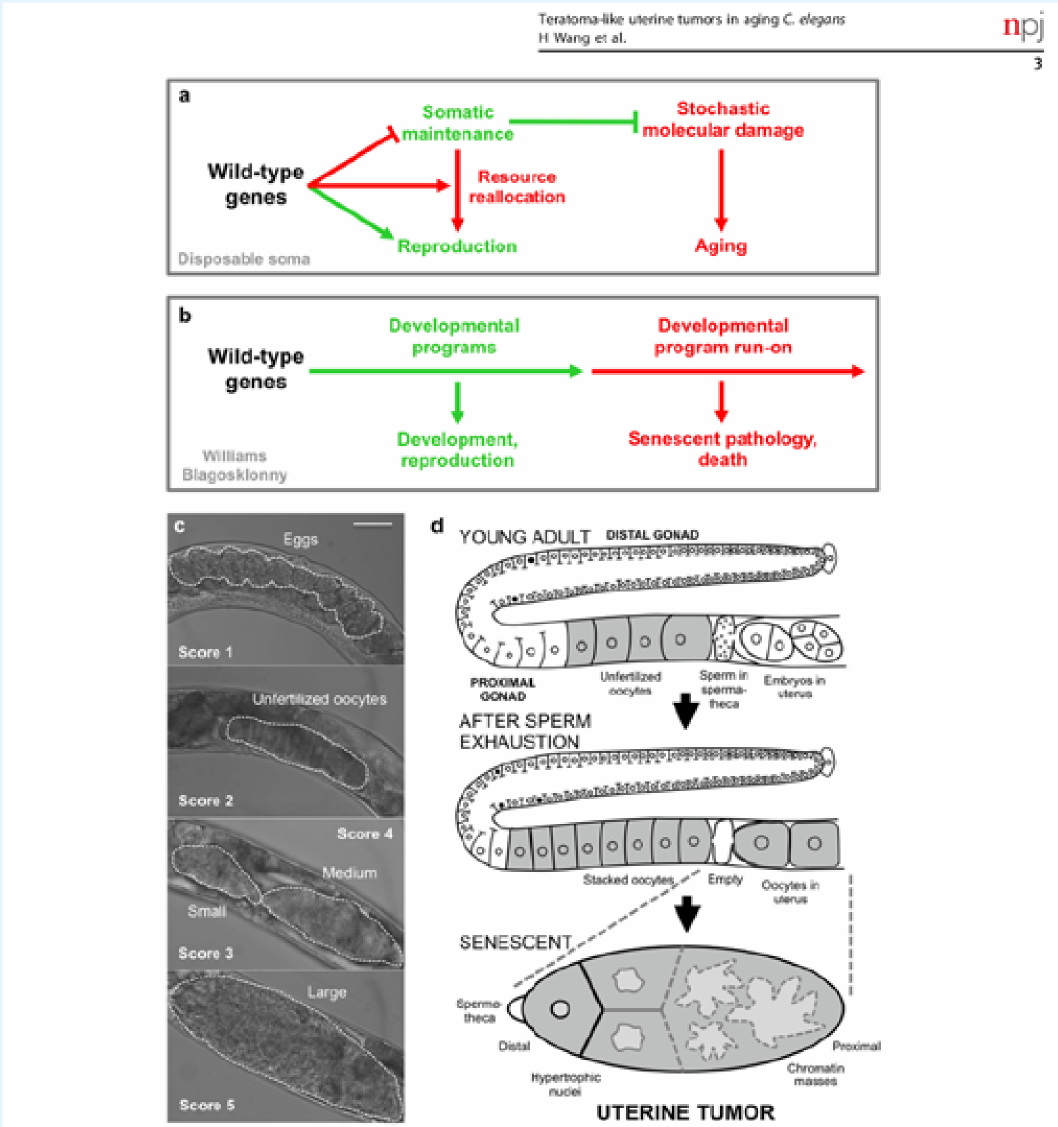

Fig. 1 Theories of aging and uterine tumor development. **a, b** Alternative models for how wild-type genes cause senescence (pathogenic action of alleles exhibiting antagonistic pleiotropy). **a** Disposable soma model. Wild-type genes promote reproduction at the expense of somatic maintenance processes that prevent the damage that causes aging. **b** Williams Blagosklonny model. Continued action of wild-type genes in later life leads to run-on of developmental programs (quasi-programs) causing development of senescent pathology. **c, d** Senescent uterine tumors in *C. elegans* hermaphrodites. **c** Stages of development of uterine tumors. Dotted lines delineate uterine contents. Scale bar, 50 μm. **d** Schematic representation of uterine tumor development, consistent with Williams Blagosklonny model. As argued in this study, the point of origin of pathophysiology is immediately after fertilization with the last sperm in the spermatheca; this is the point of transition from program to quasi-program. Red, promoting senescent pathology

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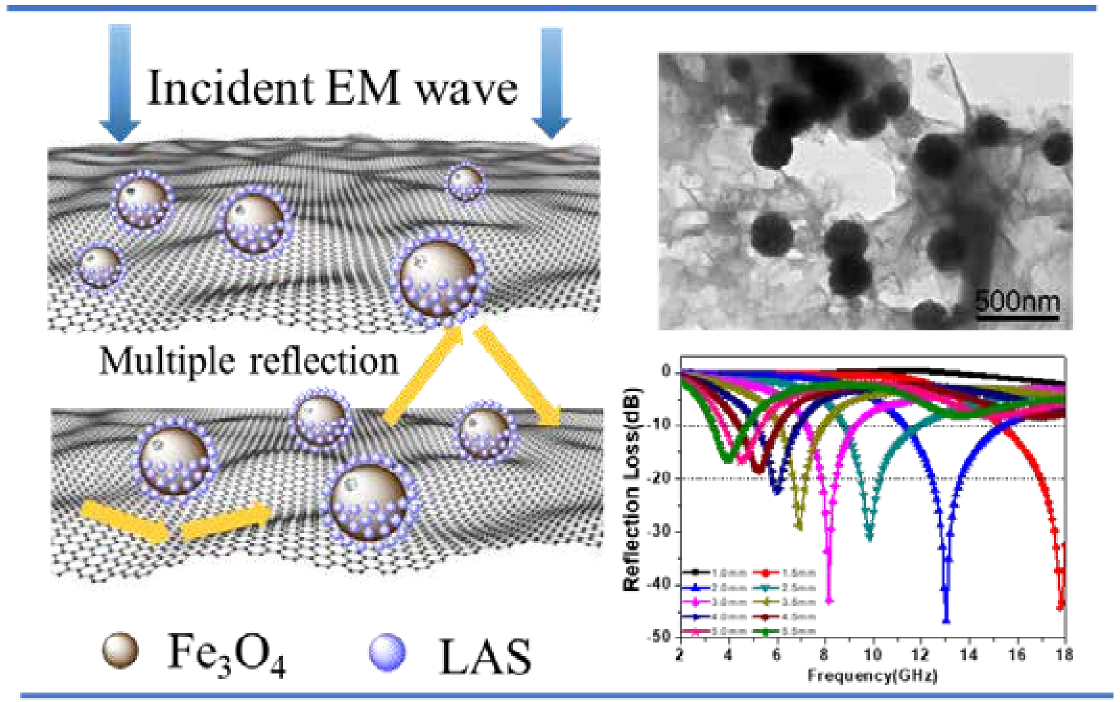
NOVEL GRAPHENE-BASED MAGNETIC COMPOSITE ABSORBING MATERIAL

A research paper titled “Fe_3O_4@LAS/RGO Composites with a Multiple Transmission-Absorption Mechanism and Enhanced Electromagnetic Wave Absorption Performance” was published in Chemical Engineering Journal by Associate Professor Xia Long from Harbin Institute of Technology (Weihai). The traditional magnetic material Fe_3O_4 composite with lithium aluminum silicate (LAS) glass-ceramic and graphene (RGO) can utilize their dielectric loss and magnetic loss comprehensively and result in the formation of a multi-component absorbing composite material with excellent performance.

Graphene has been one of the hotspots as a lightweight and high-performance material. However, as an absorbing material alone, graphene has some inherent disadvantages, such as its narrow absorption band and poor absorption strength due to its large dielectric constant and poor impedance matching. Therefore, it is generally combined with a magnetic loss absorbing material to achieve the purpose of broadening the absorption band and improving the absorbing performance. But, there is still the disadvantage of poor impedance matching. In order to solve this problem, this work uses a method of coating Fe_3O_4 with lithium aluminum silicate glass-ceramic with a low expansion coefficient and high transmittance, and constructing an intermediate state of high-efficiency wave-transmission in the composite structure. It not only overcomes the shortcomings of the high density of conventional absorbing materials, but also broadens the absorbing band to achieve a light weight, high strength and strong absorption.



The reflection loss values of Fe_3O_4@LAS/RGO could reach -65 dB at 12.4 GHz with a thickness of only 2.1 mm, and the absorption bandwidth with reflection loss values less than -10 dB (over 90% EM wave absorption) were up to 4 GHz at the corresponding thickness. At the same time, the effective absorption bandwidth in 1-5.5 mm thickness range is as high as 14.9 GHz, and the material exhibits excellent microwave absorbing performance in all frequency bands. Lithium aluminum silicate glass-ceramic as a wave-transparent material coated on the surface of Fe_3O_4 nanospheres introduces multiple transmission-absorption mechanisms. Fe_3O_4@LAS/RGO composites have outstanding performance because they are lightweight, broadband, and strong absorption, which will bring new ideas for the design of new high-performance microwave absorbers.

This work was supported by the Taishan Scholar Project, the National Natural Science Foundation of China and the Natural Scientific Research Innovation Foundation in Harbin Institute of Technology.

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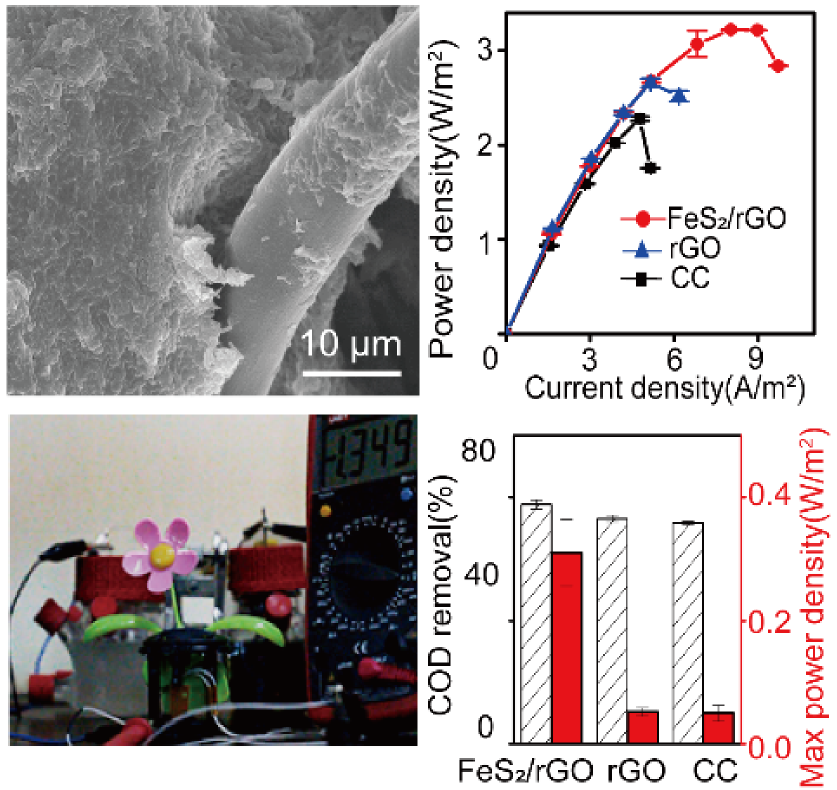
BREAKTHROUGHS IN ANOD MATERIALS OF MICROBIAL FUEL CELLS

A team led by Professor Liu Shaoqin from the School of Life Science and Technology, HIT, published a paper titled "FeS_2 Nanoparticles Decorated Graphene as Microbial-Fuel-Cell Anode Achieving High Power Density" in the high-ranking journal Advanced Materials (2018, IF: 21.950). Professor Liu is the only corresponding author and all authors are from Harbin Institute of Technology. They made progress in anode material of microbial fuel cells.

Microbial fuel cells (MFCs) have received great attention worldwide due to their potential in recovering electrical energy from waste and inexhaustible biomass. Unfortunately, the difficulty of achieving the high power especially in real samples remains a bottleneck for their practical applications. In this paper, Professor Liu fabricated a FeS_2 nanoparticles decorated graphene via a simple hydrothermal reaction, which not only benefits bacterial adhesion and enrichment of electrochemically active Geobacter species on the electrode surface but also promotes efficient extracellular electron transfer, thus giving rise to a fast start-up time of 2 days, an unprecedented power density of 3220 mW m^{-2} and a remarkable current density of 3.06 A m^{-2} in the acetate-feeding and mixed bacteria-based MFCs. MFCs equipped with FeS_2/rGO anode could successfully run an electromagnetical pendulum. The FeS_2 nanoparticles decorated graphene anode achieves a power density of 310 mW m^{-2} with simultaneous removal of 1319 ± 28 mg L^{-1} COD in effluents from a beer factory wastewater. This work paves the key step for designing high-performance MFC anodes for practical application.

The paper was financially supported by the National Key R&D Program of China, the National Natural Science Foundation of China, HIT Environment and Ecology Innovation Special Funds, Open Project of Key Lab of Microsystem and Microstructures Manufacturing Ministry of Education, Harbin Institute of Technology, China Postdoctoral Science Foundation and Heilongjiang Postdoctoral Financial Assistance.



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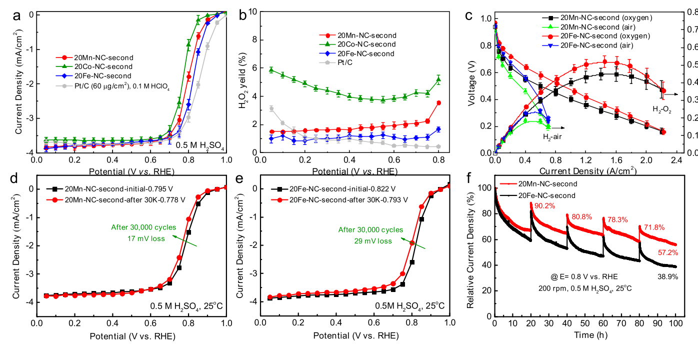
BREAKTHROUGH IN PLATINUM-GROUP-METAL FREE CATHODE CATALYST FOR PROTON-EXCHANGE MEMBRANE FUEL CELLS

A team led by Professor Wang Zhenbo from the School of Chemistry and Chemical Engineering, in collaboration with Associate Professor Wu Gang from University at Buffalo, the State University of New York, has made important progress in the field of fuel cell cathode catalyst. The research paper titled "Atomically Dispersed Manganese Catalysts for Oxygen Reduction in Proton-Exchange Membrane Fuel Cells" was published in Nature Catalysis. This paper reported a Mn-based catalyst with excellent activity and stability in acid media for the first time, which pointed out a new direction for the development of platinum group metal (PGM)-free catalysts for proton-exchange membrane fuel cells (PEMFC).

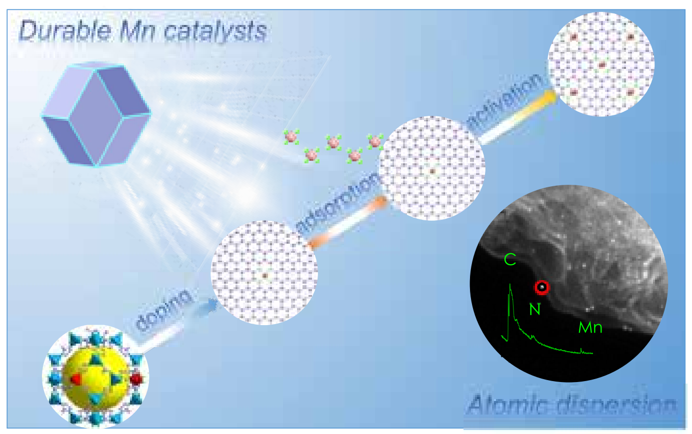
With high energy-efficiency and low CO_2 emission, PEMFC have been considered the most promising power sources for transportation and stationary applications. However, the use of expensive and scarce PGM catalysts for the sluggish oxygen reduction reaction (ORR) at the cathode hindered their large-scale application. To this end, tremendous efforts have been made to develop high-performance PGM-free catalysts, in terms of activity and durability. The state of the

art PGM-free catalysts iron and nitrogen co-doped carbon based Fe-N-C catalysts, have achieved comparable catalytic activity to Pt/C catalysts. However, the rapid performance loss result from the dissolution of active metal sites and the oxidation corrosion of carbon matrix is still a great challenge. Notably, Fe-contained catalysts are also criticized for their participation in and/or promotion of the Fenton reactions (Fe^{2+} + H_2O_2), which will generate a significant amount of active oxygen-containing hydroxyl and hydroperoxyl radicals that can degrade the ionomer within the electrode and the polymer membrane in PEMFCs.

Aiming to develop a practical PGM-free catalyst, Professor Wang Zhenbo and his co-authors focus on the study of high-performance catalysts that are also Fe-free. After comprehensive study and theoretical calculation, earth-abundant Mn was chosen to serve as the center of the active site, and a two-step doping/adsorption strategy was employed to increase the density of active sites. The as prepared Mn-N-C catalyst achieved a half-wave potential of 0.8 V (vs. RHE) in standard three-electrode system, which is comparable to traditional Fe-N-C catalysts. More importantly, Mn-N-C catalyst showed superior durability: (i) After 30,000 cycles accelerated stress testing from 0.6-1.0 V, the have-wave potential only showed a negative shift of about 17 mV, which is much smaller than that of Fe-N-C (29 mV); (ii) After 100 hours chronoamperometry testing at a constant potential of 0.8 V, the current density can still maintain 57%, which is also much higher than that of Fe-N-C (39%). X-ray absorption spectroscopy, scanning transmission electron microscopy, Raman spectrum and density functional theory calculations confirmed that this excellent performance is originated from atomically dispersed MnN_4 sites and the remarkable stability is due to the



Study of activity and durability in both standard three-electrode system and fuel cell



Schematic of two-step doping/adsorption method to synthesize Mn-N-C catalyst

robust MnN_4 sites and the enhanced corrosion resistance of adjacent carbon derived from Mn doping. The excellent performance in fuel cell tests further confirmed that the Mn-based catalyst is really a promising PGM-free catalyst in future PEMFC technologies.

The paper was supported by the National Natural Science Foundation of China.■

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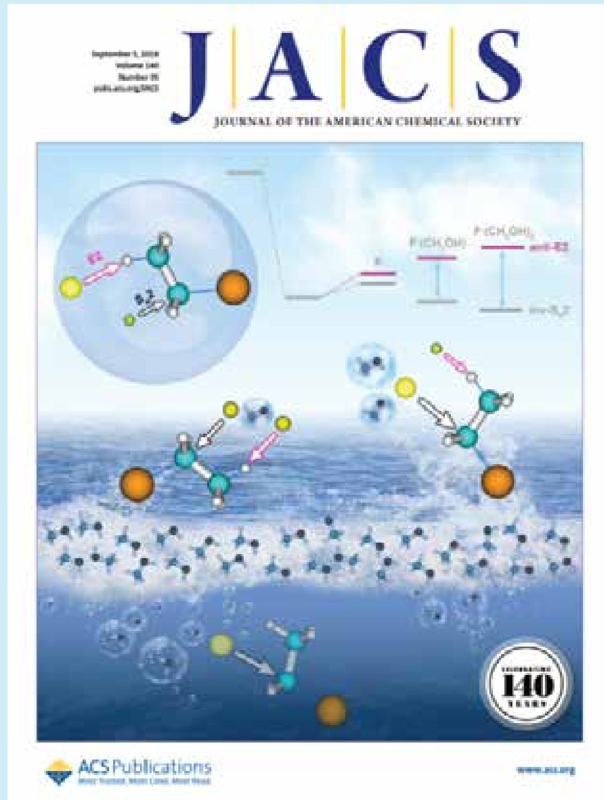
CHEMICAL DYNAMICS SIMULATIONS UNCOVER ATOMISTIC MECHANISMS IN SYNTHESIS OF MATERIALS AND MEDICATIONS

Supported by the National Natural Science Foundation of China, Professor Zhang Jiaxu, Professor Yang Li and their co-workers at the School of Chemistry and Chemical Engineering, Harbin Institute of Technology have performed chemical dynamics simulations that revealed how a solvent molecule affects competing elimination and substitution dynamics, providing insight into mechanism evolution with increased solvation. The findings were published in the Journal of the American Chemical Society, which was selected as the front cover and was highlighted by JACS Spotlights with the title "Simulations Define the Relationship between Solvation and Selectivity."

Various reaction channels commonly compete with each other in synthesis of materials or medications affecting reaction processing and outcomes. Base-induced elimination (E2) and bimolecular nucleophilic substitution (S_N2) are two fundamental and ubiquitous reaction mechanisms in preparative organic synthesis that may occur as unwanted side reactions of each other making their competition an intriguing question to be probed. Experiments found that the gas-phase trade-off between E2 and

S_N2 has been suggested in general to strongly favor elimination, but nucleophilic substitution prevails in the bulky solution. Understanding this phenomenon requires studying the detailed dynamical effects caused by solvent molecules.

Here, we reproduce the experimental findings employing direct dynamics trajectory simulations and show that the E2 mechanism dominates over S_N2 for the solvent-free reaction. This is energetically quite unexpected considering similar activation barriers for the two processes on the static PES, and alternatively dynamical effects are found to be responsible. Introducing one solvating methanol molecule, dynamical behaviors show strikingly distinct features that largely enhance the S_N2 importance, and it is understood that a differential solute-solvent interaction at the central barrier stabilizes the transition state for substitution more strongly. Upon further solvation, this subtle discrepancy in stabilization becomes more pronounced, which is assumed to drastically suppress the E2 route and, in turn, favor S_N2 events. The work opens the door to a detailed atomistic understanding of transformation reactions in distinctly different realms. Professor Zhang Jiaxu and Professor Yang Li have been working at chemical dynamics simulations and their publications were featured by ACS C&EN and RSC, and selected as cover articles.■



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Research & Academia
HIT TIMES 2018

DEVELOPMENT OF ION SELECTIVE CELGARD SEPARATOR MODIFIED BY PRUSSIAN BLUE FOR HIGH PERFORMANCE LITHIUM SULFUR BATTERY

A team led by Professor Zhang Naiqing and Professor Sun Kening from the Institute of Chemical and Energy Materials, Harbin Institute of Technology, recently published a paper titled "Ion-Selective Prussian-Blue-Modified Celgard Separator for High-Performance Lithium–Sulfur Battery" in the journal of ChemSusChem.

The separator has the characteristics of insulation, porosity and ion permeability, which is one of the key factors affecting the performance of lithium sulfur batteries. However, polysulfides diffuse across the separator inside the battery, leading to the loss of active substances. Therefore, the employment of a functional separator is one of the solutions to improve the performance of lithium sulfur batteries. Previous research used non-polar carbon paper as the functional barrier layer in lithium sulfur batteries for the first time and improved the cycling stability of the battery. Whereafter, a variety of carbon-modified separators were used to improve the cycle performance of lithium-sulfur batteries. However, these non-polar carbon materials cannot effectively anchor the polar polysulfides, and still result in loss of capacity.

The main problem of lithium sulfur batteries is the shuttle effect of soluble polysulfides between electrodes, which leads to serious capacity decay. In order to develop high-performance lithium sulfur batteries, researchers for the first time used a simple method to prepare an ion-selective Prussian blue (PB) modified Celgard separator to restrain the shuttle of polysulfides. PB is a special MOF material with high stability, non-toxicity and scalability for mass production. The appropriate lattice size and unique open frame structure with large gap sites of PB can ensure the transfer of Li^+ while effectively inhibiting the migration of polysulfides, thus achieving higher coulombic efficiency and cycle stability (Figure 1). Lithium sulfur batteries with PB/Celgard separator have an average capacity attenuation of 0.03% per cycle after 1000 cycles at the current density of 1C (Figure 2). In addition, the employed method avoids the complex filtration or coating process used in other reports, which is favorable for further quantity production.

The paper was financially supported by the National Natural Science Foundation of China, the State Key Laboratory of Urban Water Resource and Environment, Harbin Institute of Technology, the China Postdoctoral Science Foundation, the Postdoctoral Foundation of Heilongjiang Province, and the Fundamental Research Funds for the Central Universities.

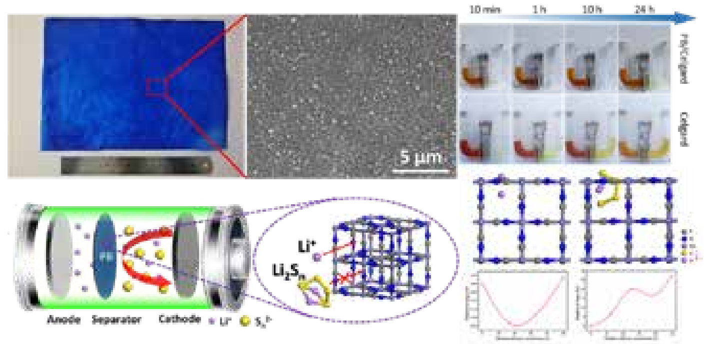

Figure 1 Related characterization and theoretical calculation of Prussian blue modified separator

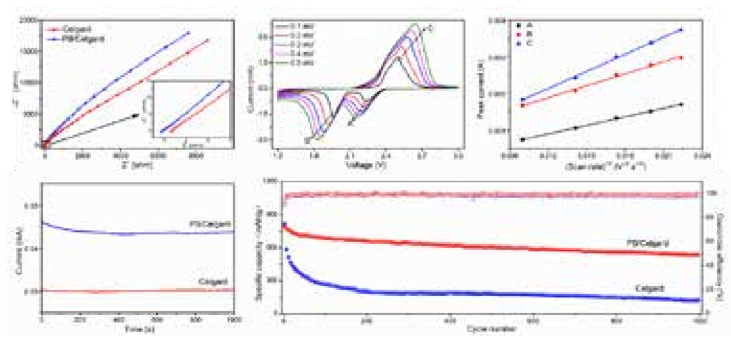

Figure 2 Electrochemical properties of PB/Celgard separator

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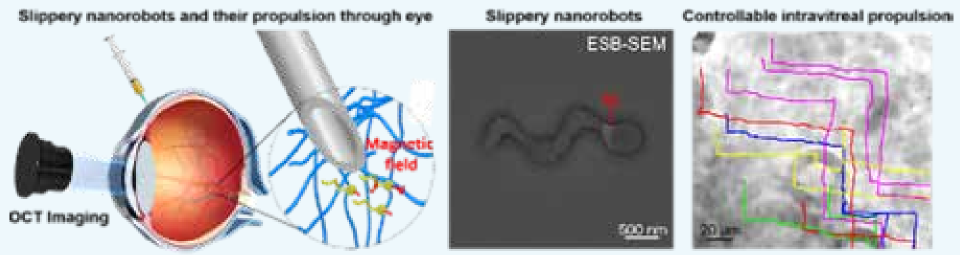
BREAKTHROUGH IN NANOROBOTS: SWIM THROUGH THE EYE

Can you imagine in the future people can create artificial nanorobots which are too tiny to be seen with the naked eye? More interestingly, these nanorobots can swim within the eyes, transport drugs, and treat ocular diseases. The researchers at HIT and international collaborators are trying to make this vision come true.

Professor Wu Zhiguang from Key Laboratory of Micro-Systems and Micro-Structures Manufacturing at HIT collaborated with Dr. Tian Qiu and Professor Peer Fischer from Max Planck Institute for Intelligence Systems (Stuttgart, Germany) to study ophthalmology nanorobots. For the first time, they demonstrated the controlled propulsion of nanorobots through dense tissue prevalent inside the vitreous of the eye. So far, existing nanorobots (or nanopropellers) were only able to travel through models or fluids, but not through real tissue. With substantial hard work, they finally took one step further towards nanorobots becoming



real tissue minimally invasive tools for precisely delivering medicine to where it is needed.

Synthetic nanorobots represent a novel pathway for targeted drug delivery in the human body due to its attractive propulsion behavior. However, their propulsion suffers from the block of the biomacromolecules. To this end, Wu Zhiguang introduced a liquid slippery surface onto the nanorobots; the slippery surface minimizes the adhesion to the biological network in the eye so that the nanorobots can move. The coating is inspired by nature; it is like the slippery layer found on the carnivorous pitcher plant to catch insects. This liquid slippery coating is crucial for the efficient propulsion of nanorobots inside the eye. It minimizes the adhesion between tight molecular mesh in the vitreous and the surface of the nanorobots. That way, the robots do not damage the sensitive biological tissue around them. Currently, they can control the nanorobots toward the targeted region of retina though the manipulation of the external magnetic field. In the future, they will transport drugs toward the diseased area in the retina and become minimally invasive tools for targeted drug delivery. ■

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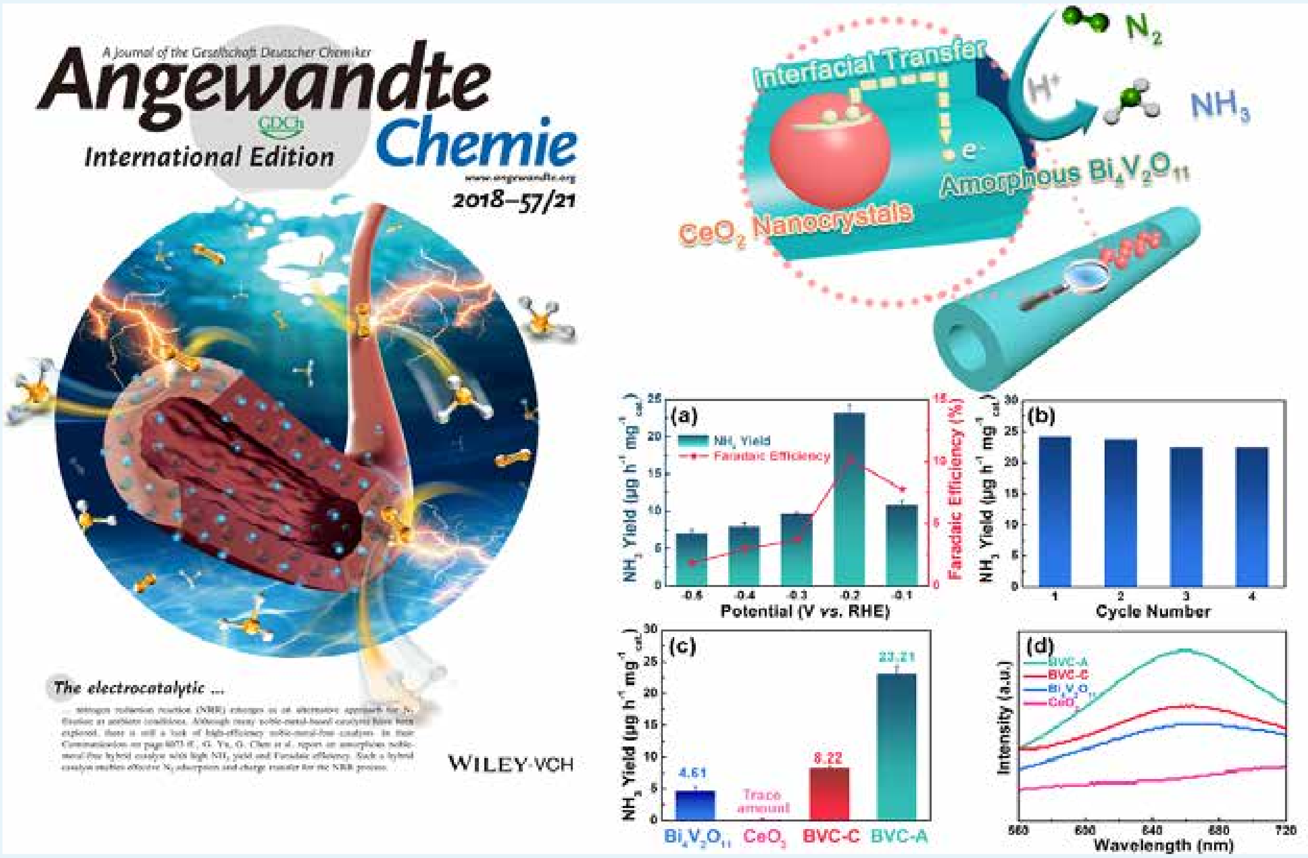
A NOBLE-METAL FREE ELECTROCATALYST FOR THE CONVERSION OF N_2 TO NH_3 AT AMBIENT CONDITIONS

A team led by Professor Chen Gang from the MIIT Key Laboratory of Critical Materials Technology for New Energy Conversion and Storage, School of Chemistry and Chemical Engineering at HIT published a research paper titled "An Amorphous Noble-Metal-Free Electrocatalyst that Enables Nitrogen Fixation under Ambient Conditions" in Angewandte Chemie International Edition as a back cover paper and VIP paper. This study reported a noble-metal-free catalyst that can realize N_2 fixation to synthesize NH_3 under ambient conditions.

The synthesis of ammonia from atmospheric abundant dinitrogen, namely nitrogen fixation, underpins global agriculture. In addition, ammonia can also be employed as an efficient renewable fuel due to its high hydrogen density and low liquefying pressure. To date, industrial ammonia manufacture still mainly relies on the Haber–Bosch process conducted at a high reaction temperature (400–500 °C) and pressure (100–200 atm), which accounts for 1.5% of global energy consumption and a significant CO_2 emission annually. Seeking sustainable systems enabling nitrogen fixation under milder conditions has been one of the most significant research focuses. Electrocatalytic nitrogen reduction reaction (NRR) is emerging as an alternative technology owing to its relatively high efficiency and moderate reaction conditions. Previous reports are limited to noble metals based catalysts, while noble-metal-free catalysts are much less explored.

Hereof, Professor Chen's team proposed a new NRR electrocatalyst on the basis of noble-metal-free $Bi_4V_2O_{11}$/CeO_2 hybrid via a spinneret electrospinning with subsequent calcination approach. As-fabricated catalyst contained amorphous $Bi_4V_2O_{11}$, which endowed the



catalyst with abundant active sites for N_2 reduction reaction. When evaluated as an electrocatalyst for nitrogen reduction reaction, the amorphous catalyst exhibited standout average NH_3 yields (23.21 μg h^{-1} $mg^{-1}_{cat.}$) at -0.2 V versus reversible hydrogen electrode (RHE), which was much more superior in sharp contrast with the crystalline counterpart, while the corresponding Faradaic efficiency was as high as 10.16%. Accordingly, the as-proposed electrocatalyst enabled standout NRR performance, which paved the way for developing N_2 fixation to synthesize NH_3 under ambient conditions.

This research was in collaboration with Professor Guihua Yu from the University of Texas at Austin and was financially supported by the National Natural Science Foundation of China.

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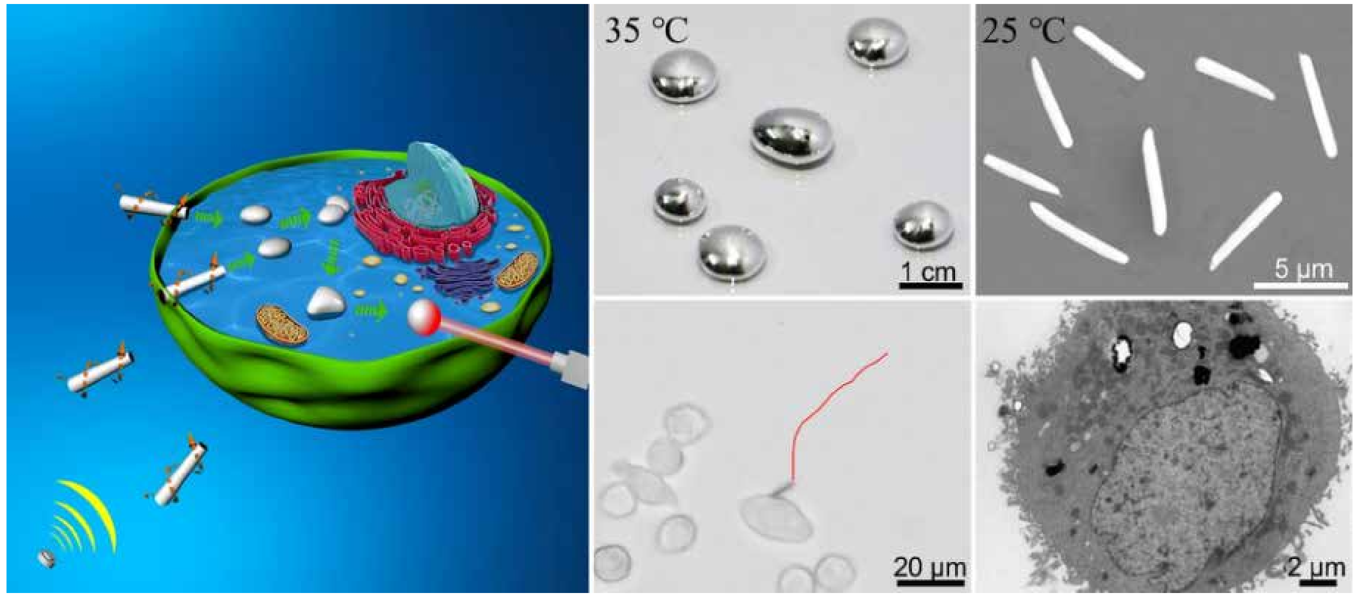
THE WORLD'S FIRST SWIMMING LIQUID METAL NANOROBOT

In October 2018, a team led by Professor Guo Bin and Professor He Qiang from the State Key Laboratory of Advanced Welding and Joining and the Micro/Nanotechnology Research Center, Harbin Institute of Technology, recently published a paper titled "Shape-Transformable, Fusible Rod-Like Swimming Liquid Metal Nanomachine" in the journal ACS NANO. It is the first liquid metal swimming nanorobot with deformation and fusion capability in the world.

The melting point of Gallium is 29.8℃, and its alloys are liquid at room temperature. Liquid gallium and its alloys have excellent properties of low melting points, high surface tension, high thermal and electrical conductivity, low toxicity and degradability. The T-1000, a liquid metal robot in Terminator 2, can transform shape, self-repair and replicate any object of a similar



size, which inspires the research on the application of liquid gallium and its alloys in the fields of robotics, biomedicine, and wearable technology. However, no liquid metal based swimming nanorobot has been reported yet.

The research team fabricated the first example of liquid metal nanorobot with an asymmetric rod-like structure by using a pressure-filter-template method. The length and diameter of the nanorobots are controllable, and the minimum diameter can reach to 200 nm. The as-prepared rod-like nanorobots show a core-shell structure, which consist of liquid gallium cores and gallium oxide shells. Due to the pre-melting effect of gallium nanoparticles, the inner gallium cores of nanorobots remain in the liquid phase at room temperature, while the gallium oxide shells stabilize their rod-like structure. The liquid gallium nanorobots also have strong full-wavelength fluorescence, further indicating that these nanorobots can be used as fluorescent probe in the next-generation precision theranostics. Under the propulsion of ultrasound field, the as-fabricated liquid metal nanomotors are capable of actively seeking at a speed up to 23 μm s^{-1} and piercing into cancer cells, and then transforming from a rod to a droplet in the acidic endosomes of cancer cells. These liquid metal nanorobots with T-1000-like deformation and fusion capabilities provide a new approach for design, manufacture and biomedical applications for a new generation of micro/nanorobots.

This work was financially supported by the National Natural Science Foundation of China and National Postdoctoral Program for Innovative Talents.

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D. L. Wang, C. Y. Gao, W. Wang, M. M. Sun, B. Guo, H. Xie, Q. He. Shape-transformable, fusible rodlike swimming liquid metal nanomachine. ACS Nano, 2018, 12 (10), 10212-10220

NEW FINDINGS FOR ATOMIC PACKING IN METALLIC GLASSES

A team led by Professor Su Yanqing from the National Key Laboratory for Precision Hot Processing of Metals at the School of Materials Science and Engineering HIT, in collaboration with Professor Robert O. Ritchie from the Lawrence Berkeley National Laboratory at the University of California, published a research paper titled “Nanometer-Scale Gradient Atomic Packing Structure Surrounding Soft Spots in Metallic Glasses” in npj Computational Materials, the top journal in computational materials science. The model of local gradient atomic packing structure proposed by them could be utilized to design strength-and-ductile metallic glasses.

The hidden order of atomic packing in amorphous structures and how this may provide the origin of plastic events has long been a goal in the understanding of plastic deformation in metallic glasses. To pursue this issue, Su Yanqing and his co-authors employ here molecular dynamic simulations to create three-dimensional models for a few metallic glasses where, based on the geometrical frustration of the coordination polyhedra, they classify the atoms in the amorphous structure into six distinct species, where “gradient atomic packing structure” exists. The local structure in the amorphous state can

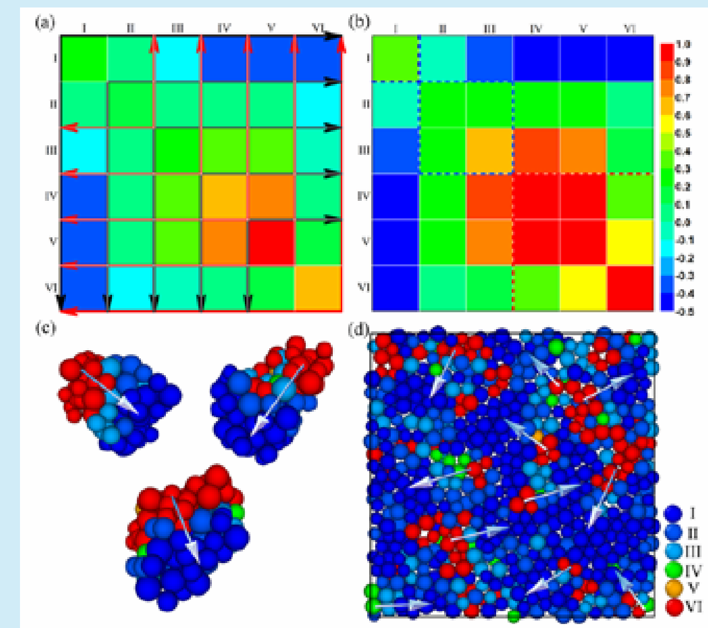

Fig. 1 Gradient atomic packing structure in Cu64Zr36 alloys. Correlation matrix of Cij for atoms classified into six types in the (a) as-quenched and (b) annealed Cu64Zr36 alloys. The correlation intensity gradually decreases along the arrows in (a). The dashed lines in (b) map three different regions according to the correlation level with I atoms. (c) Three clusters are randomly selected from the as-quenched Cu64Zr36 sample. (d) Snapshot of atomic configuration for a thin slab in the Cu64Zr36 annealed sample. The white arrows highlight that the “gradient nanostructure” existed in MGs

display a gradual transition from loose stacking to dense stacking of atoms, followed by a gradient evolution of atomic performance. As such, the amorphous alloy specifically comprises three discernible regions: solid-like, transition, and liquid-like regions, each one possessing different types of atoms.

The discernible regions, including liquid-like atoms and their neighbors, tend to be soft and fertile locations for ST bands, corresponding to so-called "soft spots". In addition, each ST should percolate through liquid-like and transition regions and finally be frustrated by the solid-like regions ("backbone") whose intensity is mainly determined by the degree of enrichment of solid-like atoms. Unlike the "geometrically unfavored motifs" model which fails to consider the role of medium-range order, their model gives a definite structure for the so-called "soft spots", in favor of quantifying and comparing their number between different metallic glasses, which can provide a rational explanation for the unique mechanical behavior of metallic glasses. Moreover, this understanding can aid the structural underpinning of dynamic heterogeneity mapped out in experiments.

The paper was financially supported by the National Natural Science Foundation of China.

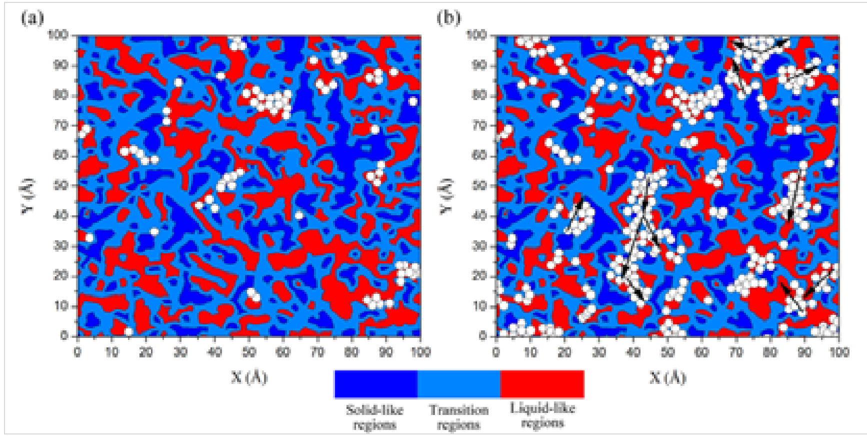

Fig.2 Correlation between different regions and shear transformations. Contoured maps showing the spatial distribution of atoms within different regions in a slice of the as-quenched $Cu_{64}Zr_{36}$ (undeformed). The thin slab having a thickness of 2.5 Å was captured from the middle of the boxes alone z-axis (orientated perpendicular to the sections shown). The white spots superimposed in the maps denote the positions of atoms that have experienced distinct shear transformations under pure shear loading to a strain of a 2% and b 4% before global yielding. Each arrow mark one actual path for the propagation of shear transformations.

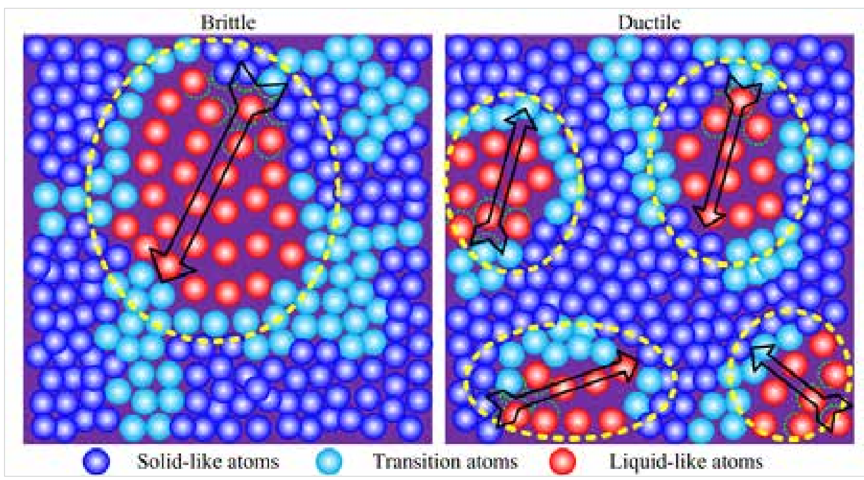

Fig.3 Schematic illustration of the atomic structure for brittle and ductile amorphous alloys. Each yellow circle labels one soft spot in MGs, and the arrows represent the possible directions of the formation of shear bands.

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ONE MILLION DONATION BY ACADEMICIAN DU SHANYI TO HIT EDUCATION DEVELOPMENT FOUNDATION

On October 25th, Academician Du Shanyi from the School of Astronautics donated 1 million RMB to the HIT Education Development Foundation for creating a new hardship fund, the "Shanyi Fund." HIT Party Secretary and the Director of the Foundation Wang Shuquan awarded a commemorative medal and certificate to Academician Du.

Academician Du recalled his student life when he was the one struggling to make ends meet. He received big help from the government, university, and teachers. Since 1964, he has been working at Harbin Institute of Technology for 55 years, with his devotion to HIT and education. Therefore, he hopes to create a new hardship fund to ensure that no HIT student should ever feel pressured to leave their studies because of lack of funds.

HIT Party Secretary Wang Shuquan, on behalf of HIT, expressed appreciation to Academician Du Shanyi for his generous support. He said "Academician Du has made an extraordinary contribution to the development of HIT and has cultivated many talents for China's space industry. This remarkable gift will have a far-reaching impact on talent cultivation. The 'Shanyi Fund' will benefit many, and the effects of this support will be enduring."

HIT ATTENDED THE APSCO 10TH ANNIVERSARY HIGH-LEVEL FORUM

Recently, the opening ceremony of the 10th Anniversary Conference of the Asia-Pacific Space Cooperation Organization was held in Beijing. Chinese President Xi Jinping sent a congratulatory letter to the 10th anniversary of the establishment of the organization. HIT President Zhou Yu and HIT Vice President Ren Nanqi were invited to attend the conference.

With the theme of "Community of Sharing Future through Space Cooperation," the forum discussed issues such as promoting free and equal access of space technology and spatial data application for developing countries and promoting capacity building in developing countries through space cooperation and talent cultivation. The "Development Vision of the Asia-Pacific Space Cooperation Organization in 2030" was issued. On behalf of HIT, Mr. Ren Nanqi delivered a report titled "Practice and Prospect of Engineering-Based Education," focusing on the international development of HIT, the characteristics and practices of space-based engineering education, etc.

On behalf of Harbin Institute of Technology, Mr. Zhou Yu signed the cooperation agreement with the Asia-Pacific Space Cooperation Organization. The Cooperation agreement mainly relates to degree education programs of the Asia-Pacific Space Cooperation Organization, which aims for training Masters, PhDs and other high-level talents for related member countries of the organization.

At the invitation of Mr. Chinbat Baatarjav, Chairman of APSCO Council, Mr. Zhou Yu and Mr. Ren Nanqi held talks with delegation members. The two sides discussed how to better carry out talent training and international cooperation under the framework of the Asia-Pacific Space Cooperation Organization. Mr. Zhou also accepted an interview by Outlook News Weekly and introduced the training of talent at HIT.

The Asia-Pacific Space Cooperation Organization (APSCO) is the only inter-governmental space cooperation organization in the Asia-Pacific region, which can play as a necessary driver for bringing the growing number of benefits derived from space science and technology applications to its member countries in their common pursuit of attaining the objectives of the APSCO. Since the establishment of APSCO, it has been successfully fulfilling its objectives by developing truly fruitful cooperation among member states as well as with other UN member countries.


SHENZHOU FORUM 2018

On December 28th, the 3rd Shenzhou Forum for International Young Scholars was held. Nearly 100 young scholars from Oxford University, Cambridge University and Harvard University, etc. attended the forum.

On behalf of Harbin Institute of Technology, HIT President Zhou Yu extended a warm welcome to all young scholars. In his speech,




he reviewed the important achievements made by HIT in the past 98 years and the school's contribution to national and local economic and social development and the development of the world's science and technology. He also elaborated on the distinctive characteristics of the school, "base on space, serve for national defense" and introduced faculty development such as cultivating talents by mechanism innovation, attracting talents by advantage platform and retaining talents by expert teams. During the process of building a world-class university, HIT needs young talents with big dreams. He hoped that young scholars would know HIT, love HIT, and join HIT through this forum.

HIT Vice President Xu Dianguo chaired the opening ceremony. HIT Vice Presidents Han Jiecai and An Shi delivered research reports. Representatives of outstanding young teachers Professor Li Longqiu and Professor Wang Dawei made speeches to share the experience of their growth and development at HIT. They hoped that young scholars would join the HIT family and get mutual development in a healthy research environment. ■

THE 4TH ANNUAL MEETING OF ASRTU HELD IN RUSSIA

From July 9th to 13th, as the highlight of the 5th China-Russia Expo on Education Cooperation Exchange, the 4th Annual Meeting of ASRTU was held in Ekaterinburg, Russia. The meeting was hosted by the Federal State Autonomous Educational Institution of Higher Education, Ural Federal University named after the first President of Russia B.N. Yeltsin, the Education Department of Heilongjiang Province, and the Association of Sino-Russian Technical Universities, and it was jointly organized by the Ural Federal University, Harbin Institute of Technology, and Bauman Moscow State Technical University. It attracted over 40 Chinese and Russian universities in the association, including more than 200 representatives. HIT Vice President Ren Nanqi attended the event.

On July 10th, with the special invitation of China's Ministry of Commerce and the Ministry for Economic Development of the Russian Federation, Anatoly Alexandrovich Aleksandrov, the President of ASRTU in Russia and the Rector of Moscow State Technical University named after Bauman, and Ren Nanqi, HIT Vice President, attended the Sino-Russian Local Cooperation Forum and made speeches. Anatoly Alexandrovich Aleksandrov and Ren Nanqi signed the "Ekaterinburg Declaration" that reached a consensus in talent cultivation (especially student exchange), scientific research, social services, cultural heritage and innovation, and international

cooperation and exchanges, making positive contributions to the promotion of cultural exchanges and local interaction between China and Russia.

During the following days, HIT Vice President Ren Nanqi attended the opening ceremony and delivered a speech. At the "Ekaterinburg Dialogue" University Presidents Forum, on behalf of the ASRTU China's permanent president, Ren Nanqi made a keynote speech titled "ASRTU Creates a New Era of Cultural Exchanges and Cooperation between Chinese and Russian Elite Universities".

The speech focused on the latest developments in Sino-Russian strategic cooperation, comprehensively summarized the construction of the association from 2016 to 2018, and put forward a number of

initiatives on the future development of ASRTU, including the promotion of the international competitiveness of ASRTU universities, the construction of the ASRTU university-enterprise cooperation platform, the 2020 plan of ASRTU nano-satellite, the active establishment of academic exchange platforms in frontier fields, and the development of ASRTU multilateral international influence.

INTERNATIONAL COLLEGIATE SPACECRAFT INNOVATION DESIGN CONTEST 2018

On August 12th, the International Collegiate Spacecraft Innovation Design Contest 2018 was held at Harbin Institute of Technology. 47 teams from 32 universities and institutes in China, Russia, Pakistan and other countries were selected for the finals. After two days of intense competition, three teams from HIT, National University of Defense Technology and Amur State University won 1st prize.

HIT Vice President An Shi attended the opening ceremony and delivered a speech. The experts introduced the research status and future development trends of the spacecraft field centring on simulation modelling of dynamic systems and aerospace engineering research, etc. The spacecraft is the integration and best embodiment of high technology in many disciplines including mechanics, communication, electronics, control, materials, etc. The innovation has expanded from single technology to system integration technology, research & production, and application mode innovation & expansion. More than 150 participants showed their innovative thinking, innovative consciousness and innovative ability, centring on new concepts in spacecraft system technology, innovative applications of spacecrafts, new sub-systems or payloads, commercial aerospace innovation mode and operation, and other forward-looking new concepts, methods and technologies, by PPT, animation, video, physical and model, etc.

This contest was jointly sponsored by the Chinese Society of Astronautics, the Association of Sino-Russian Technical Universities (ASRTU), Harbin Institute of Technology and Bauman Moscow State Technical University. It was organized by the School of Astronautics, HIT and aimed to promote exchange and cooperation among the students from aerospace universities around the world, as well as stimulate students' interest in aerospace high-tech exploration, and cultivate their sense of innovation, comprehensive analysis and practical skills.

HIT CAMPUS ICE AND SNOW FESTIVAL 2018

On the evening of December 22, people crowded on the plaza of the Electric Machinery Building and the pedestrian street to witness the opening of the 2nd HIT Campus Ice & Snow Festival. Wang Shuquan, HIT Party Secretary, opened the “Star Gate,” officially starting the festival. HIT Deputy Party Secretary Xiong Sihao, HIT Vice Presidents An Shi and Xu Xiaofei, HIT Propaganda Minister Wu Songquan and Assistant Principal Peng Yuankui attended the opening ceremony.

Ice and snow culture is the characteristic cultural vein of Heilongjiang Province nationwide and even worldwide. The HIT Campus Ice & Snow Festival is an important cultural card of HIT to build a world-class university. At the opening ceremony, HIT leaders gave awards to the winners of the International University Ice Sculpture Competition and the International Ice and Snow Innovation Construction Competition. "Lotus" won the 1st prize; "Tracing" and "Free Journey" won the 2nd prize; and "Rhythm-Icy China," "Cyprinus Cloud Dragon" and "Underwater World" won the 3rd prizes. In the International Ice and Snow Innovation Construction Competition, the team from Cambridge University won the Best Design and Construction Award. The wing from Tsinghua University, Eindhoven University of Technology and University of Leuven, Kent State University and the team from Harbin Institute of Technology won the Excellent Design and Construction Awards.

Alongside the pedestrian street, there were many delicacies, such as skewers, sugar coated haws, sweet dumplings, cakes and so on. With passion, people played "ice and snow culture" games, such as grabbing ice cubes, ice and snow balls, three snowmen, ice and snow clocks, etc. This year's Ice and Snow Festival focused on the landscape coherence and tour experience of the campus. The seven sections were more interactive, participative and entertaining than last year, which included the International University Ice Sculpture Competition, the International Ice and Snow Architecture Competition, the Snow Construction Competition, the Ice and Snow Games, Graduate Academic Forum, Photography Competition, the Ice and Snow Carnival, Featured Food Exhibition and other activities.

WORLD HAND IN HAND GALA 2018

On the evening of December 2nd, as one part of Chinese and international students' culture exchange, the World Hand in Hand Gala was held. Saint Petersburg State University, Ural Federal University, North-Eastern Federal University, etc. were invited to participate in the activity. HIT Vice President Ren Nanqi and more than 800 students and faculty attended to watch the show.

There were 3 chapters in the gala. Chapter 1 was titled "Plant Wishes in the Belt and Road" and there were many wonderful performances including dances of "Millennium Covenant," "Spring of Russia," and "Rhythm of India;" the song and dance "The Glamour of Mongolia," "Magnificent Southeast Asia," and "South Asia Imagination," etc. Chapter 2 was titled "Spread Dreams in China" with performances such as the song "Chinese Dream" and "Let It Go," dances of "Graceful Bearing," "China Exploration," "Dance My Life" and "Ardently Love," and a costume show titled "Blessing China." In Chapter 3, titled "Study at HIT," there was an award ceremony of the Chinese Government Outstanding International Student Scholarship. The performances were the song and dance "Study at HIT," "The Most Beautiful Sun," the song "Melody of Youth," etc. With the chorus "The World Hand in Hand", the gala was successfully closed.

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