HARBIN INSTITUTE OF TECHNOLOGY
NEWSLETTER 2017 ISSUE 2

HIT TIMES

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We sincerely appreciate your wholehearted support.

Contents

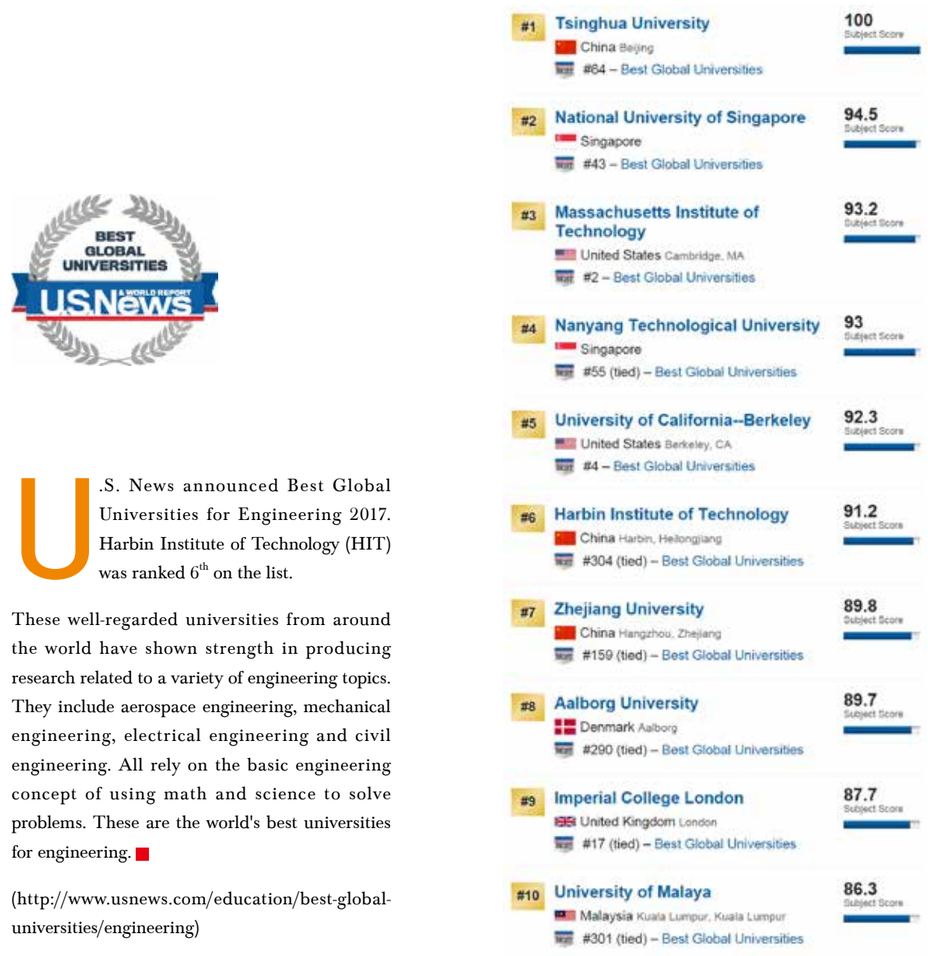
AWARDS & HONORS

HIT LISTED IN TOP 10 OF BEST GLOBAL UNIVERSITIES FOR ENGINEERING

U.S. News announced Best Global Universities for Engineering 2017. 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. ■

(http://www.usnews.com/education/best-global-universities/engineering)



ACADEMICIAN SHEN SHIZHAO WON THE HIGHEST ACHIEVEMENT AWARD OF CSCS

In 2017, the China Steel Construction Conference and the Zhejiang Province Steel Construction Forum were held in Xiaoshan. Academician Shen Shizhao from the School of Civil Engineering was awarded the Highest Achievement Award of the China Steel Construction Society (CSCS) for his outstanding contribution to the development of the steel structure industry.

The China Steel Construction Conference is an annual event of the steel construction industry. This year, it was jointly sponsored by the CSCS, the National Engineering Research Center for Steel Construction and the Steel Structure Industry Association of Zhejiang Province. Nearly 100 enterprises and industry associations from home and abroad as well as 600 experts and scholars from well-known colleges and universities gathered together to explore the future of the steel structure industry.

As a distinguished expert in the field of steel structure, Academician Shen Shizhao has been committed to the emerging field of large span spatial steel structures. He has made a great contribution to the innovation of the spatial structure system, such as the composite reticulated shell which has been applied in the Asian Games Stadium and the cable-net structure with real-time deforming which has been applied in the Five-hundred-meter Aperture Spherical radio Telescope (FAST). He is distinguished for his outstanding development of suspended - cable structure system, nonlinear stability of the latticed shell, earthquake action and wind resistance of large span spatial steel structures etc.

He participated in the design of major sports engineering projects, such as the Bird's Nest and the Water Cube for the 2008 Beijing Olympic Games, as well as other design engineering projects, such as the stadiums at Shijingshan district and Chaoyang district for the Asian Games, the speed-skating stadium in Heilongjiang Province for the Asian Winter Games, the skating center in Jilin Province, the Weihai stadium, and the Harbin International Sports Meeting and Exhibition Center. ■

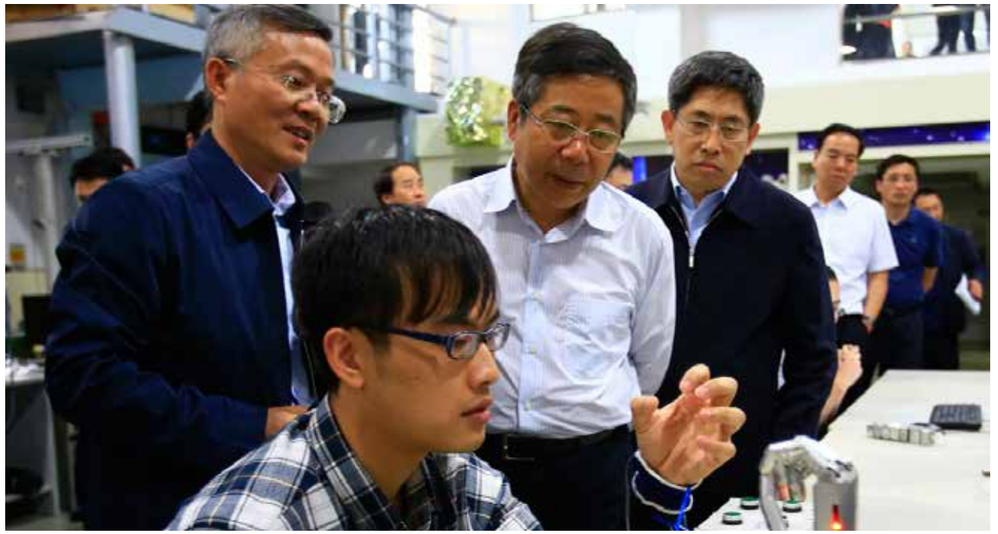
PROFESSOR DENG ZONGQUAN AND PROFESSOR TAN JIUBIN ELECTED AS THE MEMBERS OF CAE

On November 27th, 2017, the Chinese Academy of Engineering (CAE) announced the names of 67 newly elected members of the CAE. Professor Deng Zongquan and Professor Tan Jiubin from Harbin Institute of Technology (HIT) were on the list. This brings the total number of Members of the CAE (including sharing) at HIT to 38.

Professor Deng Zongquan, born in 1965, is a standing committee member of the Central Committee of the China Association for Promoting Democracy. He is recognized for his outstanding contributions to the theory and techniques research of aerospace engineering and special robots. His research has focused on the extreme environmental suitability and high reliability service issues of mechanical systems. He has mastered the key technologies of configuration creative design, structure rigidity, locking and releasing process, driving systems and module connection, and has improved the level of deployment mechanism technology in China to an internationally advanced level. The research achievements made a great contribution to the Chang'e 3 (CE-3) and Chang'e 5 (CE-5) lunar exploration programs. Professor Deng won two National Technological Invention Awards (2nd prize), one National Scientific and Technological Progress Award (3rd prize) and three 1st prizes of ministerial and provincial awards. He has published two monographs, 102 SCI papers and 224 EI papers, which have been cited 2473 times.

Professor Tan Jiubin, born in 1955, is a member of the Communist Party of China. He was recognized for his leadership of the research in ultra-precision equipment field in China and for his contributions to the ultra-precision measurement theory and sophisticated scientific research of the high-end equipment manufacturing, breakthroughs in core technologies, equipment development and engineering applications. He won one National Technological Invention Award (1st prize) and two National Technological Invention Awards (2nd prize). His 132 patents have been authorized, including 21 international patents. He has set 26 standards and published three monographs, 172 SCI papers and 280 EI papers which have been cited 2578 times.

PROFESSOR LIU HONG WON THE PRIZE FOR SCIENTIFIC AND TECHNOLOGICAL PROGRESS OF HO LEUNG HO LEE FOUNDATION



Due to his outstanding contribution to space robots and multi-fingered dexterous hand, Professor Liu Hong won the Prize for Scientific and Technological Progress from the Ho Leung Ho Lee Foundation. He was the only winner of the Award for Machinery and Electric Technology.

In 2017, a total of 52 Chinese scientists won the prizes of Ho Leung Ho Lee Foundation, including 2 prizes for Science and Technology Achievements, 34 prizes for Science and Technology Progress and 16 prizes for the Science and Technology Innovation.

Ho Leung Ho Lee Foundation was established on March 30, 1994, in Hong Kong, with funds donated by the S.H. Ho Foundation Limited, Dr. Kau-Kui Leung, Dr. Ho Tim and Dr. Lee Quo-Wei's Wei Lun Foundation Limited. The purposes of the foundation are to promote the development of science and technology in China and to reward scientific and technical personnel with outstanding achievements and great innovations. The Science and Technology Awards of Ho Leung Ho Lee Foundation, with its impartiality and authority, enjoy a good reputation in China's scientific and technological circles and in all walks of life.

Professor Liu Hong has long been engaged in the research of basic theories and key technologies of space robots. Innovative results have been achieved in dexterous robot operations and on-orbit maintenance. He set up a research team of more than 80 members, and successfully developed China's first space robotic arm system. In 2013, the space robot arm was successfully launched as the core payload of the "Experiment No. 7" satellite. It has completed space maintenance technology such as space manipulator on-orbit for the first time. Professor Liu also presided over the development of a dexterous space hand with 15 actuators, 5 fingers, and 140 sensors. In 2016, it was launched into orbit with the Tiangong-2 space laboratory and worked very successfully.

Professor Liu is a distinguished expert enrolled in the "Thousand Talents Program" of China (also known as "Recruitment Program of Global Experts"). Currently, he is the leader of the Innovative Research Group of the National Natural Science Foundation and the director of the National Key Laboratory of Robotics and System (HIT). ■

PROFESSOR LENG JINSONG ELECTED AS WORLD FELLOW OF ICCM

The 21st International Conference on Composite Materials (ICCM21) was held in Xi'an from August 20 to 25, 2017, at Qujiang International Convention Center. Professor Du Shanyi and Professor Leng Jinsong from Harbin Institute of Technology, took the honor to act as conference chairmen.

As the highest-level and most prestigious conference in the field of composite materials, the series of ICCMs was held biennially in different countries. Themed as "Advanced Composites: Innovation and Development", ICCM21 aimed to explore the very important role of innovation in the development of composite materials, and examine whether composite materials are making a difference in boosting the global economy. More than 1,800 scholars from 48 countries and regions around the world participated in this conference.

At the conference, Professor Leng was elected as the prestigious 2017 World Fellow by the ICCM. The award was recognition for scientists doing outstanding academic contributions and international achievements in promoting the international cooperation, academic communication, and talent cultivation in the composites field. Since 2001, only 29 experts in the composite materials area have obtained this honor. Professor Leng is the second ICCM World Fellow in China, following Professor Du Shanyi (Harbin Institute of Technology, China) who received this honor in 2015. Further information can be found online at http://iccm-central.org/World%20Fellows.html.

In addition, Professor Leng has been elected as Vice Chairman of the ICCM. He is China's first and only vice chairman in ICCM history, which has a profound influence in the field of composite materials in China.

President and Senior Vice President of ICCM presenting award to Professor Leng Jinsong, Prof Yiu-Wing Mai (USYD, Australia) and Professor Paul Smith (University of Surrey, UK)

Professor Leng has worked in the field of composites since the 1990s. Much of his research work is on stimulus responsive polymers (shape memory and electroactive polymers) and their composites, multifunctional nanocomposites, sensors and actuators, active vibration control, structural health monitoring, and active deployable or morphing structures. He has published more than 300 scientific papers in peer-reviewed journals, authored/co-authored 15 books/chapters and more than 50 issued patents. Some of his particular publications have been selected as the featured articles.

He was selected as a Fellow of the SPIE in 2010, a Fellow of Institute of Physics (IOP) in 2011, a Fellow of Institute of Materials, Minerals, and Mining (IMMM) in 2011, an Associate Fellow of AIAA in 2012, a Fellow of Royal Aeronautical Society (RAeS) in 2013, and a Member of the European Academy of Sciences and Arts in 2017. He was awarded as an Honorary Professor of Kingston University London (UK) in 2014, the 2nd Prize of National Natural Science Award (China) in 2015 and a Research Giant by University of Southern Queensland (Australia) in 2016.

Professor Leng said, "I am just so excited and honored to be recognized by ICCM and I would like to take this opportunity to thank my students, colleagues and coworkers whom I have been fortunate enough to work with."■

PROFESSOR DING LIANG WON THE SÖHNE-HATA-JURECKA AWARD OF ISTVS

In September 2017, during the 19th International Conference of the International Society for Terrain-Vehicle Systems (ISTVS), Professor Ding Liang from the School of Mechatronics was awarded the Söhne-Hata-Jurecka Award for Young Engineers/Scientists by the ISTVS for his contribution to the robotic terramechanics and its applications to field robots.

In recent decades, Professor Ding has devoted himself to interaction mechanics for feet or wheels of robots and terrains, based on which he carried out mechanical design research and analysis, high-fidelity simulation, and intelligent control for the mobile robots. The research results have been applied to China's "Jade Rabbit" lunar rover which was launched in 2013, large scale hexapod robots, China's future Mars rover, as well as the United States' already launched Mars rovers. In 2011, he won the 2nd Prize of the National Technological Invention Award, and in the same year he received the Hiwin Excellent Doctoral Dissertation Award. In 2016, he won the Best Conference Paper Award of IEEE ARM. He has authored or co-authored over 130 papers published in journals such as the prestigious IJRR, IEEE TIE and conference proceedings.

The Söhne-Hata-Jurecka Award was established in 1995 by ISTVS which was founded in 1962, aiming to recognize the achievements of researchers who are under 40 years of age for their outstanding accomplishments. On average, one distinguished young scholar has been awarded every three years, thus only 8 scientists have been awarded until now.

PROFESSOR HUANG ZHIWEI WON THE VCANBIO AWARD FOR BIOSCIENCES AND MEDICINE

On November 11, the 2nd VCANBIO Award for Biosciences and Medicine was presented in Beijing. Thirteen Chinese and foreign scientists won the "International Cooperation Award," "Achievement Award" and "Innovations and Breakthroughs Award" respectively, for their outstanding achievements and contributions in the field of life science and medicine. Professor Huang Zhiwei from the School of Life Science and Technology of HIT won the "Innovations and Breakthroughs Award".

The VCANBIO Award for Biosciences and Medicine was co-established by the Chinese Academy of Sciences and VCANBIO Cell & Gene Engineering Co., Ltd. on September 28, 2016. As one of the most authoritative and influential awards in the field of life science and medicine in China, it aims to reward outstanding scientists and potential innovative talents who have made great contributions in the field of life science and medicine. These contributions promoted the industrialization of life science and technology.

Professor Huang's research interests focus on the mechanisms of pathogen-host interactions. His group has determined the structural basis on hijacking 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.

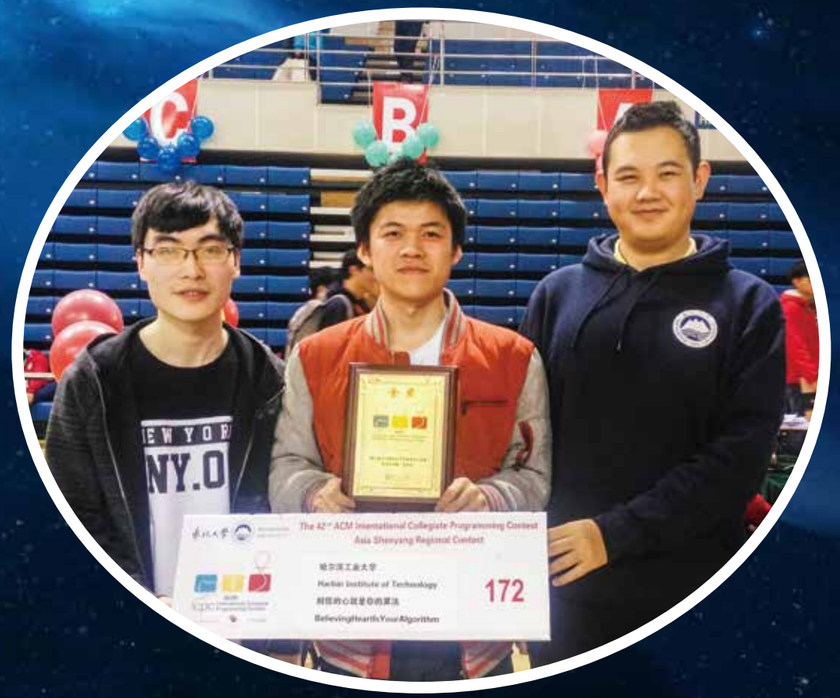
PROFESSOR YE QIANG WON CHINA INFORMATION ECONOMICS WU JIAPEI AWARD

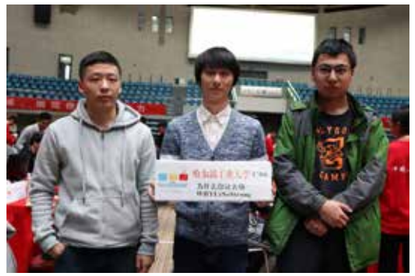
Professor Ye Qiang, the Dean of the School of Economics and Management, won the 2017 China Information Economics Wu Jiapei Award.

In 2016, the China Information Economics Wu Jiapei Award was initiated by Wu Jiapei, a very famous Chinese economist who was the founder of quantitative economics as well as information economics in China. The award aims at carrying forward persistence in science and truth and encouraging innovative research among the young generation.

The recipients of this award should be well-established young Chinese scholars who have made outstanding contributions to new theories on information economics and information management in an internet context. In 2017, only two scholars won this prize. Professor Ye was awarded due to his outstanding achievements in the field of social media and its influencing mechanisms.

HIT WON 4 GOLD MEDALS IN ACM-ICPC ASIA REGIONAL





HIT teams from the School of Computer Science and Technology participated in 5 competitions and won 4 gold medals, 1 silver medal and 3 bronze medals. 4 teams won the gold medals: the team with members Sun Huidong, Ma Yukun and Wen Haoyang; the team with members Xu Yang, Han Yue and Yang Guowei; the team with members Chen Haifeng, Yao Shun and Yu Jinlu and the team with members Wang Anjie, Ren Hanxiang and Wu Yifei.

The ACM-ICPC is the premiere global programming competition conducted by and for the world's universities. For over four decades, the ICPC has grown to be a game-changing global competitive educational program that has raised aspirations and performance of generations of the world's problem solvers in the computing sciences and engineering. ■

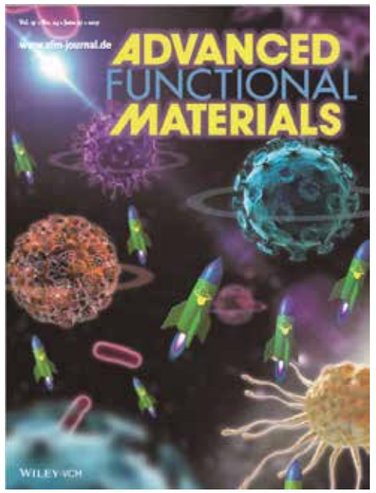
The 42nd ACM International Collegiate Programming Contest (ACM-ICPC) Asia regional competition was held in multiple cities across China: Shenyang, Xi'an, Qingdao, Beijing and Shanghai. More than a thousand teams from over 100 colleges and universities across China, including Tsinghua University, Peking University and Shanghai Jiaotong University participated in the contest.

RESEARCH & ACADEMIA

NEW FINDINGS ON CATALYTIC NANOROCKETS

Professor Li Longqiu from the School of Mechatronics Engineering invented a tubular nanomotor as a co-corresponding author with Professor Mei Yongfeng from Fudan University and Professor Joseph Wang from the University of California San Diego. The research findings were published in Advanced Functional Materials, and the paper was selected as the front cover of the journal.

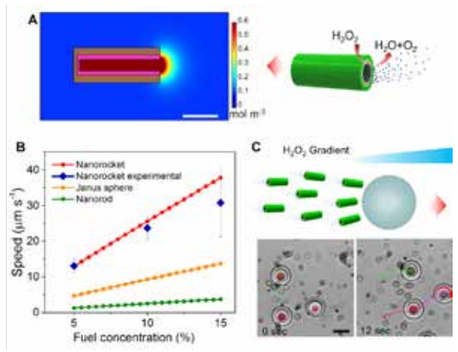
In this work, block copolymer lithography is combined with atomic layer deposition for wafer-scale fabrication of ultrasmall coaxial TiO_2/Pt nanotubes as catalytic nanorocket engines with a length below 150 nm and

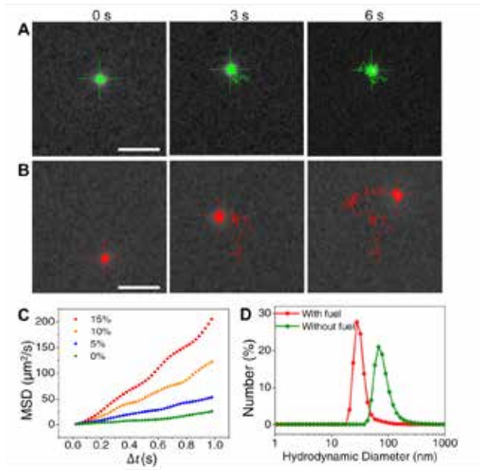


a tubular reactor size of only 20 nm. The nanorockets fabricated by the method not only have a high driving force, but also can be manufactured in huge quantities efficiently. The motion mechanism of the nanorocket is found to be similar to the principle of a rocket jet. The Pt inner layer with high catalytic activity catalyze the decomposition of hydrogen peroxide fuel to water and oxygen, producing a strong local oxygen gradient for efficient self-diffusiophoretic propulsion at the rear of the nanorocket. The movement of the nanorockets is examined using dark-field microscopy particle tracking and dynamic light scattering.

The high catalytic activity of the Pt inner layer and the reaction confined within the extremely small nanoreactor enable highly efficient propulsion, achieving speeds over 35 μm s^{-1} at a low Reynolds number of $<10^{-5}$. It was found that the nanorockets offer much more efficient hydrodynamic interactions than nanowire motors and Janus nanosphere motors of similar dimensions. It has good prospects to be used in biomedical fields such as drug targeting transport, blood clot removal and wound cleaning.

This paper was financially supported by the State Key Laboratory of Robotics and System.





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J Li, W Liu, J Wang, I Rozen, et al. Nanotubes: nanoconfined atomic layer deposition of TiO2/Pt nanotubes: toward ultrasmall highly efficient catalytic nanorockets. Advanced Functional Materials, 2017, 27 (24):1700598

BREAKTHROUGHS IN ARTIFICIAL CELLS

A team led by Professor Han Xiaojun from the State Key Laboratory of Urban Water Resource and Environment at the School of Chemistry and Chemical Engineering HIT, published a paper titled "A Fissionable Artificial Eukaryote-Like Cell Model" in the high ranking Journal of The American Chemical Society (2017 IF: 13.858). Professor Han is the only corresponding author and all authors are from Harbin Institute of Technology. They made significant progress in the field of artificial cells.

Artificial cells are important for studying the structure and function of cells, as well as for providing the clues for life origin. They are simplified cell models to effectively overcome complicated situations inside the cells, and are good to study the molecular mechanisms in/between cells. In this paper, Professor Han et. al. demonstrated the formation of an artificial eukaryote-like cell model using osmotic stress to induce the formation of vesicle in vesicle structure starting from a giant unilamellar vesicle (GUV). The genetic information molecules, DNA, were selectively loaded inside the inner vesicle to mimic

the nucleus. The amplification of DNA molecules was realized via polymerase chain reaction (PCR). The artificial eukaryote-like cell model is also able to undergo division into two daughter ‘cells’ induced by osmotic stress.

The novelty and importance of this study were fully recognized by the reviewers. In recent years, Professor Han has made a series of progress in the field of artificial cells and published a series of peer-reviewed papers. He was awarded the New Century Excellent Talents award in 2009. So far, he has published 109 peer-reviewed journal papers, and won over 20 grants, including 5 from the National Natural Science Foundation of China.

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

REFERENCE

W Zong, S Ma, X Zhang, X Wang, Q Li, X Han, A fissionable artificial eukaryote-like cell model. J. Am. Chem. Soc. 2017, 139, 9955−9960

BREAKTHROUGHS IN MULTIFUNCTIONAL "WATER DIODE" JANUS MEMBRANES FOR SMART APPLICATIONS

A simple and convenient strategy has been reported to realize excellent controllability in the fabrication of multifunctional Janus membranes (JMs) by Professor Shao Lu’s group, which was published in Materials Horizons. The strategy demonstrates its great potential for applications in water collection, lossless transportation, decontamination, and on-off control.

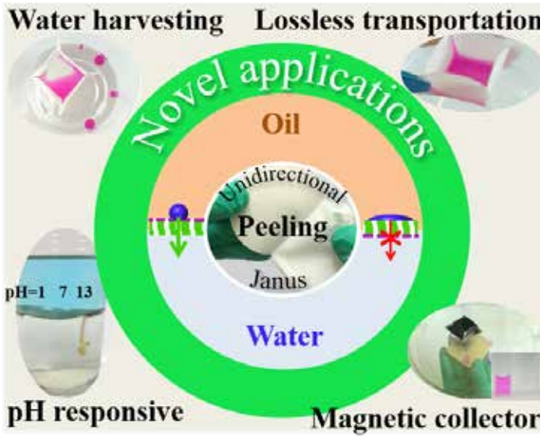
The “coating and peeling” strategy was proposed by the collaboration of Professor Shao’s group and Cheng Zhongjun et al. from Harbin Institute of Technology, utilizing the commercial polyethylene terephthalate (PET)/

polytetrafluoroethylene (PTFE) composite membranes as pristine membranes. Coating can render the pristine membrane with designed functionality, while peeling can render it asymmetric wettability, which will finally transform the membrane into multifunctional "Water Diode" JMs. Unlike previous techniques that are difficult to extend and often can only offer JMs with a single function, this strategy can provide a chance to summarize a constructive strategy for the design of multifunctional JMs.

As a demonstration for versatility, Professor Shao's group prepared two kinds of multifunctional "Water Diode" membranes: a magnetic JM prepared by this strategy that can be used for magnetic-driven collection, lossless transportation and decontamination of wastewater, and a pH-responsive JM that can realize responsive gating and the release of water droplets.

The novel strategy demonstrates the compatibility between the multifunctional coatings and the peeling-induced Janus wettability of the resultant membranes. The versatile platform will in turn accelerate the evolution of JMs from multifunctional materials to multifunctional devices with smart applications for the real world.

This work was financially supported by the National Natural Science Foundation of China, the State Key Laboratory of Urban Water Resource and Environment (HIT), and HIT Environment and Ecology Innovation Special Funds. ■



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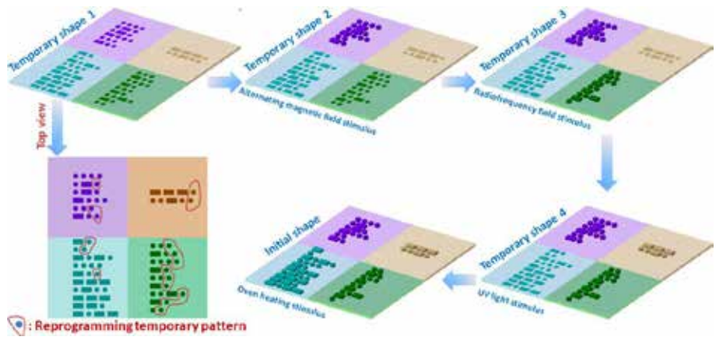
Zhenxing Wang, Xiaobin Yang, Zhongjun Cheng, Yuyan Liu, Lu Shao and Lei Jiang. Simply realizing "water diode" Janus membranes for multifunctional smart applications. Materials Horizons, 2017, 4, 701-708

PROGRAMMABLE AND SHAPE-MEMORIZING INFORMATION CARRIERS

Shape memory polymers (SMPs) are expected to play more and more important roles in space deployable structures, smart actuators, and other high-tech areas. Nevertheless, due to the difficulties in fabrication and the programmability of temporary shape recovery, SMPs have not yet been widely applied in real fields. It is ideal to incorporate the different independent functional building blocks into a material.

Recently, Professor Leng Jinsong's group designed a simple method to incorporate four functional building blocks: a neat shape memory epoxy-based resin (neat SMEP), a SMEP composited with Fe_3O_4 (SMEP-Fe_3O_4), a SMEP composited with MWCNTs (SMEP-CNT) and a SMEP composited with *p*-aminodiphenylimide (SMEP-*p*-AP) into a multicomposite in which the four region surfaces could be programmed with different language code (Morse code) patterns according to preset command by imprint lithography. Then we aimed



Programmable recovery of shape memory Morse code patterns and its potential application as an information carrier

to reprogram the initially raised code patterns into temporary flat patterns using programming moulds that, when triggered by preset stimulus processes such as alternating magnetic fields, radiofrequency fields, 365 nm UV and direct heating, could transform these language codes into the information passed by the customer.

The concept introduced here will be applied to other available SMPs, and provide a practical method to realize the information delivery. It was observed that the different driver commands could reveal different code information. When the display order was wrong, the information passed by the language codes was also wrong. Hence, our research will contribute to the field of smart information carriers.

The result has been published in the top international journal ACS Applied Materials & Interfaces.■

REFERENCE

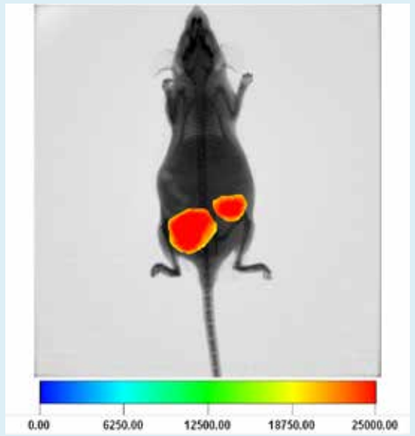
Wenbing Li, Yanju Liu and Jinsong Leng. Programmable and shape-memorizing information carriers. ACS Applied Materials & Interfaces, 2017, 9: 44792-44798

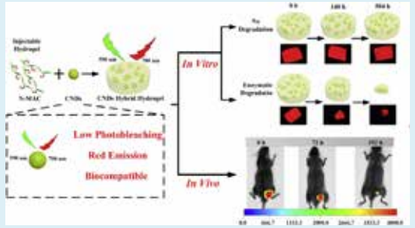
CARBON NANODOTS LIGHTING VISUAL *in vivo* DEGRADATION OF INJECTABLE HYDROGEL

A team led by Professor Li Baoqiang, a core member of Professor Zhou Yu's group from the School of Materials Science and Engineering published a paper titled "Visual *in vivo* Degradation of Injectable Hydrogel by Real-Time and Non-Invasive Tracking Using Carbon Nanodots as Fluorescent Indicator" in Biomaterials, the top journal in the biomaterials field. They proposed and demonstrated carbon nanodots first serving as nanoprobes for *in vivo* degradation of injectable hydrogel by real-time and non-invasive tracking.

Hydrogel plays an important role in tissue engineering and regenerative medicine. Visual *in vivo* degradation of hydrogel by fluorescence-related tracking and monitoring is crucial for

quantitatively depicting the degradation profile of hydrogel in a real-time and noninvasive manner. However, the current probes for fluorescent imaging still encounter limitations, such as intrinsic photobleaching of organic fluorophores and uncertain perturbation of degradation due to the change in the molecular structure of hydrogel. To address these problems, Professor Li employed CNDs with low photobleaching, red emission and good biocompatibility as fluorescent indicator for real-time and noninvasive visual *in vivo* degradation of injectable hydrogel. The embedded CNDs in hydrogels hardly diffuse outside in the absence of degradation. The mathematical equation to quantitatively depict in vitro degradation profile for the predication of *in vivo* degradation of hydrogel was established. They also developed a visual platform that could quantitatively depict *in vivo* degradation behavior of new injectable biomaterials by real-time and non-invasive fluorescence tracking. In addition, carbon-carbon double bonds boosted the record breaking ultrahigh-yield (85.9%) synthesis of carbon nanodots (CNDs) that have shown protective effects against H_2O_2-induced oxidative stress. This offered significant therapeutic approaches aiming at preventing and curing age-induced diseases such as neurodegeneration, diabetes and cancer.





This fluorescence-related visual imaging methodology holds great potential for rational design and convenient *in vivo* screening of biocompatible and biodegradable injectable hydrogels in tissue engineering and cosmetic surgery.

The paper was highlighted by Science and Technology Daily, Health News and it was financially supported by the National Natural Science Foundation of China.

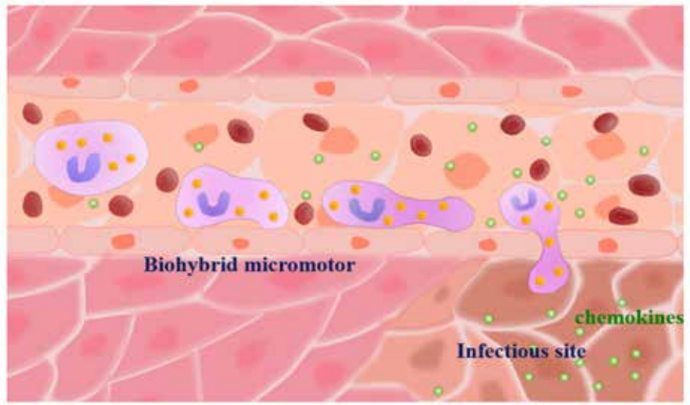
REFERENCE

Wang L, Li B, Xu F, Li Y, Xu Z, Wei D, et al. Visual in vivo degradation of injectable hydrogel by real-time and non-invasive tracking using carbon nanodots as fluorescent indicator. Biomaterials, 2017, 145:192-206

BREAKTHROUGHS IN BIOHYBRID MICROMOTORS TOWARDS CHEMOTAXIS-GUIDED DRUG TRANSPORT

Professor He Qiang from the Academy of Fundamental and Interdisciplinary Science, Micro/Nano Technology Research Center, recently published a paper titled “Chemotaxis-Guided Hybrid Neutrophil Micromotors for Targeted Drug Transport” in the internationally renowned journal Angewandte Chemie International Edition. In the past several years, Professor He’s group has performed systematical studies in the field of micro-/nanomotors (MNMs), and has made important progress in the study of biohybrid micromotors. Through combining natural living neutrophils with synthetic mesoporous silica nanoparticles with high drug-loading capacity, the group, for the first time, constructed a chemotaxis-guided, self-propelled biohybrid micromotor. This progress will promote the applications of MNMs in targeted drug delivery by integrating chemotaxis-guided homing-in ability.

As described by many science fiction and many movies, it has been a long-term dream of human beings to build micro-/nanomachines capable of swimming autonomously in blood and accomplishing complex tasks such as targeted drug delivery. Although scientists have developed a series of artificial MNMs based on *in-situ* chemical reactions or external physical fields in recent years, it is still difficult for artificial MNMs to swim to the lesion sites as efficiently and autonomously as natural biological swimmers and to achieve the controlled release of drugs. In order to address these problems, one solution is to learn from nature. In this study, Professor He’s group proposed a strategy for the fabrication of high-performance MNMs in a



biohybrid manner by directly employing natural self-propelled swimmers, that is, neutrophils with intrinsic chemotaxis capability. Neutrophils, as an important component of the human immune system, have excellent chemotaxis and phagocytosis. They can autonomously migrate along chemoattractant gradients toward inflammatory or infected sites and eliminate the pathogens (e.g., bacteria, viruses) by phagocytosis.

However, it still remains a huge challenge to integrate necessary artificial components without loss of the biological activity and chemotaxis of natural components in the construction of biohybrid micromotors. Through further learning from nature, Professor He's team has solved the problem skillfully by camouflaging synthetic nanoparticles with natural E. coli membranes. The study indicates that the biointerfacial modification of mesoporous silica nanoparticles by E. coli membranes significantly increases the uptake of the nanoparticles into neutrophils and effectively encapsulates the drug molecules in the nanoparticles without undesired leaking. The resulting biohybrid micromotors inherit the characteristic chemotaxis capability of neutrophils and could effectively move along the chemoattractant gradients secreted by E. coli. The camouflaging strategy provides a new way for the design and construction of nanoparticle-loaded biohybrid micromotors for advanced biomedical applications, such as actively seeking disease sites and targeted drug transport.

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

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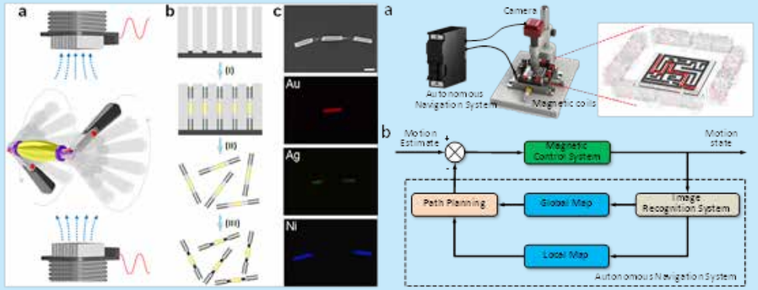
MAGNETIC PROPELLED AND NAVIGATION OF MICRO/NANOROBOT

Dr. Li Tianlong et al. published a paper titled “Highly Efficient Freestyle Magnetic Nanoswimmer” in Nano Letters and a paper titled “Autonomous Collision-Free Navigation of Microvehicles in Complex and Dynamically Changing Environments” in ACS Nano. These papers were completed in collaboration with Professor Joseph Wang from the University of California at San Diego.

The unique swimming strategies of natural microorganisms have inspired the recent development of magnetic micro/nanorobots powered by artificial helical or flexible flagella. However, as artificial nanoswimmers with unique geometries are being developed, it is critical to explore new potential modes for kinetic optimization. For instance, the freestyle stroke is the most efficient competitive swimming strokes for humans. Here we report a new type of



Design, fabrication, and navigation of microrobot

magnetic nanorobot, a symmetric multilinked two-arm nanoswimmer, capable of efficient "freestyle" swimming at low Reynolds numbers. These two-arm nanorobots are capable of powerful propulsion up to 12 body lengths per second, along with on-demand speed regulation and remote navigation. This new swimming mechanism and its attractive performance opens new possibilities in designing remotely actuated nanorobots for biomedical operation at the nanoscale.

Self-propelled micro- and nanoscale robots represent a rapidly emerging and fascinating robotics research area. However, designing autonomous and adaptive control systems for operating micro/nanorobotics in complex and dynamically changing environments, which is a highly demanding feature, is still an unmet challenge. Here we describe a smart microvehicle for precise autonomous navigation in complicated environments and traffic scenarios. Real-time object detection offers adaptive path planning in response to dynamically changing environments. We demonstrate that the autonomous navigation system can guide the vehicle movement in complex patterns, in the presence of dynamically changing obstacles, and in complex biological environments. Such a navigation system for micro/nanoscale vehicles, relying on vision-based close-loop control and path planning, is highly promising for their autonomous operation in complex dynamic settings and unpredictable scenarios expected in a variety of realistic nanoscale scenarios.

These two papers were financially supported by the National Natural Science Foundation of China, and the State Key Laboratory of Robotics and System.

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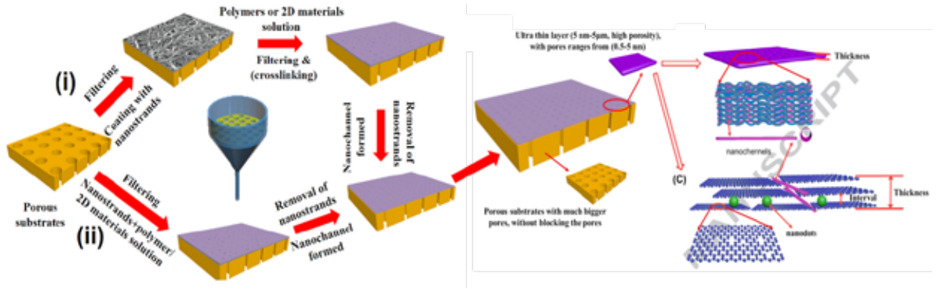
THE CRITICAL REVIEW ON ULTRAFAST MOLECULAR-SEPARATION (UMS) MEMBRANES

The team led by Professor Shao Lu from the Department of Chemistry and Chemical Engineering recently published an important review paper titled "Towards Sustainable Ultrafast Molecular-Separation Membranes: From Conventional Polymers to Emerging Materials" in Progress in Materials Science to summarize the recent progress and challenges in the development of Ultrafast Molecular-Separation (UMS) Membranes.

Separation processes are fundamental in the biopharmaceutical, food, agricultural, chemical and petrochemical industries. Compared with traditional energy-intensive separation technologies such as distillation, pressure- and temperature-swing adsorption, membrane separation is more attractive due to its low carbon footprint, small spatial requirements and non-phase transition in most cases. Ultrafast molecular separation (UMS) membranes are highly selective towards active organic molecules such as antibiotics, amino acids and proteins that are 0.5-5 nm wide while requiring a low energy input to achieve high speed separation. These advantages are crucial to deploying UMS membranes



in a plethora of industries, including petrochemical, food, pharmaceutical, and water treatment industries, especially for dilute system separations. Most recently, advanced nanotechnology and cutting-edge nanomaterials have been combined with membrane separation technologies to generate tremendous potential for accelerating the development of UMS membranes. It is therefore critical to update the broader scientific community on the important advances in this exciting interdisciplinary field.

This review emphasizes the unique separation capabilities of UMS membranes, theories underpinning UMS membranes, traditional polymeric materials and nanomaterials emerging on the horizon for advanced UMS membrane fabrication and technical applications to address the existing knowledge gap. This work includes detailed discussions regarding existing challenges, as well as perspectives on this promising field.

This work was financially supported by the National Natural Science Foundation of China, the State Key Laboratory of Urban Water Resource and Environment (HIT), and HIT Environment and Ecology Innovation Special Funds.

REFERENCE

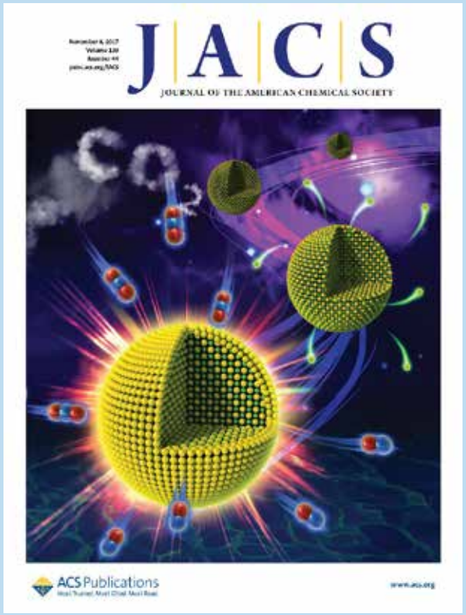
Cheng X Q, Wang Z X, Jiang X, et al. Towards sustainable ultrafast molecular-separation membranes: from conventional polymers to emerging materials. Progress in Materials Science, 2017, 92: 258-283

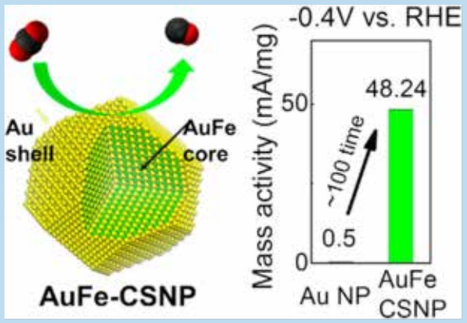
BBREAKTHROUGHS IN HIGH-EFFICIENCY CO_2 REDUCTION ENABLED BY NOVEL GOLD-IRON CORE-SHELL NANOPARTICLES

A team led by Associate Professor Wang Zhijiang from the School of Chemistry and Chemical Engineering, in collaboration with the theoretical computational chemist Professor William A. Goddard from California Institute of Technology, has made important progress in the field of CO_2 utilization. The research paper titled “Ultrahigh Mass Activity for Carbon Dioxide Reduction Enabled by Gold–Iron Core–Shell Nanoparticles” was published in Journal of the American Chemical Society (2017 IF: 13.858). Considering the important guiding role of this research for the design of high performance catalysts for CO_2 conversion to fuels and the potential for the promotion of the CO_2 conversion industry, this paper was chosen to be the cover paper. The editor commented on the paper through Spotlight.

The reduction of CO_2 to carbon-based energy materials such as carbon monoxide and methane can decrease the atmospheric CO_2 concentration and store renewable energy. Electrocatalytic reduction of CO_2 is thought to be one of the most promising conversion technologies for CO_2 utilization considering green power sources from solar or wind. Au based catalysts can reduce CO_2 to CO with high selectivity. However, the high cost of Au remains the primary limiting factor preventing its widespread application in CO_2 reduction. Alloying is an attractive way to improve the catalytic performance and to reduce the amount of precious metals at the same time.

Wang Zhijiang and his co-authors used in silico quantum mechanics rapid screening to identify the Au–Fe alloy from 20 metals as a candidate for improving CO_2 reduction and then synthesized and tested it experimentally. The synthesized Au–Fe alloy catalyst evolves quickly into a stable Au–Fe core–shell nanoparticle after leaching out surface Fe. This Au–Fe core–shell nanoparticle exhibits exclusive CO selectivity. At -0.40 V





(RHE), the nanoparticles can reduce CO_2 exclusively to CO, with hydrogen evolution reaction almost entirely suppressed. The current density and Faradaic efficiency for CO_2 conversion into CO remain almost constantly in the 90 hours duration test, indicating its superior stability toward CO_2 reduction. Theoretical calculations suggest that this excellent performance toward CO_2 reduction reaction arises from subsurface Fe combined with surface defects due to surface Fe leaching. This research provides an entirely new means to guide the fabrication of new catalysts and promotes the industrialization of CO_2 reduction.

The paper was jointly supported by the National Natural Science Foundation of China and the Natural Science Foundation of Heilongjiang Province.

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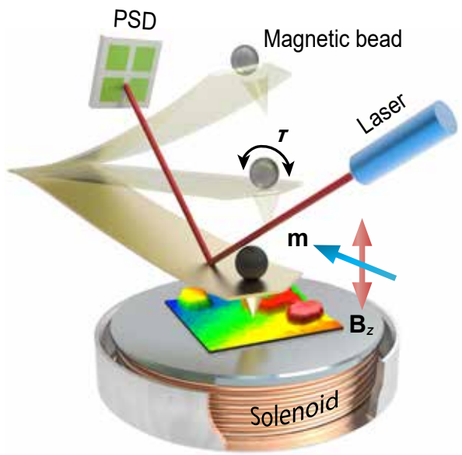
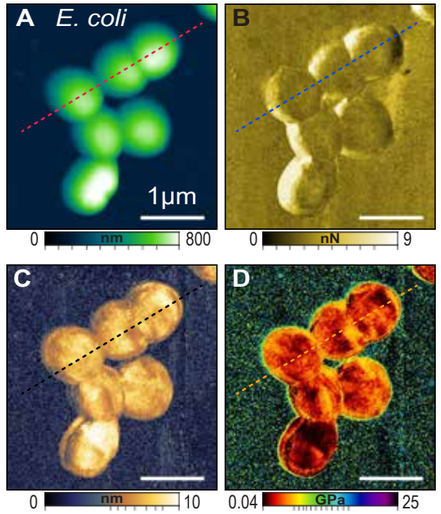
K. Sun, T. Cheng, L. Wu, Y. Hu, J. Zhou, A. Maclennan, Z. Jiang, Y. Gao, W. A. Goddard and Z. Wang. Ultrahigh mass activity for carbon dioxide reduction enabled by gold-iron core-shell nanoparticles. Journal of the American Chemical Society, 2017, 139: 15608

BREAKTHROUGHS IN BOARD MODULUS RANGE NANOMECHANICAL MAPPING

Professor Xie Hui's group from the State Key Laboratory of Robotics and System, the School of Mechatronics Engineering made important progress in mapping materials with large elastic moduli variation at the nanoscale. The corresponding paper titled "Broad Modulus Range Nanomechanical Mapping by Magnetic-Drive Soft Probes" was published in Nature Communications.

Nanomechanical Mapping (NM) by atomic force microscopy (AFM) provides irreplaceable information in understanding the local properties of materials and intermaterial interactions with nanoscale spatial and pico-Newton force resolution. NM relies on understanding, utilizing and controlling the cantilever properties to achieve quantitative





results. Due to the limitations in calculating/calibrating the non-linear cantilever dynamics and its integration with the hard- and soft-ware of the instrument, current systems in the market can only provide discrete NM solutions. That is, each cantilever can work within a narrow range of elastic moduli, creating a demand for cantilever change and calibration for samples with moduli range larger than that of the cantilever. Requiring change and recalibration of the cantilever(s) is time and money consuming. Perhaps more importantly, it restricts the NM of heterogeneous surfaces.

In this work, they developed a magnetic drive peak force modulation AFM to break the limit of the nanomechanical measurement range of probes with direct cantilever excitation. Rather than the whole probe module, only the cantilever beam is sinusoidally oscillated by the magnetic torque to tap the sample surface at selected off-resonance frequencies. This approach not only successfully drives the softest commercial probe (6 pN nm-1) for mapping extremely soft samples in liquid but also provides an indentation force of hundreds of nanonewtons for stiff samples with a soft probe. Features of direct measurements of the indentation force and depth can unify the elastic modulus range up to four orders of magnitude, from 1 kPa to 10 MPa (in liquid) and 1 MPa to 20 GPa (in air or liquid) using a single probe. This approach can be particularly useful for analyzing heterogeneous samples with large elastic modulus variations in multi-environments. In addition, the direct actuation fashion has the potential to drive the probe with a rate up to tens of kilohertz, which provides the possibility of measuring fast time-varying nanomechanical forces.

This work was supported by the National Natural Science Foundation of China and the National Key Research and Development Programme of China.

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NEWS & EVENTS

HIT CAMPUS ICE AND SNOW FESTIVAL

On December 20th, 2017, with the theme of "Enjoy the Beauty of Ice and Snow", the first HIT Campus Ice and Snow Festival was held at the plaza of the Dianji Building. At the opening ceremony, HIT Party Secretary Wang Shuquan kicked off the festival. HIT Deputy Party Secretary Xiong Sihao, HIT Vice President Ding Xuemei, HIT Deputy Party Secretary and Vice President Zhang Hongtao, HIT Vice President Guo Bin, Director of HIT Publicity Department Wu Songquan, and Assistant Principal Peng Huaiyuan and Liu Hong attended the ceremony.

Xi Jinping, General Secretary of the Central Committee of the Communist Party of China, hoped to motivate 300 million people take part in winter sports in order to promote the revitalization and development of Heilongjiang Province and its tourism. From this year, HIT will hold a campus ice and snow festival annually, which includes the International Ice Sculpture Contest, Ice and Snow Building Contest, Ice & Snow Forum, Ice & Snow Games, Ice & Snow Photography Competition, Ice & Snow Carnival, and Food Show. The festival provided the opportunity for teachers and students to feel the charm of ice and snow, enjoy the delight of winter sports, and spontaneously participate in the cultural brand construction of a world-class university. The entire world will be able to see HIT and its beauty.

Twelve universities and colleges participated in the first International Ice Sculpture Contest which also attracted many international students from countries along the Belt and Road. Evaluated by experts, "Sitting by the Dormer Window Watching Clouds" won the first prize. "Jumping in Winter" and "Flying - Dream of Ice" won the second prizes. "Harvest," "Rhythm of Harbin" and "Sea World outside the Ice Window" won the third prizes.

The first Ice & Snow Building Festival attracted many universities such as HIT and Tsinghua University, as well as colleges and universities from the USA, Belgium and the Netherlands. "Tiny World" from Tianjin University won the first prize. "Listening for..." from HIT and Kent State University and "Weathering" from South China University of Technology won the second prizes. "ON-rosironi" from HIT, "Searching a City through Mountains" from Chongqing University and "Gap" from Xi'an University of Architecture and Technology won the third prizes.■

HIT PRESIDENT ZHOU YU ATTENDED THE 6TH APEC CONFERENCE ON COOPERATION IN HIGHER EDUCATION IN VLADIVOSTOK

On September 5th and 6th, the 6th APEC Conference on Cooperation in Higher Education of the Eastern Economic Forum was held at Far Eastern Federal University in Vladivostok, Russia. HIT President Zhou Yu joined university presidents from Japan, South Korea, Russia, China and more than a dozen other countries and delivered a speech titled “The History, Present Situation and Future Prospect of Sino-Russian Cooperation in Higher Education-Taking HIT as An Example”.

In his speech, taking HIT as an example, after reviewing the history and summarizing the present situation of Sino-Russian cooperation in higher education, President Zhou pointed out the existing problems and challenges and gave reasonable suggestions for the cooperation issues.

During the conference, HIT President Zhou met with President of Far Eastern Federal University Nikita Anisimov and Rector of North-Eastern Federal University Evgenia Mikhailova successively. They exchanged ideas and reached consensus on the issues that how to enhance relationship between universities in personnel training and scientific cooperation as well as to promote the cooperation level to realize a double win.

Representatives from international organizations, government officials, presidents of universities, experts on higher education and scholars of relative institutions, from 13 countries and regions in the Asia-Pacific region, got together to discuss the latest trend of the globalization of education and to explore the key roles universities play in the decision-making processes on global issues.

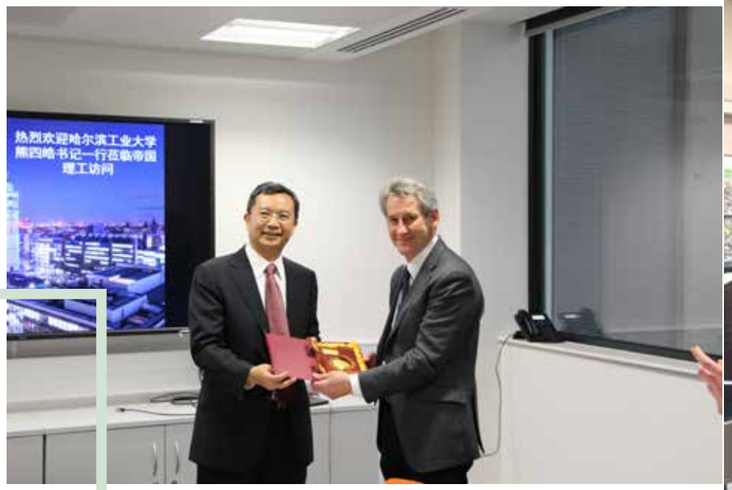
Since 2012, the APEC Conference on Cooperation in Higher Education has been held in Vladivostok six times. In this year, the conference continued the private-public dialogue on education collaboration, providing the platform of discussion to the senior officials, academics, providers, customers of the education process. It also responded to APEC priorities, which encourage member economies to continue the promotion of cross-border education and improve people-to-people connectivity to support globally relevant education systems.

HIT PRESIDENT ZHOU YU ATTENDED PRESIDENT FORUM IN HONG KONG

From 6th to 8th December, 2017, the President Forum was held by Hong Kong Polytechnic University with the theme of "The Impact of Universities on the Future". From the perspective of the core functions of universities, 42 university presidents from 21 countries conducted discussion on the future influence of universities on the world, the nation and the society.

HIT President Zhou Yu attended the forum and delivered a speech. In the speech, he looked back HIT's positive impact on the development of China, Heilongjiang Province and Harbin during the almost one hundred years since it was founded, and he presented three modes of mutual development of the university, region and nation. The meeting also discussed the future development of the university and the interaction with the society.

During the visit, Mr. Zhou attended the 80th anniversary celebration of the Hong Kong Polytechnic University. He also met with alumni of HIT. After introducing the latest developments of HIT, he hoped that they could keep paying attention to the development of HIT and try their best to expand its influence in Hong Kong.



HIT DEPUTY PARTY SECRETARY XIONG SIHAO VISITED BRITISH UNIVERSITIES

On 6th and 7th December, 2017, HIT Deputy Party Secretary Xiong Sihao visited the Imperial College London and the University of Warwick in the UK.

The Associate Provost for Academic Planning of Imperial College London and Fellow of the Royal Academy of Engineering Neil Alford met with the HIT delegation. After briefly introducing Imperial and its collaboration with China, he showed the willingness of cooperating with HIT in many ways. Deputy Secretary Xiong Sihao shared ideas of student exchange, PhD joint training and scientific cooperation and he hoped to reach future cooperation through this meeting. During the visit, the delegation also conducted talks with

HIT alumni, including Professor Cheng Kai and Professor Xu Yuchun, the Honorary Chairman of the HIT Alumni Association in the UK.

At the University of Warwick, Pro-Vice-Chancellor Simon Swain met with Deputy Secretary Xiong. After summarizing the cooperation between the two universities since the relationship was established in 2014, they had an in-depth discussion on the development of student exchange, academic visits and the details of the summer school and the undergraduate joint training programs.

HIT VICE PRESIDENT REN NANQI VISITED UNIVERSITIES IN THE U.S.

From November 30 to December 2, HIT Vice President Ren Nanqi led an HIT delegation to visit the University of California, Berkeley and the University of California, Los Angeles. He also attended the founding ceremony of the HIT Alumni Association of Southern California.

During the visit, the delegation met with people in charge of both universities and discussed the issues of scientific research, personnel training and alumni administration.

On December 2, the delegation attended the founding ceremony of the HIT Alumni Association of Southern California in San Gabriel. Consular Officer of Education Cao Qian from the Consulate General of PRC in Los Angeles and the Alderman of West Covina Wu Tonghuai attended the activity. On behalf of HIT and the HIT Alumni Association, Ren Nanqi expressed gratitude to the alumni for their great efforts on the founding of the association and hoped that HIT alumni would expand the influence of HIT in Southern California, provide more services to the local alumni and promote communication and cooperation on both sides. ■

HIT VICE RESIDENT DING XUEMEI ATTENDED CAUSTL 2017

On November 27, with the theme of “Transformation of the Higher Education”, the China-Australia University Summit on Teaching and Learning 2017 (CAUSTL 2017) was held at the University of Queensland, Australia. HIT Vice President Ding Xuemei attended the summit and delivered a speech at the opening ceremony.

During the summit, leaders from university alliances such as China’s C9 and Australia’s Go8 discussed and exchanged ideas on the transformation of higher education, the development of MOOCs and how to cope with the rapid pace of technological change.

Ding Xuemei pointed out in her speech that science and technology, society, economy and culture are developing rapidly in the world. Higher education urgently needs to reposition, take opportunities and explore new ways to cultivate talent to meet the new needs of the society. The China-Australia summit provided a platform for universities in China and Australia to share new ideas of university administration. She met with the Deputy Vice-Chancellor of the University of Western Australia, David Sadler, and the Deputy Vice-Chancellor of the University of Melbourne Richard James, successively and further discussed teaching-related cooperation.

At the background of the globalization of higher education, the China-Australian University Summit on Teaching and Learning is jointly sponsored by HIT and the University of Adelaide to expand and promote the cooperation between universities in both countries in the fields of teaching and student development. ■

WORLD HAND IN HAND GALA 2017

On the evening of December 22nd, the “New Chapter of One Belt and Road” World Hand in Hand Gala was held in the auditorium of the HIT Main Building. Secretary General of the China Scholarship Council (CSC) Sheng Jianxue, Consul General of the Russian Federation Consulate General in Shenyang Sergey Paltov, Chief of the Division for International Cooperation and Exchange of the Heilongjiang Provincial Education Department Zhang Dazhu, HIT Vice President Ren Nanqi and Director of the HIT Publicity Department Wu Songquan attended the gala.

The gala was divided into 3 parts, which included “One Belt One Road - Different Languages but the Same Happiness,” “HIT Sentiment - Building and Seeking Dreams” and “Sensing China - Hand in Hand and Stepping Forward”. The opening show was a dance named “Inspiring China,” performed by Chinese and foreign students. Other wonderful performances included the song and dance performance “One Belt and Road, One World One Family”, the song and dance drama “African Love Story”, the Chinese allegro “Studying at HIT,” “In the Field of Hope,” etc. The last song “World Hand in Hand” performed by both Chinese and overseas students was very moving and unforgettable.

Since 2010, the World Hand in Hand Gala is held annually to provide an opportunity for international students to experience Chinese culture and show their personalities. It also promotes the friendship between China and the world. The gala has become an important platform for the display and exchange of Chinese and foreign cultures.

As a part of the cross-cultural communication, member universities of the Association of Sino-Russian Technical Universities (ASRTU), such as the Ural Federal University, the Far Eastern Federal University and Amur State University were invited to participate. Guests from the ASEAN High School Principals Forum, the Harbin Dialogue and the C9 Universities Studying in China Seminar attended the gala. More than 1,500 teachers and students enjoyed this wonderful evening together. ■

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