陕西师範大学
SHAANXI NORMAL UNIVERSITY

化学化工学院
School of Chemistry & Chemical Engineering

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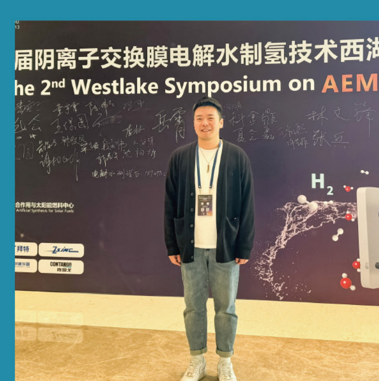
简报
Newsletter

新概念传感器与分子材料研究院
INSTITUTE OF NEW CONCEPT SENSORS AND MOLECULAR MATERIALS



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房喻院士为“长安大讲堂”第二期作报告

Fang Yu gives a report at the second session of Chang’an Lectures

2025 年 4 月 2 日下午，“长安大讲堂”第二期在陕西师范大学长安校区新勇学生活动中心学生剧场举办，房喻院士作题为“创新驱动背景下的人才培养与科学研究：我的一些思考”的报告。

房喻院士从创新引领高质量发展的高度，介绍了国内外教育领域和科技领域的前沿发展动态，分享了多年来自己带领科研团队在 CBRN 传感器和分子材料领域的探索实践。他通过详实的数据和具体的案例，阐明当前经济社会发展对科学研究和人才培养提出的新要求新挑战，指出加强基础研究和基础学科人才培养对于应对国际科技竞争、实现高水平科技自立自强、推动构建新发展格局、实现高质量发展都具有至关重要的现实意义。

房喻谈到，作为引领新一轮科技革命和产业变革的战略性技术，人工智能通过颠覆性创新实现新技术新产品新场景的大规模应用示范。教育工作要更加强调对学生综合素养和创新能力的培育，努力培养热爱科学、志存高远、敢为人先、心系家国的卓越创新人才。他表示，科学研究要以国家重大需求为牵引，以综合性新型科研平台建设为依托，开展“功在千秋、利在后代”的基础性研究，持续产出高水平科研成果，为加快建设创新型国家作出贡献。房喻勉励青年学子要传承和发扬科学家精神，将个人理想追求融入党和国家事业之中，坚持真理、勇于创新，在科研之路上不断探索前行，努力成长为堪当民族复兴重任的时代新人。

报告会由董治宝副校长主持，校党委常委、党委宣传部部长马晓云、化学化工学院党委书记高玲香教授、院长薛东教授等出席了报告会。

化学化工学院、材料科学与工程学院、物理学与信息技术学院、食品工程与营养科学学院、生命科学学院和计算机科学学院的师生及研究生院、教务处、科技处等部门的行政人员约 400 人参加了报告会。

On April 2, 2025, Prof. Fang Yu gave a report titled “My Thoughts on Innovation-driven Talent Cultivation and Scientific Research” at the second session of “Chang’an Lectures” held in the Student Theater of Xinyong Student Activities Center, Chang’an Campus, Shaanxi Normal University.

From the height of innovation-led high-quality development, Fang Yu introduced the cutting-edge development in the field of education and science and technology at home and abroad, and shared his group’s exploration and practice in the field of CBRN sensors and molecular materials over the years. Through detailed data and specific cases, he expounded the new requirements and challenges put forward by the current

economic and social development on scientific research and talent cultivation, and argued that strengthening basic research and talent cultivation of basic disciplines is of vital significance for coping with the international competition in science and technology, realizing the self-reliance and self-reliance of high-level science and technology, promoting the construction of a new pattern of development, and realizing high-quality development.

Fang Yu also told the audience that as a strategic technology leading a new round of scientific and technological revolution and industrial change, AI realizes large-scale application demonstration of new technologies and new products and new scenarios through disruptive innovations. He said that education should emphasize more on the cultivation of students' comprehensive literacy and innovation ability, and strive to cultivate outstanding innovative talents who love science, have high aspirations, dare to be the first, and have a patriotic heart for their country. He said that scientific research should be guided by the major national needs, based on the construction of comprehensive new research platforms, and carry out basic research that will be of great merit and benefit to future generations, so as to produce high-level research results and contribute to the acceleration of the construction of an innovative country. Fang Yu encouraged the young students to inherit and carry forward the spirit of scientists, integrate their personal ideals and pursuits into the cause of the Party and the country, adhere to the truth, be innovative, continue to explore the road of research, and strive to grow up to become a new person of the times who is capable of taking on the heavy responsibility of national rejuvenation.

The report was presided over by SNNU vice president Dong Zhibao, and attended by Ms Ma Xiaoyun, member of the Standing Committee of SNNU Party Committee and director of the Publicity Department of the Party Committee, and Prof.

Gao Lingxiang, secretary of the Party Committee of School of Chemistry and Chemical Engineering, and SCCE Dean Prof. Xue Dong, and other university officials.

About 400 students and teachers from the School of Chemistry and Chemical Engineering, the School of Materials Science and Engineering, the School of Physics and Information Technology, the School of Food Engineering and Nutrition Science, the School of Life Science and the School of Computer Science, the school of Graduate School, the Office of Academic Affairs, the Department of Science and Technology and other departments attended the event.

房喻院士出席西安交通大学仪器科学与技术学院座谈会

Fang Yu attends symposium of XJTU School of Instrument Science and Technology

2025 年 4 月 3 日，房喻院士出席西安交通大学仪器科学与技术学院座谈会。

西安交通大学校长、中国工程院院士张立群带队调研仪器学院，中国工程院院士蒋庄德、欧阳晓平出席会议。仪器学院党政班子成员、教师代表等参加会议，仪器学院党委书记韦学勇主持会议。

房喻院士表示，期待与西安交大仪器学院开展深度合作，共同培养高水平创新人才，联合攻关重大科研项目，力争产出具有国际影响力的标志性成果，为服务国家重大战略需求和高水平科技自立自强作出贡献。

On April 3, 2025, Prof. Fang Yu attended a symposium organized by the School of Instrument Science and Technology at Xi’an Jiaotong University.

Zhang Liqun, president of Xi’an Jiaotong University and academician of Chinese Academy of Engineering, led a team to survey the School of Instrument Science and Technology, and Jiang Zhande and Ouyang Xiaoping, academicians of Chinese Academy of Engineering, attended the meeting. SIST party and administrative officials, faculty representatives attended the meeting, and SIST Party Committee secretary Wei Xueyong presided over the meeting.

Fang Yu said that he looks forward to deep cooperation with SIST, to jointly cultivate high-level innovative talents, to jointly tackle major research projects, and to strive to produce landmark results with international influence, so as to contribute to the service of the country’s major strategic needs and the high level of scientific and technological self-reliance and self-improvement.

刘小燕副教授被推荐为 2025 年度 RSC Applied Polymers 期刊新锐科学家

Liu Xiaoyan selected 2025 Emerging Scientist of RSC Applied Polymers

近日，新概念传感器与分子材料研究院刘小燕副教授被推荐为 2025 年度英国皇家化学学会 RSC Applied Polymers 期刊“新锐科学家”。

同时，刘小燕副教授获邀在 RSC Applied Polymers 期刊“新锐科学家”专刊上发表其最新工作，该专刊收录聚合物应用科学领域的青年科学家在其独立开展研究工作早期发表的创新研究成果。

Recently, Assoc. Prof. Liu Xiaoyan of the Institute of New Concept Sensors and Molecular Materials was selected as a 2025 Emerging Investigator of the Journal of RSC Applied Polymers of the Royal Society of Chemistry.

Meanwhile, Liu Xiaoyan was invited to present her latest work in the Emerging Investigator issue of the RSC Applied Polymers, which includes innovative research results published by young scientists in applied polymers in the early years of their independent research.

研究院《传感器与检测技术》课程打造“产教融合 +AI 赋能”新范式

INCSMM course “Sensor and Detection Technology” builds new paradigm of “Industry-education Integration + AI empowerment”

新概念传感器与分子材料研究院教师为主要成员讲授的《传感器与检测技术》课程探索“理论教学—实践训练—创新应用”一体化教学体系，构建“AI+ 产业”双轮驱动的教学新模式，在本科教学改革与课程建设中取得了阶段性成效。

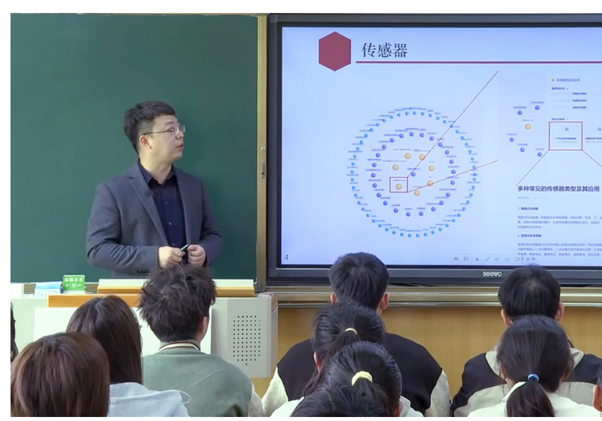
《传感器与检测技术》课程授课团队包括丁立平教授、彭浩南教授、刘太宏副教授、专职科研人员文瑞娟及物理学与信息技术学院辛云宏教授和化学化工学院刘成辉教授。

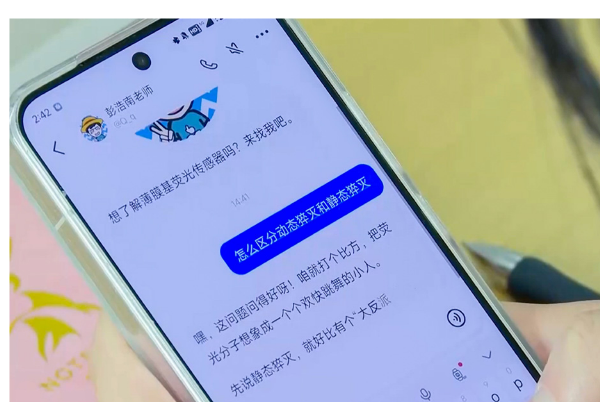
该课程聚焦现代传感与检测系统的发展前沿，系统讲授传感器原理、信号调理、误差分析等基础内容，结合研究院最新科研成果和行业发展动态，动态引入薄膜荧光传感器、MEMS 传感器、智能传感器等新技术内容，帮助学生建立对“感知—传输—处理”完整技术链条的系统理解，着力提升学生的工程实践能力和综合素养。

教学中，授课教师依托研究团队优势，引入人工智能辅助教学工具，通过 AI 助教开展个性化答疑与学习建议，结合知识图谱构建课程导航系统，显著提升了学生的学习效率与课程参与度。

课程建设过程中，研究院还积极推动产教融合，邀请两家传感器相关高科技企业参与课程设计与实施，选派企业高管和工程师进入课堂授课，并将产品展示与测试平台引入校园，构建“课堂教学 + 企业实践”双线融合的沉浸式教学场景，为学生提供贴近实际、面向产业的学习体验。

作为研究院服务人才培养、推动课程改革的重要实践，该课程不仅丰富了传感器方向的教学内容，也为建设一流课程和培养复合型创新人才提供了有力支撑。





The course “Sensor and Detection Technology” taught by teachers of the Institute of New Concept Sensors and Molecular Materials explores the integrated teaching system of “Theoretical teaching-Practical training-Innovative application” and builds a new dual-wheel driving teaching mode of “AI+Industry”, making new progress in undergraduate teaching reform and curriculum construction.

The teaching team of the course includes Prof. Ding Liping, Prof. Peng Haonan, A/Prof. Liu Taihong, research assistant Ms Wen Ruijuan, Prof. Xin Yunhong from the School of Physics and Information Technology and Prof. Liu Chenghui from the School of Chemistry and Chemical Engineering.

The course, focusing on the development of modern sensing and detection systems, systematically teaches the principles of sensors, signal conditioning, error analysis and other basic content, combined with the Institute’s latest research results and industry developments, introducing film-based fluorescent sensors, MEMS sensors, smart sensors and other new technologies, to help students establish a systematic understanding of the complete technological chain of “Sensing-Transmission-Processing”, and endeavors to improve students’ engineering practical ability and comprehensive literacy.

In course teaching, the teachers rely on the advantages of the INCSMM research team, introduces artificial intelligence-assisted teaching tools, carries out personalized Q&A and learning suggestions through AI teaching assistant, and builds a course navigation system by combining with knowledge mapping, which significantly improves students’ learning efficiency and course participation.

In the process of course construction, the Institute also actively promote the integration of industry and education, inviting two sensor-related high-tech enterprises to participate in the design and implementation of the course, which selected and dispatched corporate executives and engineers into the classroom teaching, and introduced the product display and testing platform to the campus, so as to build the “Classroom teaching + Enterprise practice” fusion of immersive teaching scenarios to provide students with a learning experience that is close to reality and oriented to the industry.

As an important practice of the Institute to serve talent cultivation and promote curriculum reform, this course not only enriches the teaching content of the sensor direction, but also provides a strong support for the construction of first-class courses and the cultivation of composite innovative talents.

薄鑫参加第二届阴离子交换膜电解水制氢技术西湖研讨会

Bo Xin attends 2nd Westlake Symposium on AEM-WE

2025 年 4 月 11 至 13 日，新概念传感器与分子材料研究院薄鑫副研究员参加了在杭州举行的第二届阴离子交换膜电解水制氢技术西湖研讨会。

本次会议由西湖大学、白马湖实验室、浙江省浙江省海外高层次人才联谊会能源资源与环境分会、人工光合作用与太阳能燃料中心主办，召集人为中国科学院院士、西湖大学化学讲席教授、人工光合作用与太阳能燃料中心主任孙立成。会议邀请了阴离子交换膜电解水制氢领域的国内知名专家学者、企业专家作报告分享，结合圆桌会谈、海报交流等形式展开沟通交流。

From April 11 to 13, 2025, Assoc. Prof. Bo Xin of the Institute of New Concept Sensors and Molecular Materials, participated in the Second Westlake Symposium on Anion Exchange Membrane Water Electrolysis (AEM-WE) held in Hangzhou.

The conference was organized by Westlake University, Baima Lake Laboratory, Energy Resources and Environment Branch of Zhejiang Association of Scholars from Overseas, Artificial Photosynthesis and Solar Fuel Center, convened by Prof. Sun Licheng of Westlake University, who is an academician of the Chinese Academy of Sciences and the director of the Artificial Photosynthesis and Solar Fuel Center. The conference invited well-known experts and scholars and enterprise experts in the field of anion-exchange membrane water electrolysis to present reports, and conducted exchange in the form of roundtable talks and poster exchanges.

第四届全国超快振动光谱会议在西安开幕

The 4th National Conference on Ultrafast Vibrational Spectroscopy Opens in Xi’an

2025 年 4 月 12 日上午，由陕西师范大学化学化工学院和应用表面与胶体化学教育部重点实验室主办的第四届全国超快振动光谱会议在西安斯瑞特酒店开幕。

本届大会邀请了上海交通大学仲冬平教授、复旦大学周鸣飞教授、北京师范大学苏红梅教授、中国科学院物理研究所翁羽翔研究员、西湖大学王鸿飞教授、俄勒冈州立大学 / 中国科学院大连化学物理研究所方狆教授、中国科学院化学研究所王建平研究员、北京大学郑俊荣教授等专家学者作大会报告。

截止大会召开，共有来自北京大学、复旦大学、中国科学院、中国科学技术大学、上海交通大学等 41 所大学和科研院所的 200 余名专家学者和青年化学工作者参会。大会共收到论文摘要 123 篇，安排大会报告 8 个、分会邀请报告 47 个、口头报告 19 个和墙报展示 49 个。

大会开幕式由陕西师范大学新概念传感器与分子材料研究院边红涛教授主持。陕师大科学技术处处长、化学化工学院院长薛东教授出席会议并致辞，欢迎参会代表，介绍了学校及学院的基本情况、办学定位和学科布局与发展方向，并鼓励师大老师们积极与参会代表沟通、交流，促进学院相关研究快速发展。

全国超快振动光谱会议发起人之一、中国科学院化学研究所王建平研究员发表讲话，向会议主办方和组委会表示感谢，讲述了会议的发起初衷，并回顾了前三届会议的召开情况，肯定了学院在此次会议举办中的筹备组织工作。

中国化学会时间分辨谱学专业委员会主任、中国科学院物理研究所翁羽翔研究员发表讲话，肯定了此次会议的办会质量及参会规模，并鼓励在场青年科学家立志于解决国家大问题、把才华发挥到工业界、推动大仪器装置的发展。

大会主席房喻院士在开幕式上作专题讲话。房院士回顾了他早期在单光子荧光、同步辐射等时间分辨研究领域的工作，感慨近年来超快领域的飞速发展，介绍了目前西安及学院已搭建的超快研究平台，鼓励青年科学

家利用科学装置解决基础研究领域的难题。

全国超快振动光谱会议每两年举办一次，会议旨在交流超快振动光谱领域最新研究进展，促进相关理论计算和实验技术的发展。会议为国内外同行广泛交流创造了难得的机会，对提升学校学科影响力，深化学校与社会各界的合作具有重要意义。

On April 12, 2025, the Fourth National Conference on Ultrafast Vibrational Spectroscopy, hosted by the School of Chemistry and Chemical Engineering of Shaanxi Normal University and the Key Laboratory of Applied Surface and Colloid Chemistry of the Ministry of Education, opened at the Xi’an Slater Hotel in Xi’an.

The conference invited renowned scholars to deliver plenary reports, including Prof. Zhong Dongping from Shanghai Jiaotong University, Prof. Zhou Mingfei from Fudan University, Prof. Su Hongmei from Beijing Normal University, Researcher Weng Yuxiang from the Institute of Physics of the Chinese Academy of Sciences (CAS), Prof. Wang Hongfei from Westlake University, Prof. Fang Chong from Oregon State University/Dalian Institute of Chemical Physics (CAS), Researcher Wang Jianping from the Institute of Chemistry (CAS), and Prof. Zheng Junrong from Peking University.

By the conference opening, over 200 experts, scholars and young chemical researchers from 41 universities and research institutions, including Peking University, Fudan University, CAS, the University of Science and Technology of China, and Shanghai Jiaotong University, had registered. The conference received 123 abstract submissions and scheduled 8 plenary reports, 47 invited session reports, 19 oral presentations, and 49 poster presentations.

The opening ceremony was chaired by Prof. Bian Hongtao of the Institute of New Concept Sensors and Molecular Materials of Shaanxi Normal University. Prof. Xue Dong, director of SNNU Department of Science and Technology and dean of the School of Chemistry and Chemical Engineering, delivered a welcome speech introducing the university’s profile, educational positioning, disciplinary development strategies, and encouraged its faculty members to actively engage with attendees to accelerate research progress.

Researcher Wang Jianping from the Institute of Chemistry (CAS), one of the conference founders, expressed gratitude to the organizing committee, reviewed the original purpose of establishing the conference and the previous three editions, and commended the SNNU’s preparatory and organizational efforts.

Researcher Weng Yuxiang from the Institute of Physics (CAS), chair of the Time-Resolved Spectroscopy Committee of the Chinese Chemical Society, acknowledged the conference’s quality and attendance scale, urging young scientists to address major national challenges, apply their expertise in industry, and advance large-scale instrumentation development.

Conference chair Prof. Fang Yu delivered a keynote speech at the opening ceremony. He reflected on

his early work in time-resolved fields such as single-photon fluorescence and synchrotron radiation, marveled at the rapid advancements in ultrafast science, introduced current ultrafast research platforms established in Xi'an and by the university, and encouraged young scientists to use advanced facilities to tackle fundamental research challenges.

Held biennially, the Conference aims to exchange the latest research advances in ultrafast vibrational spectroscopy and promote developments in theoretical and experimental methodologies. It provides a valuable platform for global academic exchanges, significantly enhancing the university's disciplinary influence and strengthening collaborations between academia and society.

第四届全国超快振动光谱会议闭幕

The 4th National Conference on Ultrafast Vibrational Spectroscopy Concludes

2025 年 4 月 13 日，由陕西师范大学化学化工学院和应用表面与胶体化学教育部重点实验室主办的第四届全国超快振动光谱会议在西安闭幕。

陕西师范大学新概念传感器与分子材料研究院边红涛教授主持闭幕式，并向全体参会教师和同学、大会组委会成员、志愿者和赞助单位的辛勤付出致谢。

全国 40 余家单位的 200 多名代表出席会议。到会专家围绕“时间分辨红外光谱与飞秒多维振动光谱”“和频振动光谱”“稳态及时间分辨拉曼光谱”“时间分辨太赫兹光谱”“红外与太赫兹光源”“超快振动光谱理论”和“超快电子光谱中的电子－振动耦合与电子－声子散射现象”等七个主题，探讨和交流了超快振动光谱领域最新研究进展以及相关理论计算和实验技术的发展。

大会进行了优秀口头报告和优秀墙报评选，经专家现场评审，李鑫茂等 10 人获优秀口头报告奖，池振等 16 人获优秀墙报奖。

闭幕式上公布了下一届大会的承办单位。第五届全国超快振动光谱会议将在北京举行，承办单位负责人盖锋教授对本届会议会务组表达了感谢，肯定了主办方的办会水准和良好的参会体验，代表第五届全国超快振动光谱会议组委会发布了参会邀请。

On April 13, 2025, the Fourth National Conference on Ultrafast Vibrational Spectroscopy, hosted by the School of Chemistry and Chemical Engineering of Shaanxi Normal University and the Key Laboratory of Applied Surface and Colloid Chemistry of the Ministry of Education, concluded in Xi’an.

Prof. Bian Hongtao from the Institute of New Concept Sensors and Molecular Materials at Shaanxi Normal University chaired the closing ceremony, expressing gratitude to all participants, committee members, volunteers, and sponsors for their contributions.

Over 200 delegates from more than 40 institutions nationwide attended the conference. Experts engaged in discussions on seven key themes: “time-resolved infrared spectroscopy and femtosecond multidimensional vibrational spectroscopy”, “sum-frequency vibrational spectroscopy”, “steadystate and time-resolved Raman spectroscopy”, “time-resolved terahertz spectroscopy”, “infrared and terahertz light sources”, “ultrafast vibrational spectroscopy theory”, and “electron-vibration coupling and electron-phonon scattering phenomena in ultrafast electronic spectroscopy”, exchanging insights on cutting-edge advancements and experimental methodologies.

The conference featured awards for outstanding oral presentations and posters. After expert evaluations, 10 researchers including Li Xinmao received the “Outstanding Oral Presentation Award”, while 16 participants such as Chi Zhen were honored with the “Outstanding Poster Award”.

At the closing ceremony, the next host institution was announced. Prof. Gai Feng, the designated chair of the 5th National Conference to be held in Beijing, thanked the current organizers for their exceptional arrangements and for the good participation experience, and extended an official invitation on behalf of the new organizing committee.

房喻院士出席中国化学会第十九届全国光化学学术会议

Fang Yu attends 19th National Conference on PhotoChemistry of the Chinese Chemical Society

2025 年 4 月 18 日上午，房喻院士出席在四川大学国际学术交流中心举行的中国化学会第十九届全国光化学学术会议，并主持大会报告。

本次会议由中国化学会光化学专业委员会主办，四川大学化学学院承办，会议主题为“光化学助力绿色低碳高质量发展”，来自全国 200 余所高校、科研院所、企业和行业协会的 1000 余名代表参会。

On April 18, 2025, Prof. Fang Yu attended the 19th National Conference on Photochemistry of the Chinese Chemical Society held at the International Academic Exchange Center of Sichuan University and presided over the conference report.

The conference was hosted by the Photochemistry Professional Committee of the Chinese Chemical Society and organized by the College of Chemistry of Sichuan University. Themed “Photochemistry Facilitating Green, Low-carbon and High-Quality Development”, the conference was attended by over 1,000 representatives from more than 200 universities, research institutes, enterprises and industry associations across the country.

房喻院士出席 2025 智能传感功能材料与器件大会并作报告

Fang Yu speaks at 2025 Conference on Intelligent Sensing Functional Materials and Devices

2025 年 4 月 20 日，房喻院士出席在广东佛山召开的“2025 智能传感功能材料与器件大会”并作题为《面向传感器的分子材料创新》的报告。

房喻院士还作为嘉宾，与天津大学常务副校长胡文平、中国有研科技集团有限公司副总经理毛昌辉等一同出席了主题为“人工智能背景下传感技术的机遇与挑战”的圆桌论坛。

本次大会由中国材料研究学会智能传感功能材料与器件分会、智能传感功能材料全国重点实验室主办，主论坛围绕稀土功能材料、智能传感与生命科学、智能传感器技术及产业等前沿课题展开，吸引了来自高校、科研院所、企事业单位 150 余名专家、学者等代表围绕智能传感功能材料与器件领域展开交流与探讨。

On April 20, 2025, Prof. Fang Yu attended the 2025 Conference on Intelligent Sensing Functional Materials and Devices held in Foshan, Guangdong Province, and delivered a report titled “Innovation in Molecular Materials for Sensors”.

Fang Yu also attended a roundtable forum themed “Opportunities and Challenges of Sensor Technology in the Context of Artificial Intelligence”, along with Hu Wenping, executive vice president of Tianjin University, Mao Changhui, deputy general manager of China Grinm Group, and others.

This conference is hosted by the Intelligent Sensing Functional Materials and Devices Branch of the Chinese Materials Research Society and the National Key Laboratory of Intelligent Sensing Functional Materials. The main forum focuses on cutting-edge topics such as rare earth functional materials, intelligent sensing and life sciences, and intelligent sensor technology and industry. It attracted over 150 experts, scholars and other representatives from universities, research institutes, enterprises and public institutions to exchange and discuss in the field of intelligent sensing functional materials and devices.

陕西省新概念传感器及分子材料重点实验室召开第一届学术委员会第一次全体会议

The First Plenary Meeting of the First Academic Committee of Shaanxi Provincial Key Laboratory of New Concept Sensors and Molecular Materials Held

2025 年 4 月 21 日下午，陕西省新概念传感器及分子材料重点实验室第一届学术委员会第一次全体会议在陕西师范大学新概念传感器与分子材料研究院一层报告厅召开。

重点实验室第一届学术委员会主任蒋庄德院士（西安交通大学），首席科学家房喻院士（陕西师范大学 / 西安交通大学），副主任委员付玉喜研究员（中国科学院西安光学精密机械研究所）、张秋禹教授（西北工业大学）、邵金友教授（西安交通大学）、薛东教授（陕西师范大学），委员王进义教授（西北农林科技大学）、孔杰教授（西北工业大学）、张伟教授（西安交通大学）、张志成教授（西安交通大学）、杨鹏教授（陕西师范大学）、栾新军教授（西北大学）、曹睿教授（陕西师范大学）、韩英锋教授（西北大学）出席会议。

陕西师范大学副校长陈新兵，科


第一届学术委员会第一次会议
陕西·西安
2025年4月21日


陕西省新概念传感器


第一届学术委员会第一次会议
陕西·西安
2025年4月21日


陕西省新概念传感器及分子材料重点实验室


陕西省新概念传感器及分子材料重点实验室


陕西省新概念传感器及分子材料重点实验室
第一届学术委员会第一次会议


陕西省新概念传感器及分子材料重点实验室


蒋庄德
陈新兵

技处处长、化学化工学院院长薛东，学院党委书记高玲香，副院长刘成辉，副院长、重点实验室副主任丁立平，新概念传感器与分子材料研究院行政副院长杨小刚，西安交通大学科研院常务副院长邵金友，西安交通大学前沿院党委书记赵卫滨，西安交通大学仪器科学与技术学院院长赵立波，西安交通大学前沿院副院长、重点实验室主任何刚，西安交通大学新概念传感器与分子材料研究院执行院长、重点实验室学术带头人刘峰，西安交通大学仪器科学与技术学院副院长董涛，陕西省西咸新区秦汉新城管理委员会中国西部创新港建设联席会议工作专班主任韩娜，重点实验室骨干教师代表等 50 余人参加了会议。

会议第一阶段由丁立平主持，她介绍了学术委员会委员和其他参会人员。陈新兵代表学校致辞，向蒋院士、房院士，以及各位专家学者致以热烈欢迎。他介绍了重点实验室的基本情况，对各位专家学者长期以来对陕师大的支持表示衷心的感谢。薛东宣读了重点实验室批文和学术委员会聘任名单，陈新兵为学术委员会委员颁发了聘书。

会议第二阶段由蒋庄德院士主持。何刚汇报了重点实验室的筹备工作以及后续的工作计划。重点实验室教师代表刘太宏、彭军霞、何怡楠、李国平分别对“薄膜荧光传感器研究及产业化”“STCPS 防水拒油透气膜技术及产业化”“高性能可定制介质材料及概念性应用”“中性水系有机液流电池及产业化”等领域进行了产学研汇报。各位委员在听取主任工作汇报和青年教师代表学术汇报的基础上，肯定了重点实验室的前期研究基础和定位，并对实验室开创的高校联合共建模式表示高度肯定，一致认为重点实验室将在基础研究、产业应用、人才培养等方面取得卓越成绩。

蒋庄德院士祝贺陕西省新概念传感器及分子材料重点实验室第一届学术委员会第一次全体会议顺利召开，并鼓励青年教师借助重点实验室的平台，构建与省内乃至国内外学者的交流平台，实现自身的责任担当和快速成长，在基础研究和科技转化方面大展身手。

最后，房喻院士感谢委员会专家的建议，并建议重点实验室的教师们要活跃思想，勇于面向高科技前沿、未来技术开展研究工作。

On April 21, 2025, the First Plenary Meeting of the First Academic Committee of Shaanxi Provincial Key Laboratory of New Concept Sensors and Molecular Materials was convened in the lecture hall on the first floor of the Institute of New Concept Sensors and Molecular Materials at Shaanxi Normal University.

Chinese Academy of Engineering Academician Jiang Zhuangde (Xi’an Jiaotong University), the Chairperson of the First Academic Committee of the Key Laboratory, and Chinese Academy of Sciences Academician Fang Yu (Shaanxi Normal University / Xi’an Jiaotong University), the Lead Scientist, and vice chairpersons Researcher Fu Yuxi (Xi’an Institute of Optics and Fine Mechanics, Chinese Academy of Sciences), Prof. Zhang Qiuyu (Northwestern Polytechnical University), Prof. Shao Jinyou (Xi'an Jiaotong University), and Prof. Xue Dong (Shaanxi Normal University), and members Prof. Wang Jinyi (Northwest A&F University), Prof. Kong Jie (Northwestern Polytechnical University), Prof. Zhang Wei (Xi'an Jiaotong University), Prof. Zhang Zhicheng (Xi'an Jiaotong University), Prof. Yang Peng (Shaanxi Normal University), Prof. Luan Xinjun (Northwest University), Prof. Cao Rui (Shaanxi Normal University), and Prof. Han Yingfeng (Northwest University) attended the meeting.

More than 50 people, including Chen Xinbing, vice president of Shaanxi Normal University, Xue Dong, director of the Science and Technology Department and dean of the School of Chemistry and Chemical Engineering, SCCE Party Secretary Gao Lingxiang, vice dean Liu Chenghui, Ding Liping, vice dean and deputy director of the Key Laboratory, Yang Xiaogang, INCSMM administrative vice dean; XJTU Research Institute executive vice dean Shao Jinyou, Institute of Frontier Sciences Party Secretary Zhao Weibin, School of Instrument Science and Technology dean Zhao Libo, He Gang, vice dean of the Institute of Frontier Sciences and director of the Key Laboratory, Liu Feng, executive director of the Institute of New Concept Sensors and Molecular Materials at Xi'an Jiaotong University and Academic Leader of the Key Laboratory, School of Instrument Science and Technology vice dean Dong Tao; Han Na, director of the Working Group for the Joint Conference on the Construction of China's Western Innovation Port under the Management Committee of Qinhan New City, Xixian New Area, Shaanxi Province, and representatives of key laboratory teachers, attended the meeting.

The first stage of the meeting was presided over by Ding Liping, who introduced the members of the Academic Committee and other participants. Chen Xinbing delivered a speech on behalf of the university, extending a warm welcome to Academician Jiang, Academician Fang, and all the experts and scholars present. He introduced the basic situation of the Key Laboratory and expressed his sincere gratitude to all the experts and scholars for their long-term support to Shaanxi Normal University. Xue Dong read out the approval document for the Key Laboratory and the list of members appointed to the Academic Committee. Chen Xinbing presented the appointment letters to the committee members.

The second stage of the meeting was presided over by Academician Jiang Zhuangde. He Gang reported on the preparatory work of the Key Laboratory and the subsequent work plan. Representatives of the key laboratory teachers, Liu Taihong, Peng Junxia, He Yinan and Li Guoping, respectively made industry-university-research reports on the fields of "Research and Industrialization of Film-based Fluorescent Sensors", "STCPS Waterproof Oil-repellent Breathable Membrane Technology and Industrialization", "High-performance Customizable Dielectric Materials and

Conceptual Applications", and "Neutral Aqueous Organic Flow Batteries and Industrialization". After the director's work report and the young teachers' presentations, committee members affirmed the previous research foundation and positioning of the laboratory, and highly praised the university joint construction model initiated by the laboratory. They unanimously believed that the laboratory would achieve outstanding results in basic research, industrial application, and talent cultivation.

Academician Jiang Zhuangde congratulated the successful convening of the first plenary session of the first Academic Committee of the Shaanxi Provincial Key Laboratory of New Concept Sensors and Molecular Materials. He encouraged young teachers to take advantage of the platform of the laboratory to build an exchange platform with scholars within the province and even at home and abroad, to fulfill their own responsibilities and achieve rapid growth, and to make great achievements in basic research and technology transfer.

Finally, Academician Fang Yu thanked the experts of the committee for their suggestions and advised the teachers of the laboratory to keep their minds active and be courageous in conducting research on the cutting-edge of high technology and future technologies.

房喻院士出席第十五届全国大学化学教学研讨会暨《大学化学》创刊 40 周年论坛

Fang Yu attends 15th National University Chemistry Teaching Symposium

2025 年 4 月 26 日，房喻院士应邀出席第十五届全国大学化学教学研讨会暨《大学化学》创刊 40 周年论坛开幕式，并主持大会报告。

此次会议由高等学校化学教育研究中心和中国化学会教育学科委员会主办，北京大学化学与分子工程学院承办。

On April 26, 2025, Prof. Fang Yu was invited to attend the opening ceremony of the 15th National University Chemistry Teaching Symposium and the Forum for the 40th Anniversary of Founding of "University Chemistry", and presided over the conference report.

This event is hosted by the Research Center for Chemistry Education in Higher Education Institutions and the Education Discipline Committee of the Chinese Chemical Society, and organized by the College of Chemistry and Molecular Engineering, Peking University.

边红涛、马佳妮参加首届上海复杂体系超快动力学会议并作报告

Bian Hongtao and Ma Jiani present at First Shanghai Conference on Ultrafast Dynamics of Complex Systems

2025 年 4 月 25 至 27 日，新概念传感器与分子材料研究院边红涛教授和马佳妮教授参加了在上海举行的首届上海复杂体系超快动力学会议，并分别作了题为“水溶液复杂体系氢键网络动态演化的超快动力学研究”和 Reaction mechanism studies on selected photocaged compounds 的邀请报告。

本次会议由上海交通大学主办，聚焦“超快动力学国际前沿探索”和“技术驱动的学科交叉”两大主线，研讨超快光子与电子技术在多尺度物质科学中的突破性应用，探索飞秒至阿秒时间尺度下复杂体系动态行为的本质规律，以推动超快科学在中国的发展。

From April 24th to 27th, 2025, Prof. Bian Hongtao and Prof. Ma Jiani from the Institute of New Concept Sensors and Molecular Materials attended the First Shanghai Conference on Ultrafast Dynamics of Complex Systems held in Shanghai, and presented invited reports titled “Ultrafast Kinetic Study on the Dynamic Evolution of Hydrogen Bond Networks in Complex Aqueous Solution” and “Reaction mechanism studies on selected Photoaged compounds” respectively.

This conference, hosted by Shanghai Jiao Tong University and focusing on two main lines of “International Frontier Exploration of Ultrafast Dynamics” and “Technology-driven Interdisciplinary Integration”, aims to discuss the breakthrough applications of ultrafast photonics and electronic technology in multi-scale material science, explore the essential laws of dynamic behavior of complex systems at femtosecond to attosecond time scales, and promote the development of ultrafast science in China.

彭灵雅获批 2025 年陕西省科协青年人才托举计划项目

Peng Lingya funded by 2025 Shaanxi Science and Technology Association Young Talent Support Program

近日，陕西省科学技术协会公布了 2025 年度青年人才托举计划项目评审结果，新概念传感器与分子材料研究院彭灵雅获得资助。

Recently, Shaanxi Provincial Association of Science and Technology announced the results of the 2025 Young Talent Support Program project evaluation, and Peng Lingya of the Institute of New Concept Sensors and Molecular Materials was awarded the funding.

RESEARCH ARTICLE

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The Effect of Saccharin on the Crystallization Behavior of Electroless Cobalt Plating

Yuxin Luo[a, #], Jingjing Wang[a, #], Lu Wang[a], Ziyi Yan[a], Yi Ma[a], Xin Bo[a, *], Jingshuang Dang[a, *], Zenglin Wang[a, *]

化学镀钴过程中添加剂糖精对结晶取向的调控

Yuxin Luo#, Jingjing Wang#, Lu Wang, Ziyi Yan, Yi Ma, Xin Bo*, Jingshuang Dang*, Zenglin Wang*,
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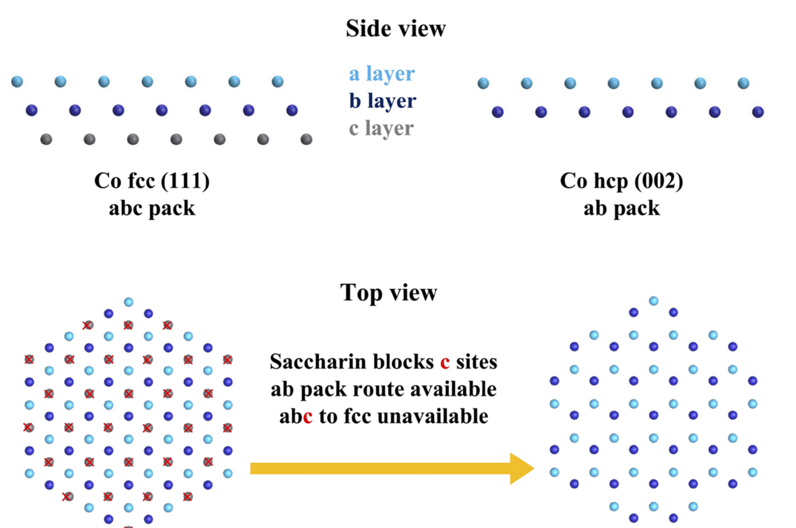

在化学镀钴过程中，我们发现添加剂糖精的加入可明显改变化学镀钴层表面的形貌、织构取向及镀层的导电性。研究表明，当糖精添加量为 3 mg·L–1 时，钴镀层由无序大晶粒转变为蜂巢状结构，具有密排六方（HCP）钴晶体的（002）择优取向，其电阻率降低至 14.4 μ Ω·cm，经过热处理后，电阻率进一步降低至 10.7 μ Ω·cm，这对于其在芯片中的应用具有重要价值。当糖精浓度升高时，晶粒逐渐细化，呈现“石林”状结构，择优取向不变，而糖精的加入在一定程度上提高了镀钴膜的纯度。通过密度泛函理论对钴镀层结晶行为的研究表明，糖精分子可吸附于钴密排晶面的特定 c 位点，抑制 abc 堆积方式生长，诱导晶体按 ab 堆积方式生长，从而实现 HCP（002）晶面的择优生长。

共同第一作者：陕西师范大学硕士研究生罗雨欣、王静静
通讯作者：陕西师范大学薄鑫副研究员、党静霜副教授、王增林研究员
全文链接：https://jelectrochem.xmu.edu.cn/online_first/104/

In the process of electroless cobalt plating, the saccharin additive can significantly change the surface morphology, texture orientation, and conductivity of the cobalt coating layer. When the amount of saccharin was 3 mg•L-1, the cobalt coating transformed from disordered large grains to a honeycomb structure, with a preferred orientation of (002) facet on hexagonal close-packed (HCP) cobalt crystals. The resistivity of the cobalt film decreased to 14.4 μΩ•cm, and after annealing treatment, the resistivity further decreased to 10.7 μΩ•cm. When the concentration of saccharin increases, the grain size gradually refines and presents a "stone forest" structure, with the preferred orientation remaining unchanged. The addition of saccharin also slightly improves the purity of cobalt coating to a certain extent. Through the study of the crystallization behavior of cobalt electroless plating, saccharin molecules can adsorb to specific c-sites on the cobalt dense crystal plane, inhibiting the growth of abc stacking arrangement and inducing the crystal growth in ab stacking mode, thereby achieving optimal growth of HCP (002) texture.

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Full Text Link: https://jelectrochem.xmu.edu.cn/online_first/104/

ACS APPLIED POLYMER MATERIALS

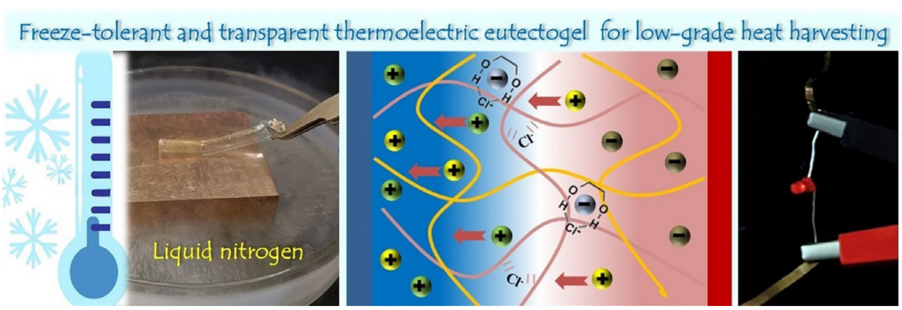
pubs.acs.org/acsapm Article

Freeze-Tolerant and Transparent Eutectogel with High Conductivity and Long-Lasting Usability for Low-Grade Heat Harvesting

Yaolong Zhi, Maohua Li, Xuelei Ma, Xinyue Zhu, Jiakang Yuan, Yunhong Xin, Yu Fang, and Junxia Peng*

具有高导电性和持久可用性的耐冻透明低共熔凝胶用于低品位热量捕获

Yaolong Zhi Maohua Li, Xuelei Ma, Xinyue Zhu, Jiakang Yuan, Yunhong Xin, Yu Fang, Junxia Peng. ACS Appl. Polym. Mater. 2025, 7, 4383−4393, Doi: 10.1021/acsapm.5c00097



近年来，低品位热能再利用日益受到学界关注。人类社会广泛存在大量的废热资源。由于热能利用效率低下，超过一半的热能以废热形式散逸至大气中，电子设备运行及机械加工过程也不可避免地产生废热，其中多数属于温度低于100℃的低品位热能。如何实现低品位热能的回收利用对可持续发展具有重要意义。在众多技术路径中，基于热电效应（即热能－电能直接转换特性）的热电技术被视为最具应用前景的低品位热能回收方案之一。如今，热电技术不仅需要实现高功率密度，还需兼具高效性、可扩展性、成本效益以及多场景适用性。例如可穿戴设备及日常生活应用领域对柔性耐用热电材料存在巨大需求。

热电材料可分为电子型热电（e-TE）材料和离子型热电（i-TE）材料。e-TE 材料虽因高电导率被广泛研究，但仍存在塞贝克系数低（10^{-2} 至 10^{-1} mV K^{-1} 量级）、柔性差、生产成本高等固有缺陷，这些因素严重制约了其可靠的热电转换性能及其应用。相比之下，i-TE 材料，如液体电解质，离子水凝胶和离子凝胶。它们通过离子扩散（也称 Soret 效应）表现很高的塞贝克系数，通常比 e-TE 材料高 2-3 个数量级，因此成为低品位热源捕获的重要材料。

离子型凝胶热电材料能有效解决离子型液体热电材料的泄漏问题。目前 i-TE 凝胶研发主要聚焦离子水凝胶和离子凝胶两类体系，离子水凝胶虽具有高离子电导率，但面临极端环境适应性和长期稳定性挑战—高温易导致水分蒸发，低温易引发冻结，这些都会造成力学性能劣化及热电性能衰减。深共晶溶剂（DESs）作为新兴绿色溶剂备受关注，具有更环保、经济、无毒等优势。这类溶剂还展现出低蒸气压、高导电性以及对离子/非离子化合物的强溶剂化能力，已在电化学储能与转换等多个领域获得应用。因此基于深共晶溶剂的凝胶材料（即共晶凝胶）通常表现出卓越特性：包括高稳定性、强粘附力、良好导电性以及显著的强度与柔韧性。

在本工作报道了一种包含绿色低共熔溶剂 EaCl:EG 与锂盐的高透明聚合物共晶凝胶（称为 PAH-5% LiTFSI），该凝胶展现出 20.2 mS cm^{-1} 的高离子电导率与 9.7 mV K^{-1} 的离子塞贝克系数。得益于 EaCl:EG 优异的抗冻特性，即使在 -20° C 下凝胶仍能保持 7.6 mS cm^{-1} 的离子电导率。聚合物网络与 DES 的相互作用抑制了共晶凝胶的结晶行为，使其在 -114° C 呈现玻璃化转变（略高于 DES 的 -113° C 凝固点）。PAH-5%

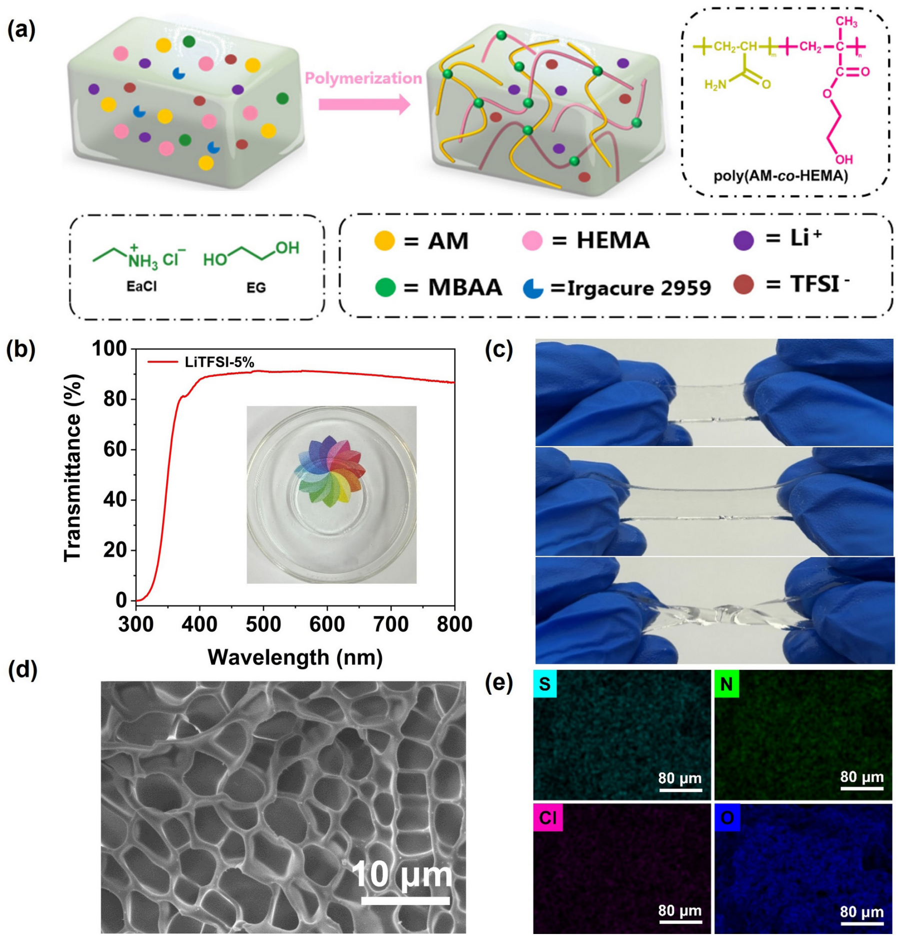


图 1. 低共熔凝胶 PAH−5% LiTFSI 的制备示意图和性能表征。
Figure 1. Preparation and characterization of the PAH-5% LiTFSI eutectogel.

LiTFSI 同时具有卓越的溶剂保持能力：在常温环境（23° C，60% 相对湿度）中暴露 7 天无质量损失，在通风干燥箱（50° C，30% 相对湿度）中放置 24 小时后仍能保持 90% 质量。其热电性能在宽湿度范围内表现出优异稳定性。基于 PAH−5% LiTFSI 的自制电源模型能够驱动小型电子设备（如发光二极管、计时器）及回收太阳能电池板废热的潜力。本研究为开发具有出色环境耐性和持久使用性的生物友好型热电凝胶材料奠定了基础。

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The reuse of low-grade heat energy has attracted increasing research interest in recent years. Abundant waste heat exists widely inhuman society. Due to the low efficiency of heat utilization, more than half of the thermal energy is dissipated into the atmosphere as waste heat. Additionally, waste heat is inevitably generated during the operation of electronic equipment and mechanical processes. Most of this waste heat is low-grade heat with a temperature below100 °C. Recycling low-grade heat is significant for sustainable development. Among various technologies, utilizing the thermo-electric (TE) effect, characterized by direct heat-to-electricity conversion, is considered one of the most promising methods for recovering low-grade heat from different real-world situations. Nowadays, TE technology must not only produce high power densities but also be efficient, scalable, cost effective, and suitable for multiple application scenarios. For example, there is a high demand for flexible and robust TE materials for wearable devices and daily life applications.

TE materials can be classified into electronic thermoelectric (e-TE) materials and ionic thermoelectric (i-TE) materials. e-TE materials, although widely investigated for their high conductivity, still suffer from the inherent drawbacks of low Seebeck coefficients (on the order of 10^{-2} to 10^{-1} mV K^{-1}), poor flexibility, and high production costs, which severely limit their reliable

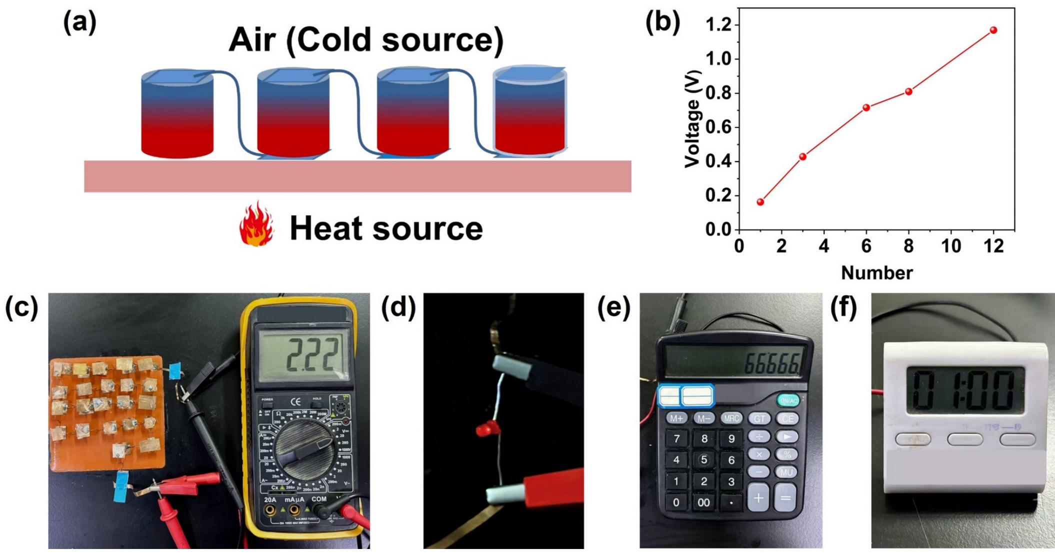

图 2. 低共熔凝胶的热电应用。
Figure 2. Thermoelectrical applications of the eutectogels.

thermoelectric conversion performance and their applications. In contrast, i-TE materials, such as liquid electrolytes, ionic hydrogels and ionogels. They exhibit high Seebeck coefficients, which are 2-3 orders of magnitude higher than those of e-TE materials, through ion diffusion (also known as the Soret effect), and thus have become important materials for low-grade heat energy harvesting.

i-TE gel-like materials can effectively solve the leakage problem of liquid-based i-TE materials. As a quasi-solid material, Gel effectively prevents liquid leakage. At present, i-TE gel mainly focuses on two types of systems: ionic hydrogel and ionogels. Although ionic hydrogel has high ionic conductivity, they face challenges of extreme environmental adaptability and long-term stability. High temperatures can cause water evaporation, while low temperatures may lead to freezing, resulting in mechanical property deterioration and TE performance attenuation. Deep eutectic solvents (DESs) have garnered significant attention as an emerging class of green solvents, offering more environmentally friendly, cost-effective, and nontoxic. DESs also exhibit low vapor pressures, high conductivity, and strong solvation toward ionic and nonionic compounds. They have been utilized in various fields, particularly in electrochemical energy storage and conversion. Consequently, DES-based gel materials, referred to as eutectogels, often exhibit excellent properties, including high stability, strong adhesive strength, good conductivity, and notable strength and flexibility.

Herein, we present a highly transparent polymer eutectogel comprising a green deep eutectic solvent (DES) along with lithium salt. This eutectogel exhibits a high ionic conductivity of 20.2 mS cm^{-1} and ionic Seebeck coefficient of 9.7 mV K^{-1}. Thanks to the excellent freeze-resistant property of DES, the ionic conductivity can still reach 7.6 mS cm^{-1} even at -20 °C. Additionally, the interaction between polymer network and DES prevents crystallization within as prepared eutectogel, instead resulting in a glass transition at -114 °C, slightly higher than the freezing point of DES at -113 °C. Furthermore, as prepared eutectogel demonstrates exceptional long-term solvent retention, showing no weight loss when exposed to ambient environment (~23°C, ~60% RH) for 7 days, and maintaining 90 % of its weight after being placed in an oven for 1 day (50°C, ~30% RH with strong air circulation). As prepared eutectogel also shows excellent stability of thermoelectric performance over a wide range of the relative humidity. The homemade device utilizing as prepared eutectogel shows the potential to directly power some small electronic devices (such as light-emitting diode and timer) and to recover wasted heat generated by solar panel. Our results provide a foundation for the development of bio-friendly TE gel-like materials that exhibit outstanding environmental tolerant and long-lasting usability.

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Disclosing the intrinsic electrocatalytic activity of transition-metal sulfides for enhanced water oxidation

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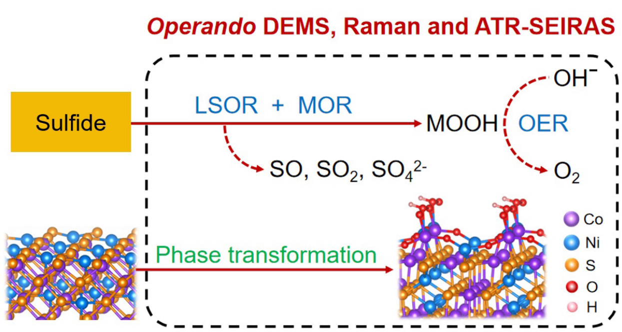
揭示过渡金属硫化物在电化学水氧化反应中的本征活性

Dan Zhu#, Lingxing Zan#,*, Yunchuan Tu*, Wenlin Zhang, Hongling Zhang, Yuxin Luo, Lu Liu, Jiawen Zheng, Qiang Weng, Qingbo Wei, Di Li, Xin Bo*, Chuan Zhao*, Feng Fu, Science China Chemistry, 2025, 68



在电解水阳极催化剂的研发中，掺入硫元素往往可促进其表观电流密度，其中，电流密度的提升一部分源自于本征析氧催化过程，但也不可避免的由电极自身电氧化引起了表面重构，因而产生额外的电流叠加，从而导致长期使用时的活性降低，对催化剂本征活性的判断产生误导。这种催化剂的表面重构机理仍然复杂且有争议。为此，我们采用了原位电化学－光谱方法来研究金属硫化物异质催化剂 [(CoNi)xSy] 上的精确界面活化过程，该催化剂在 190 mV 过电位下可产生 100 mA cm−2 的催化电流密度。原位微分电化学质谱（DEMS）表明晶格 S 被电化学氧化为 SO、SO2 和 SO42− 物种以及配位不饱和金属位点。原位拉曼光谱和原位表面增强红外吸收光谱证实了硫化物→氧化物→羟基氧化物的相变，最终羟基氧化物充当析氧反应的活性位点。密度泛函理论还模拟了这一过程，并阐明了表观活性在析氧过程中衰减的动力学过程。本研究展示了特定掺硫催化剂的结构演变，并建立了实时反应下真实活性的鉴定方法。

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The apparent OER activity on S-incorporated catalyst outputs an over-estimated current, which is actually contributed not only from the oxygen evolution reaction (OER), but also from the inevitable surface reconstruction-involved electrochemical oxidation reactions. The mechanism on the such catalyst still stays complex and controversial. Here, we applied a set of operando electrochemical-spectrometric methodologies to investigate the precise interfacial activation process on the bimetallic sulfide heterogeneous catalyst, which delivers an extraordinary OER activity of 100 mA cm-2 at 190 mV overpotential. Differential electrochemical mass spectrometry (DEMS) suggested the electrochemical oxidations of the lattice S to SO, SO2 and SO42- species and the coordinately unsaturated metal sites. Operando Raman and attenuated total reflectance surface-enhanced infrared absorption spectra confirmed the phase transformation of sulfide to oxide, and then to oxyhydroxide, which acted as active site for OER. The density functional theory also simulated this process that the (CoNi)xSy transition-phase exhibited the optimal activity, and elucidated the attenuation kinetics of the apparent activity upon OER. This study demonstrates the structure evolution of the certain S-incorporated catalyst and establishes the protocol for the real activity identification under the real-time reaction.

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西安市育才中学师生来院进行科普参观学习

Xi’an Yucai Middle School teachers and students received for science popularization tour

2025 年 4 月 8 日下午，西安市育才中学组织校宣讲团成员和优秀团员代表来到新概念传感器与分子材料研究院进行科普参观学习，感受科技魅力，感悟科学风采。

刘太宏副教授向同学们介绍了研究院基本情况、科研团队、科研概况和发展理念，带领他们参观了研究院成果展厅、实验室，讲解了传感器技术在环境监测、医疗健康、国防安全等领域的重要作用，以及房喻院士团队研发的爆炸物探测仪、毒品探测仪等科研成果转化产品。

育才中学师生还参观了陕西师范大学教育博物馆和化学化工学院大型科学仪器共享平台。

On April 8, 2025, a group of representatives of the members of the school publicity group and the Youth League of Xi’an Yucai Middle School visited the Institute of New Concept Sensors and Molecular Materials in a science popularization tour to feel the charm of science and technology.

Assoc. Prof. Liu Taihong introduced the basic situation, research team, research overview and development concept of the institute to the students, led them to visit the institute’s achievements exhibition hall and laboratory, explained the important role of sensor technology in environmental monitoring, medical health, national defense, public security and other fields, and the products such as explosive detection device and illicit drug detection device transformed from the research results developed by Prof. Fang Yu’s group.

Teachers and students of Yucai Middle School also visited the Museum of Education of Shaanxi Normal University and the Large Scientific Instrument Sharing Platform of the School of Chemistry and Chemical Engineering.

Cell Press 科学编辑林宇卿博士应邀作报告

Cell Press science editor Dr. Lin Yuqing invited to give a report

2025 年 4 月 10 日，Cell Press 科学编辑林宇卿博士应邀来新概念传感器与分子材料研究院访问，并作题为“在 Cell Press 发表材料科学研究”的报告，阐述了 Cell Press 的创刊理念、期刊类型、期刊侧重点以及期刊发展的趋势等，并与研究院师生进行了讨论交流。报告会由研究院刘凯强教授主持。

On April 10, 2025, Cell Press science editor Dr. Lin Yuqing visited the Institute of New Concept Sensors and Molecular Materials and gave a report titled “Publishing Materials Science Research in Cell Press”, which explained the founding concept of Cell Press, type of journal, focus of journal, and trends of journal development, and discussed and exchanged ideas with attending students and faculty members of the institute. The presentation was hosted by Prof. Liu Kaiqiang.

人工智能时代：从基础研究的重要性看科学教育与人才培养

The Era of Artificial Intelligence: Science Education and Talent Cultivation from the Importance of Basic Research

文 / 房 喻 by Fang Yu

作为改革开放恢复高考后的第一届大学生，我是教育的受益者。教育可以改变我的命运，教育也可以改变一个国家的命运。国家当时围绕教育改革做了三件大事情：一是 1977 年恢复高考制度，二是 1978 年决定大量派遣留学生，三是 1981 年开始实施学位制度。这三项制度的落实，解决了国家建设所需要的人才源源不断地供给问题，缩短了我们和发达国家的差距。新中国教育发展的历程可以大体分为三个阶段：第一个阶段是新中国的前 30 年，我们学习苏联老大哥，打下基础；第二个阶段是改革开放 40 年，我们引进、消化、吸收西方的科学技术，加速发展，缩小差距；如今我们发展进入新阶段，需要创新驱动发展的新理念。

一、人类文明面临前所未有的重大挑战，人类应对危机的能力也不断增强

人类社会发展到今天，面临着很多挑战。拿气候问题来说，极端气候越来越多。2022 年巴基斯坦特大水灾，全境三分之一陆地被淹。2023 年 7 月 6 日，根据美国国家海洋和大气管理局与美国缅因大学的数据，全球气温创下历史新高，地球表面以上 2 米的全球平均气温达到 17.23℃，这超过了 7 月 4 日和 5 日创下的 17.18℃的联合纪录，而后者之前曾打破了 7 月 3 日创下的 17.01℃的纪录。自 19 世纪 50 年代有仪器记录以来，这一周是地球上最热的一周。2024 年 2 月，阿根廷湿地遭遇历史大干旱，而巴西则暴雨成灾。2024 年 6 月，印度西北部及巴基斯坦东部和南部遭遇持续高温。愈演愈烈的环境、能源等问题，都需要通过新的科学技术来解决。

与此同时，以人工智能（artificial intelligence，AI）为代表的科学技术迅猛发展，人类应对危机的能力也不断增强。2016 年 3 月，谷歌公司的人工智能围棋程序“阿尔法围棋”（AlphaGo）与围棋世界冠军、职业九段棋手李世石进行人机大战，以 4 比 1 的比分获胜。此后，该程序与中日韩数十位围棋高手对决，无一败绩。2018 年，谷歌公司推出了人工智能程序“阿尔法折叠”（AlphaFold），用于预测蛋白质结构。蛋白质结构非常复杂，但是人工智能解决得非常好，准确性也非常高，该成果迅速获得了 2024 年的诺贝尔化学奖。

化学是一门实验学科，2020 年英国利物浦大学研究团队开发的 AI 化学机器人 Robot Chemist 能够从 9800 万个备选实验数据中学习，智能优化反应条件。OpenAI 公司 2023 年推出的 ChatGPT-4，已经成功用于全新化合物的设计合成，可以用于高性能新材料的设计，甚至数学问题的求解。2023 年 3 月，加拿大多伦多大学的研究人员与 AI 生物科技公司英矽智能（Insilico Medicine）合作，利用人工智能药物发现平台在 30 天内就开发出肝细胞癌的潜在治疗药物。2023 年 7 月 9 日，世界首场机器人主导的新闻发布会召开。

可以看到，人工智能赋能科学研究已经无可逆转。第三次工业革命方兴未艾，第四次工业革命已经悄然兴起，世界政治、经济格局正在被重塑。我们要清楚地认识到，历史上所有带来革命性进步的技术一定来自基础研究的突破，基础研究是科技革命的源头活水。

二、面对以人工智能为基石的第四次工业革命，科研范式、教育范式亟待变革

科技革命是人类文明发展的根本动力，每一次科技革命都极大地改变了人类命运，重塑了世界政治、经济格局。第一次工业革命靠蒸汽机、靠机械；第二次工业革命靠电力；第三次工业革命靠计算机、互联网。现在，人工智能已经成为人类第四次工业革命的核心驱动力。以蒸汽机、电力和信息技术为基石的前三次工业革命深刻改变了人类文明的进程，我们需要更好地应对以人工智能为基石的第四次工业革命的冲击。

2024 年 1 月 28 日，北京通用人工智能研究院发布了全球首个通用智能小女孩“通通”。她能够自主生成任务，服务于教育、康养等产业。她爱干净，眼里有活，可以主动做家务，能够记住是谁偷吃了苹果，还会要小脾气，会感到无聊，无聊时自己可以去看电视……“通通”的问世，意味着通用人工智能雏形已经形成。通用人工智能的目的是要让智能体像人一样，不仅能够独立感知环境、进行思考、作出决策、学习新技能、执行任务，还能够理解人类的情感。

2024 年 2 月，国际期刊《科学报告》（Scientific Reports）报道了美国科学家对人类和人工智能的发散思维能力进行的一项测试研究。科学家

让151名人类志愿者与人工智能程序ChatGPT-4在三项测试中进行对决，评估二者的发散思维能力。结果显示，ChatGPT-4的表现优于所有人类参与者。发散思维能力是创造性思维能力的重要衡量指标，其特点是能对没有预期解决方案的问题提出独特的答案。也就是说，面对开放性问题，ChatGPT-4提供了比人类参与者更新颖、更精细的答案。

2024年5月，OpenAI发布了GPT-4o，其名称里的“o”是omni的缩写，也就是“全能”的意思。它可以接收文本、音频和图像的任意组合输入，并生成文本、音频和图像输出，可以在短至232毫秒、平均320毫秒的时间内响应音频输入，与人类在对话中的反应速度一致。

中国科学院计算技术研究所原所长李国杰院士在《中国科学院院刊》2024年第1期发表的文章《智能化科研（AI4R）：第五科研范式》里写到AI for Research，即人工智能可以用于研究。实际上，人工智能不仅可以用于研究，AI for Technology也没有问题，AI for Education更没有问题，它带来的是社会方方面面的变革。科研范式（scientific paradigm）、教育范式（educational paradigm）都需要改变。

2025年1月，美国亚利桑那州特许学校委员会批准了其下辖特许学校（政府拨款、私人运营的一类学校）无界学院（Unbound Academy）提出的“AI驱动的适应性学习技术”（AI-driven adaptive learning technology）计划。根据该计划，无界学院将在2025年招收完全经由AI教授文化课程的学生。这些学生每天只需跟随AI学习两个小时，其余时间在教师的陪同下进行专题研讨，以期更好地培养学生的批判性思维能力、创造性解决问题能力以及规划人生、进行演讲、开展自主学习等能力。

人工智能的赋能将使未来技术的迭代进一步加速。当机器有了感知能力、认知能力，将会带来怎样的影响？年青一代需要对此有紧迫感、敏锐性。不同的国家和民族发展进步的程度不同，能否抓住这个发展机遇是每个国家和民族面临的重大问题。如果我们的教育工作者不能非常敏锐、清醒地认识到新科技革命带来的变化，就很难把学生培养好。

三、加强基础研究和基础学科人才培养，是国家强大、民族复兴的根本所在

我一直在思考，为什么近代以来西方国家走在了世界的前列。我想，关键就在于他们对科学的重要作用的认识比我们要早得多、到位得多。1883年，美国物理学家亨利·罗兰（Henry Rowland）在美国科学促进会年会上作了题为“为纯科学呼吁”（A Plea for Pure Science）的演讲，后来在《科学》（Science）杂志上发表。这篇文章的内容涉及何谓大学、何谓大师、何谓科学、何谓教育、大学教授应该是一个什么样子、青年学者应该如何成长、社会怎么才能够进步等，号称是美国的“科学宣言”，在美国社会的影响非常大。

最近，我无意中看到《科学》杂志在1916年发表的一位美国教授撰写的《科学研究对工业的重要性》（The Importance of Scientific Research to the Industries）评述文章。这篇文章的一些观点放到今天也并不过时。其中有一个重要观点是：从长远的眼光看，没有无用的基础研究。若干年后，今天的基础研究突破可能构成新的工业或者科学发展的里程碑。文章呼吁产业界和政府重视那些聚焦揭示事物发展基本规律和底层原理的研究，以及在未来具有变革性的技术进步。这篇文章最后一段引用的是法国化学家杜马（Dumas）的话“未来属于科学”。1870年法国在与普鲁士的战争中战败，法国全国上下都在反思，杜马认为振兴法国没有别的办法，只能靠科学，他的那篇著名演讲就叫“未来属于科学”（The Future Belongs to Science），科学就是未来。

1930年，拥有亿万资产的商人和慈善家班伯格（Bamberger）兄妹，请教育改革家弗莱克斯纳（Flexner）帮助建立一个新的研究机构。当时美国社会存在高等教育过分功利化、过分组织化和科研教学庸俗化的现象，实用型的研究机构已经够多了，于是弗莱克斯纳建议创办一个新型的高级研究机构，聘请各个学科的第一流学者，开展前沿基础研究。研究院只设少数终身教授职位，其他研究人员则是非固定的成员或访问学者。研究什么、怎样研究，一切听任学者们自己的想法，研究院只负责提供足够的经费。这就是著名的普林斯顿高等研究院的来历。

该研究机构以人为中心，而不是以学科为中心；规模小，拥有少数“大师”级学者，爱因斯坦、冯·诺依曼、哥德尔、奥本海默等都曾在此工作；摒除一切“服务性”职能，以纯理论研究为唯一目的；与大学保持密切联系，弥补学科的局限性和人员不足。在普林斯顿高等研究院的地下室设计并建造了世界上第一台高速存储程序计算机，这是曼哈顿计划的核心。普林斯顿高等研究院的成功创办使得弗莱克斯纳对于科学研究的认识进一步加深，为此，在差不多十年后，他撰写出版了著名的《无用知识的有用性》（The Usefulness of the Useless Knowledge）。

1945年7月，在第二次世界大战即将结束之际，应罗斯福总统的要求，美国科学家万尼瓦尔·布什（Wannevar Bush）等编写了《科学：无尽的前沿》（Science：Endless Frontier）报告。该报告为战后美国科学技术的发展指明了方向，该报告建议政府设立国家研究基金会，更加重视基础科学研究，给予科学工作者更多的研究自由等。这些理念和建议直到今天仍然熠熠生

辉，常读常新。

事实上，大凡重视基础研究的国家都尝到了甜头，走在了世界前列。以美国为例，美国国防高级研究计划署（Defense Advanced Research Projects Agency，DARPA）是美国军方的原创研究管理机构。1957 年，苏联率先发射了人造地球卫星，给了美国一记技术突袭。为应对威胁，美国军方于 1958 年 2 月组建了 DARPA，旨在加强基础研究以提升美国的国家安全能力。DARPA 资助的基础研究后来引起了很多技术变革，典型案例包括但不限于：（1）预防流行性疾病技术；（2）互联网的前身阿帕网（ARPANET）技术；（3）深度学习技术；（4）集成电路技术；（5）量子计算和感知技术；（6）隐身技术；（7）宽禁带半导体技术等。

四、让社会各界充分认识基础研究的重要作用，中小学科学教育意义重大

我们国家此前对技术应用的重视多于对基础研究的重视，近年来我们才开始加强对基础研究的重视，特别是美国在科技领域打压我们之后，我们开始反思我们的科学教育和人才培养。2024 年初，在上海组建了上海数学与交叉学科研究院，丘成桐院士担任首任理事长，中国科学院院士、复旦大学教授李骏担任首任院长。这个研究院的理念和美国普林斯顿高等研究院的理念几乎是一样的。我觉得这个做法特别好，我们这么大的一个国家，经过多年发展，已经积聚了足够的实力，应该沉下心来做一些意义重大的事情。这种着眼长远、旨在源头创新的长周期科学研究需要鼓励创新、宽容失败的社会文化。广大中小学科学教师不仅承担着传授科学知识的责任，也担负着培育科学文化的重任。

2021 年 6 月，美国参议院通过的《2021 年美国创新与竞争法案》整合了此前旨在限制中国的多个法案，包括芯片和 5G 开放无线接入网紧急拨款、《无尽前沿法案》、《2021 年战略竞争法案》和《2021 年迎接中国挑战法案》等。2022 年 8 月 9 日，时任美国总统拜登在白宫正式签署《芯片与科学法案》。该法案推出以后，立刻引起了全世界广泛关注。该法案分五年执行，总额 2800 亿美元，核心内容是为了解决美国国内芯片安全问题，通过对内补贴促进本土芯片产业发展，进而遏制中国等国家的芯片产业发展。“卡现在”已经升级到“卡未来”。

美国在高科技方面限制中国，只能使我们更加清醒地认识到基础研究的重要性和创新型人才培养的重要性。需要注意的是，创新人才培养不能只盯着高水平大学，中小学教育也十分关键。世界正在经历百年未有之大变局，中国式现代化建设到了最关键时期，科技创新已经成为决定中华民族命运最为重要的因素，让社会各界充分认识到科学研究，特别是基础研究的重要作用，科学教育工作者责任重大。基础研究是技术创新的源头，是创新型国家建设的重要基石。基础研究容不得急功近利。意义重大的基础研究突破只能寄希望于科学家个体的兴趣和坚持，而这类科学家的出现需要包容个性的文化、鼓励创新的土壤。因此，重视科学教育与人才培养对于孕育志存高远的科学家、对于中华民族伟大复兴意义重大。

As one of the first university students after the restoration of the college entrance examination following China's reform and opening up, I am a beneficiary of education. Education can change my destiny, and education can also change the destiny of a country. China did three big things around education reform at that time: first, the resumption of the college entrance examination system in 1977; second, the decision to send a large number of students to study abroad in 1978; and third, the implementation of the academic degree system in 1981. The implementation of these three systems solved the problem of a constant supply of talents needed for national construction and shortened the gap between China and the developed countries. The history of educational development in the People's Republic of China can be roughly divided into three stages: the first stage was the first 30 years of P.R.C., when we learned from the Soviet big brother and laid the foundation; the second stage was the 40 years of reform and opening up, when we introduced, digested, and absorbed Western science and technology to accelerate our development and narrow the gap; and now that we have entered a new stage of development, we need a new concept of innovation-driven development.

I. Human civilization faces unprecedented major challenges and human capacity to respond to crises is increasing

Human society has developed to the present day and faces many challenges. Take the climate issue for example, there are more and more extreme climates. In 2022 Pakistan had mega floods in which one-third of the land was flooded. On July 6, 2023, according to the National Oceanic and Atmospheric Administration (NOAA) and the University of Maine in the U.S., the global temperature hit an all-time high, with the global average temperature 2 meters above the Earth's surface reaching 17.23 ℃, exceeding the joint record of 17.18 ℃, which had been set on July 4 and 5 and had broken the previous record of 17.01 ℃ set on July 3. This was the hottest week on Earth since instrumental records began in the 1850s. In February 2024, Argentina's wetlands were hit by a historic drought, while Brazil was plagued by torrential rains. In June 2024, northwestern India and eastern and southern Pakistan were hit by sustained high temperatures. The growing environmental and energy problems need to be solved by new science and technology.

At the same time, the rapid development of science and technology represented by artificial intelligence (AI) has enhanced the ability of human beings to cope with crises. In March 2016, Google's artificial intelligence Go program AlphaGo defeated world champion and professional nine-dan player Lee Sedol in a man-machine battle, winning 4-1. Since then, the program has played against dozens of Go masters from China, Japan, and South Korea without a single loss. In 2018, Google launched AlphaFold, an artificial intelligence program for predicting protein structures. Protein structure is very complex, but the AI solved it so well and with such high accuracy that the result quickly won the Nobel Prize in Chemistry in 2024.

Chemistry is an experimental discipline, and Robot Chemist, an AI chemistry robot developed by a team of researchers at the University of Liverpool, UK, in 2020, is able to learn from 98 million alternative experimental data to intelligently optimize reaction conditions. ChatGPT-4, launched by OpenAI, Inc. in 2023, has already been successfully used for designing and synthesizing brand new compounds, and can be used for high-performance new material design, and even mathematical problem solving. In March 2023, researchers at the University of Toronto, Canada, in collaboration with AI biotech company Insilico Medicine, used an AI drug discovery platform to develop a potential therapeutic drug for hepatocellular carcinoma in just 30 days. On July 9, 2023, the world's first robot-led press conference was held.

It can be seen that artificial intelligence-enabled scientific research has been irreversible. The third industrial revolution is in the ascendant, the fourth industrial revolution has quietly emerged, and the world's political and economic patterns are being reshaped. We should clearly realize that all the technologies that bring revolutionary progress in history must come from breakthroughs in basic research, and basic research is the source of the scientific and technological revolution.

II. In the face of the AI-based fourth industrial revolution, the paradigm of research and education is in need of urgent change

Scientific and technological revolutions are the fundamental driving force behind the development of human civilization, and each of them has dramatically changed the destiny of mankind and reshaped the world's political and economic landscape. The first industrial revolution relied on steam engines and machinery; the second industrial revolution relied on electricity; and the third industrial revolution relied on computers and the Internet. Now, artificial intelligence has become the core driving force of mankind's fourth industrial revolution. The first three industrial revolutions, with steam engines, electricity and information technology as their cornerstones, have profoundly changed the course of human civilization, and we need to better cope with the impact of the fourth industrial revolution, which has artificial intelligence as its cornerstone.

On January 28, 2024, the Beijing Institute of General Artificial Intelligence released the world's first general-purpose intelligent little girl, "Tongtong". She is capable of generating tasks on her own and serving in the education and healthcare industries. She keeps the house spotless and magically notices every household chore needing attention, and steps up to tackle it. She can remember who stole the apple, will play a little temper, will be bored, and when she is bored, she can go to watch TV. ...... The introduction of "Tongtong" means that the prototype of general artificial intelligence has been formed. The purpose of general artificial intelligence is to make intelligent agents like people, not only can independently perceive the environment, think, make decisions, learn new skills, perform tasks, but also be able to understand human emotions.

In February 2024, the international journal Scientific Reports reported on a test study conducted by American scientists on the divergent thinking abilities of humans and artificial intelligence. The scientists pitted 151 human volunteers against the AI program ChatGPT-4 in three tests to assess the divergent thinking abilities of both. The results showed that ChatGPT-4 outperformed all human participants. Divergent thinking ability is an important measure of creative thinking ability, which is characterized by the ability to come up with unique answers to problems that do not have an expected solution. That is, faced with open-ended questions, ChatGPT-4 provided more novel and refined answers than human participants.

In May 2024, OpenAI released GPT-4o, the "o" in its name is an abbreviation for omni, which means "omnipotent". It can receive any combination of text, audio, and image inputs and generate text, audio, and image outputs, and can respond to audio inputs in as little as 232 milliseconds, with an average of 320 milliseconds, which is in line with the speed of human response in a conversation.

Academician Li Guojie, former director of the Institute of Computing Technology of the Chinese Academy of Sciences, wrote about AI for Research, i.e., AI can be used for research, in his article "Intelligent Scientific Research (AI4R): the Fifth Scientific Research Paradigm," which was published in Proceedings of the Chinese Academy of Sciences, Issue 1, 2024. In fact, not only AI can be used for research, AI for Technology is no problem, AI for Education is no problem at all, and it brings about changes in all aspects of society. Scientific paradigm and educational paradigm need to be changed.

In January 2025, the Arizona State

Charter School Board approved the "AI-driven adaptive learning technology" program proposed by its charter school, Unbound Academy (a privately operated, government-funded school). Under the program, Unbound Academy will enroll students in 2025 who will be taught general knowledge courses entirely through AI. These students will spend only two hours a day learning with AI, and the rest of the time in seminars accompanied by teachers, in order to better develop their critical thinking skills, creative problem-solving skills, and the ability to plan their lives, give presentations, and engage in self-directed learning.

The empowerment of artificial intelligence will further accelerate future iterations of technology. What will be the impact when machines have the ability to sense and recognize? The younger generation needs to have a sense of urgency and sensitivity to this. Different countries and nations have different levels of development and progress, and whether or not they can seize this opportunity for development is a major issue for every country and nation. If our educators do not recognize the changes brought about by the new scientific and technological revolution with great sensitivity, it will be difficult to train our students well.

III.Strengthening basic research and talent cultivation in basic disciplines is fundamental to the strength of the state and the rejuvenation of the nation

I have been thinking about why the Western countries have been at the forefront of the world in recent times. I think the key lies in the fact that their understanding of the important role of science is much earlier and more in place than ours. In 1883, the American physicist Henry Rowland made a speech titled "A Plea for Pure Science" at the annual meeting of the American Association for the Advancement of Science, which was later published in the journal Science. The content of this article involves what is a university, what is a master, what is science, what is education, what a university professor should be like, how young scholars should grow, how society can progress, etc., which is known as the American "Science Manifesto", and has had a great impact on the American society.

Recently, I came across an article "The Importance of Scientific Research to the Industries", a review written by an American professor and published in Science magazine in 1916. Some of the ideas in this article are still relevant today. One of the key points is that, in the long run, there is no such thing as useless basic research. Years from now, today's basic research breakthroughs may constitute new industrial or scientific milestones. The article calls on industry and government to emphasize research that focuses on revealing the fundamental laws and underlying principles of how things develop, as well as technological advances that will be transformative in the future. The last paragraph of the article quotes the French chemist Dumas, who said, "The future belongs to science." In 1870, when France was defeated in the war with Prussia, the whole country reflected on the situation, and Dumas believed that there was no other way to revitalize France but through science. "The Future Belongs to Science", science is the future.

In 1930, the Bamberger siblings, billionaire businessmen and philanthropists, asked education reformer Flexner to help them establish a new research institution. At the time, American society was overly utilitarian and overly organized in higher education and vulgar in research and teaching, and there were already enough practical research institutes, so Flexner suggested the creation of a new type of high-level research institute that would employ first-class scholars from a variety of disciplines to carry out cutting-edge basic research. The institute would have only a handful of tenured professorships, and the rest of the researchers would be non-tenured members or visiting scholars. As for what to study and how to study, everything is left to the scholars' own discretion, and the institute is only responsible for providing adequate funding. This is the origin of the famous Princeton Institute for Advanced Study.

This research institute is people-centered rather than discipline-centered; it is small in size and has a handful of "master" scholars, such as Einstein, Von Neumann, Gödel, Oppenheimer, etc., who have worked here; it excludes all "service" functions, and takes purely theoretical research as its sole purpose; it maintains close ties with universities to compensate for the limitations of the discipline and the lack of staff. The design and construction of the world's first high-speed storage program computer in the basement of the institute was the centerpiece of the Manhattan Project. The success of the Princeton Institute of Advanced Study led to a deepening of Flexner's understanding of scientific research, for which he wrote and published his famous "The Usefulness of the Useless Knowledge" almost a decade later.

In July 1945, at the end of the Second World War, at the request of President Roosevelt, American scientists Wannevar Bush and other scientists compiled the report "Science: Endless Frontier". The report pointed out the direction for the development of science and technology in the United States after the war, and it recommended that the government set up the National Research Foundation, pay more attention to basic scientific research, and give scientists more freedom of research. These ideas and recommendations are still shining today and are always new.

As a matter of fact, all countries that attach importance to basic research have tasted the sweetness and taken the lead in the world. Take the United States as an example, the U.S. Defense Advanced Research Projects Agency

(DARPA) is the U.S. military's original research management agency. In 1957, the Soviet Union took the lead in launching an artificial earth satellite, giving the U.S. a technological surprise. In response to the threat, the U.S. military formed DARPA in February 1958, with the goal of strengthening basic research to enhance U.S. national security capabilities. DARPA-funded basic research has since led to a number of technological transformations, with typical examples including, but not limited to, the following: (1) pandemic disease prevention technology; (2) the predecessor of the Internet, the ARPANET; (3) deep learning technology; (4) integrated circuit technology; (5) quantum computing and sensing technology; (6) stealth technology; and (7) wide-band semiconductor technology.

IV. Enabling all sectors of society to fully recognize the important role of basic research and the science education in primary and secondary schools is of great significance

Our country previously paid more attention to technology applications than to basic research, and it is only in recent years that we have begun to strengthen our emphasis on basic research, especially after the United States suppressed us in the field of science and technology, and we have begun to rethink our science education and talent cultivation. At the beginning of 2024, the Shanghai Institute of Mathematics and Interdisciplinary Research was formed in Shanghai, with Academician Yau Shing-Tung as the first chairman and CAS Academician, Fudan University Prof. Li Jun served as the first director. The concept of this institute is almost the same as that of the Princeton Institute for Advanced Study. I think this approach is particularly good. As such a large country, after years of development, we have accumulated enough strength, so we should concentrate on doing something significant. This kind of long-cycle scientific research with a long-term perspective aiming at source innovation requires a social culture that encourages innovation and tolerates failure. Science teachers in primary and secondary schools bear not only the responsibility of imparting scientific knowledge, but also the important task of fostering a scientific culture.

In June 2021, the American Innovation and Competitiveness Act of 2021, passed by the U.S. Senate, consolidated a number of previous bills aimed at restricting China, including the Chip and 5G Open Radio Access Networks Emergency Appropriations, the Endless Frontiers Act, the Strategic Competitiveness Act of 2021, and the Meeting the China Challenge Act of 2021. On August 9, 2022, then-President Joe Biden officially signed the Chip and Science Act at the White House. Immediately after its introduction, the bill attracted widespread attention around the world. The bill is implemented in five years, with a total investment of 280 billion U.S. dollars, and its core content is to solve the U.S. domestic chip security issues, through internal subsidies to promote the development of the local chip industry, and then curb the development of China and other countries in the chip industry. The "blocking now" has been upgraded to "blocking future".

The United States' restrictions on China in the area of high technology can only make us more conscious of the importance of basic research and the importance of training innovative talents. It should be noted that the cultivation of innovative talents can not only focus on high-level universities, primary and secondary education is also very critical. The world is experiencing a great change that has not been seen in a hundred years, Chinese-style modernization has reached the most critical period, scientific and technological innovation has become the most important factor in determining the fate of the Chinese nation, so that all sectors of society fully understand the importance of scientific research, especially the important role of basic research, in which science educators have a great responsibility. Basic research is the source of technological innovation and an important cornerstone for the construction of an innovative country. Basic research should not be rushed. Significant breakthroughs in basic research can only rely on the interest and persistence of individual scientists, and the emergence of such scientists requires a culture of tolerance for individuality and a soil that encourages innovation. Therefore, attaching importance to science education and talent training is of great significance to the nurturing of scientists with high aspirations and to the great rejuvenation of the Chinese nation.

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