

GUEST EDITORIAL

Innovative and Multidisciplinary Research of Materials Science at Fudan University

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1 | Introduction

This Special Issue is collected to celebrate the 121st anniversary of Fudan University (FDU). Featured articles are contributed by the faculty of FDU, spanning a wide range of research areas in materials science, including micro-nano electronic and optoelectronic materials, hydrogen energy materials, polymer films and coating materials, biomedical materials, as well as engineering materials and their service behaviors.

FDU is situated in Shanghai, China. As a comprehensive and research-oriented national key university, it is directly affiliated with the Ministry of Education and jointly built with the Shanghai Municipal Government. Established in 1905, it merged with Shanghai Medical University in 2000, forming a strong foundation in liberal arts, social sciences, engineering, and medicine. FDU has consistently ranked among one of the top universities in China in the major domestic and international rankings, including the Quacquarelli Symonds World University Rankings 2025 (QS) and Times Higher Education World University Rankings 2025 (THE). With campuses in Handan, Fenglin, Zhangjiang, and Jiangwan, FDU boasts a strong faculty and academic reputation, making significant contributions to talent cultivation, academic research, technological advancements and national developments (Figure 1).

Materials science and engineering (MSE) stands as a core interdisciplinary discipline at Fudan University. Founded in 1986, the Department of Materials Science at FDU is one of China's earliest engineering-oriented materials departments established in comprehensive universities. Over the past four decades, the department has evolved into a nationally leading and internationally recognized center for materials research and talent education. It has consistently strengthened its original innovation and orig-



FIGURE 1 | The Jiangwan campus of Fudan University. Copyright Fudan University (<https://www.fudan.edu.cn/>).

inal research capabilities, fueling the high-quality advancement of materials science and engineering. It has established itself as a pivotal hub for scientific and technological innovation and talent cultivation rooted in Shanghai, serving national strategic needs and embracing global academic frontiers.

Building on this strong foundation, the College of Smart Materials and Future Energy (Figure 2), formally established on April 16, 2025, is FDU's important strategic arrangement to advance engineering development and align disciplinary construction with national needs for new quality productive forces and emerging industries. Centered on the integration of industry, education, science and research, the college develops a complete innovation and talent cultivation chain spanning basic research, technological R&D and industrial translation, and pioneers an AI-enabled model for smart materials and future energy



FIGURE 2 | The building of the college of smart materials and future energy at Fudan University. Copyright FDU University.



FIGURE 3 | The logo of College of Smart Materials and Future Energy and the corresponding meaning as iCOME.

disciplines. FDU's materials science and engineering discipline, the core of the college, ranks among the world's top 1‰ in ESI rankings. Focusing on key technical challenges in smart materials and future energy, the college drives the integration of new materials, new energy and artificial intelligence through interdisciplinary collaboration, with key research areas covering intelligent catalysis, clean energy, flexible smart materials, bio-nanomaterials, optoelectronics, sensing, intelligent design and characterization.

The logo of College of Smart Materials and Future Energy names iCOME, and each letter corresponds to innovation, collaboration, outlook, mission, and empowerment, respectively (Figure 3). Backed by four research bodies and two national key laboratories, the college endeavors to build a world-class innovation platform in 5 to 10 years and facilitate the commercialization of research outcomes. In order to exhibit FDU's characteristic R&D progress, we are pleased to publish this Special Issue in *Advanced Materials*. The special issue comprises 22 Reviews and 10 Perspectives, covering the full scope of the aforementioned key research fields in materials science and engineering.

2 | Highlights of the Special Issue

In the area of electronic and optoelectronic materials, Wenwu Li and coworkers review ferroelectric transistors from materials innovation to intelligent electronic systems ([adma.202515480](#)); Peng Zhou and coworkers discuss integrated neuromorphic

photonic computing for AI acceleration ([adma.202508029](#)); Xiaosheng Fang and coworkers summarize chiral metal halides toward circularly polarized photodetectors ([adma.202508016](#)); Jianlu Wang and coworkers present advanced architectures and emerging materials for high-operating-temperature infrared photodiodes ([adma.202508115](#)); Xuefeng Lu and coworkers introduce conjugated macrocycles for host–guest recognition and optoelectronic applications ([adma.202506256](#)); Ziqi Liang and coworkers provide a perspective on refining exciton dissociation and charge transport of nonfullerene organic photovoltaics ([adma.202509697](#)); and Fan Zhang and coworkers discuss antenna effect for enhanced near-infrared luminescence in lanthanide-doped nanoparticles ([adma.202508521](#)).

In the area of flexible electronics and advanced manufacturing, Zhuo Li and coworkers review three-dimensional interconnect technologies for advanced flexible electronics ([adma.202510294](#)); Jiandong Ding and coworkers summarize skin-relevant biomaterials spanning wound healing, medical aesthetics, flexible electronics to artificial intelligence ([adma.202512919](#)); Yongfeng Mei and coworkers discuss origami and kirigami on nanomembranes: design, fabrication and applications ([adma.202510883](#)); Yan Zhao and coworkers present advances in stretchable polymer semiconductors for human-machine integration ([adma.202507519](#)); and Dacheng Wei and coworkers review multi-scale manufacturing of organic electronic materials ([adma.202509949](#)).

In the area of energy storage and catalytic materials, Yong-Ning Zhou and coworkers review recent progress in cathode materials for Ca-ion batteries ([adma.202510291](#)); Jie Zhao and coworkers discuss general prelithiation approaches and corresponding full cells design ([adma.202508874](#)); Yonggang Wang and coworkers address challenges for aqueous organic redox flow batteries regarding electrolyte degradation and ion-selective design ([adma.202507952](#)); Yanhui Guo and coworkers summarize hydridoborate-based solid electrolytes for all-solid-state batteries ([adma.202507809](#)); Dongliang Chao and coworkers provide a perspective on high-energy aqueous sulfur battery chemistry ([adma.202507561](#)); Peng-Cheng Chen and coworkers review polyelemental nanoparticle catalysts ([adma.202507944](#)); Angang Dong and coworkers discuss surface ligands in nanocrystal electrocatalysis ([adma.202507862](#)); Yang Liu and coworkers present machine learning-driven nanoscale synthesis for electrocatalytic performance ([adma.202508263](#)); and Gengfeng Zheng and coworkers review electrocatalytic and photocatalytic C–N coupling from small molecules ([adma.202507144](#)).

In the area of bio/medical and sensing materials, Guosong Chen and coworkers review immunofunctions of protein and carbohydrate assemblies modulated by multi-scale structures ([adma.202509881](#)); Wenbo Bu and coworkers provide a perspective on piezo-bio interaction interfaces of piezoelectric nanomaterials for biomedicine ([adma.202507881](#)); Xuemei Sun and coworkers discuss design, construction, and application of implantable fiber biosensors ([adma.202508190](#)); Limin Wu and coworkers review advancing soft mechanosensors by colloidal design ([adma.202508349](#)); and Yonghui Deng and coworkers present tailoring chemiresistive nanomaterials toward integrated circuit compatible gas sensor fabrication ([adma.202508411](#)).

In the area of intelligent and functional materials, Renbing Wu and coworkers review intelligentization of electromagnetic functional materials from design to applications ([adma.202510212](#)); Hongjun Xiang and coworkers summarize recent advances in unconventional ferroelectrics and multiferroics ([adma.202507070](#)); Min Chen and coworkers provide a perspective on developments and opportunities in temperature-responsive thermal smart materials ([adma.202509337](#)); Huisheng Peng and coworkers discuss metal-backboned polymers from a materials viewpoint ([adma.202509064](#)); Faxian Xiu and coworkers review hybrid superconducting-magnetic van der Waals heterostructures ([adma.202507866](#)); and Wei Li and coworkers introduce versatile synthesis of mesoporous nanomaterials via monomicelle-directed assembly ([adma.202508715](#)).

Finally, we are sincerely grateful to the editors especially Dr. Duoduo Liang, Dr. Anke Osterland and the editorial team of *Advanced Materials* for the support on publishing this issue. By the chance of this special issue, we would like to celebrate the 40th anniversary of the Department of Materials Science & the first anniversary of the College of Smart Materials and Future Energy of Fudan University (FDU). We hope this Special Issue will fully display the fruitful research achievements of FDU in the field of materials science, and inspire more in-depth collaboration between FDU and institutions worldwide.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

Biographies



Xiaosheng Fang is a Professor in the College of Smart Materials and Future Energy at Fudan University. After receiving his Ph.D. from the Institute of Solid State Physics, Chinese Academy of Sciences in 2006, he served as a Japan Society for the Promotion of Science (JSPS) Postdoctoral Fellow and later as a Tenure-track Researcher at the National Institute for Materials Science (NIMS) in Japan from 2006 to 2010. He joined Department of Materials Science at Fudan University as a Professor in 2010, and now works at College of Smart Materials and Future Energy. His current research interests are primarily focused on micro/nanostructured semiconductors and their applications in advanced photodetectors.



Renbing Wu is a Professor in the College of Smart Materials and Future Energy at Fudan University. After receiving his Ph.D. from Zhejiang University in 2009, he served as Research Fellow at the School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore from 2011 to 2015. He joined Department of Materials Science at Fudan University in 2015, and now works at College of Smart Materials and Future Energy. His current research interests are primarily focused on carbon/metal-based materials and their applications in energy storage and conversion.



Yanlei Yu is Professor and Executive Dean of the College of Smart Materials and Future Energy at Fudan University. She graduated from Anhui University in 1993 and obtained her Master's degree from the University of Science and Technology of China. She joined Fudan University in 1996 and was promoted to Full Professor after she gained the Doctoral degree from Tokyo Institute of Technology in 2004. She obtained Distinguished Young Scholars Award from the National Natural Science Foundation of China (NSFC) (2012), Chang Jiang (Cheung Kong) Scholar Chair Professor (2016), and the first prize of Natural Science Award of Shanghai twice as the primary contributor (2019, 2024) etc. Her research interests focus on the development of smart liquid crystal polymers and soft machines.



Dongyuan Zhao is a Professor and Dean of the College of Smart Materials and Future Energy at Fudan University. He received his B.S. (1984), M.S. (1987) and PhD (1990) from Jilin University. He then served as a postdoctoral fellow at University of Houston (1995–1996) and University of California at Santa Barbara (1996–1998). He is a member of Chinese Academy of Sciences and The World Academy of Science (TWAS). He has devoted himself for more than 30 years to the interfacial assembly and synthesis of ordered functional mesoporous materials for applications in catalysis, batteries, environmental science, sensors, and biology. Prof. Zhao has received numerous awards, including Tan Kah Kee Science Award in 2024, National Innovation Medal in 2023, Shanghai Science and Technology Hero in 2022, National Natural Science First Prize in 2020 and Second Prize in 2004, American Chemical Society ACS Nano Award in 2021, Nano Research Award in 2020, Khwarizmi International Award in 2019, JCIS Darsh Wasan Award in 2018, Chemical Contribution Award from Chinese Chemical Society in 2018, TWAS-Lenovo Science Prize in 2016, Ho-Leung-Ho-Lee Award in 2009, IMMA Achievement Award in 2008, etc.