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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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研究院项目在中国国际大学生创新大赛（2025）校内选拔赛中获两金一银

INCSMM projects win gold and silver medals in campus selection for China Int’l College Student Innovation Competition (2025)

近日，新概念传感器与分子材料研究院三个项目在中国国际大学生创新大赛（2025）陕西师范大学校内选拔赛上取得好成绩，分获两项金奖、一项银奖。

金奖项目“‘膜’力全开—自适应刚柔并济薄膜引领传感新时代”面向公共安全与反恐实战需求，通过构建“刚性荧光基团 + 柔性聚合骨架”的分子结构体系，实现材料在保有优异力学柔韧性的同时具备对毒剂模拟物的高选择性识别与快速荧光响应，显著提升了薄膜传感器的整体性能。团队成员为刘倩华、田红、谢皓月、张玉玺、韩申宜、张佳、王茆榛，指导教师为彭浩南教授、谢攀副教授(国际商学院)和房喻院士。

金奖项目“‘苯’踪锐探—超灵敏苯系物光子鼻荧光阵列探测仪”面向苯系物原位快速检测需求，创新提出材料与器件协同设计策略，实现了灵敏度与稳定性的数量级突破，为研制高性能实用化传感器提供了全新解决方案。团队成员为陈周玉、韦何曦、谷雪、张晟琿、江艳、王政、宁晨羽、温翊宇、薛舒心、李奕霖、赵泽琦、刘若晞、郭晶晶，指导老师为张荷兰工程师、罗艳彦工程师和房喻院士。

银奖项目“‘毒’眼金睛—便携式在线原位毒品筛查仪”开发了针对含胺类新精神活性物质的便携式在线原位毒品筛查仪，建立了能够适应复杂环境的单检和混检的区分策略，实现了毒品分析物的高效检测。团队成员为陈怡嘉、罗雯丹、殷丽娜、王宝月、耿昱，指导老师为刘太宏副教授和杨春（国家毒品实验室陕西分中心）。

Recently, three projects of the Institute of New Concept Sensors and Molecular Materials won two gold awards and one silver award in the Shaanxi Normal University intra-school selection competition for the China International College Student Innovation Competition (2025).

The gold award-winning project, “Unleashing

the Power of Membranes: Adaptive Flexible and Rigid Thin Films Pioneering a New Era of Sensing,” addressing the practical needs of public safety and counter-terrorism, constructs a molecular structure system combining “rigid fluorescent groups + flexible polymer frameworks,” and achieves materials that retain excellent mechanical flexibility while exhibiting high-selective recognition of toxic agent simulants and rapid fluorescent responses, significantly enhancing the overall performance of thin-film sensors. The team members are Liu Qianhua, Tian Hong, Xie Haoyue, Zhang Yuxi, Han Shenyi, Zhang Jia, and Wang Maozhen, and the project advisors are Prof. Peng Haonan, Assoc. Prof. Xie Pan (International Business School), and Prof. Fang Yu.

The gold award-winning project, “Benzene Trace Detection: Ultra-Sensitive Benzene Compound Photon Nose Fluorescence Array Detector,” addresses the need for rapid in-situ detection of benzene compounds. It innovatively proposes a collaborative design strategy for materials and devices, achieving a significant breakthrough in sensitivity and stability, and providing a new solution for the development of high-performance practical sensors. The team members are Chen Zhouyu, Wei Hexi, Gu Xue, Zhang Shenghun, Jiang Yan, Wang Zheng, Ning Chenyu, Wen Hongyu, Xue Shuxin, Li Yilin, Zhao Zeqi, Liu Ruoxi, and Guo Jingjing, and project advisors are S. Engineer Zhang Holland, Engineer Luo Yanyan, and Prof. Fang Yu.

The silver award-winning project, “Eagle Eye—Portable Online In-Situ Drug Screening Instrument,” develops a portable online in-situ drug screening instrument targeting amine-containing new psychoactive substances, and establishes a differentiation strategy for single and mixed testing that can adapt to complex environments, achieving efficient detection of drug analytes. The team members are Chen Yijia, Luo Wendan, Yin Lina, Wang Baoyue, and Geng Yu, and the project advisors are Assoc. Prof. Liu Taihong and Ms. Yang Chun (National Anti-Drug Laboratory Shaanxi Regional Center).

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房喻院士出席陕西省传感器与物联网产业链推介招商签约互采对接会并作报告

Fang Yu speaks at Shaanxi Sensor and IoT Industry Chain Matchmaking Conference

2025 年 6 月 18 日，房喻院士应邀出席在西安高新区举办的陕西省传感器与物联网产业链推介招商签约互采对接会，并作了题为《新型传感技术及未来发展趋势》的主题报告，从分子材料视角切入，阐释传感器技术革新方向，为产业链技术突破提供了前瞻性启示。

在本次对接会上，陕西省传感器与物联网重点产业链和学科链协同创新联盟首次发布了“陕西省传感器与物联网重点产业链和学科链协同创新资源图谱”与“陕西省高校传感器与物联网产业技术研究成果”。

On June 18, 2025, Prof. Fang Yu attended the Shaanxi Province Sensor and Internet of Things Industry Chain Promotion, Investment Attraction, Signing, and Mutual Procurement Matchmaking Conference held in the Xi'an High-Tech Zone, and delivered a keynote speech titled “New Sensor Technologies and Future Development Trends”, approaching the topic from the perspective of molecular materials to elucidate the direction of sensor technology innovation, thereby providing forward-looking insights for breakthroughs in the industry chain.



At this conference, the Shaanxi Province Sensor and IoT Key Industry Chain and Discipline Chain Collaborative Innovation Alliance released for the first time the “Shaanxi Province Sensor and IoT Key Industry Chain and Discipline Chain Collaborative Innovation Resources Map” and “Shaanxi Province University Sensor and IoT Industry Technology Research Achievements.”

房喻院士、刘凯强教授参加“兰州化物所－赣江院创新融合项目”研讨会

Fang Yu and Liu Kaiqiang participate in seminar on “Innovation Integration Project of Lanzhou Institute of Chemical Physics - Ganjiang Innovation Institute”



2025 年 6 月 19 日，新概念传感器与分子材料研究院房喻院士、刘凯强教授应邀参加“兰州化学物理研究所－赣江创新研究院创新融合项目”研讨会。

房喻院士主持了项目进展汇报会，听取了项目阶段性成果介绍，针对项目研究难题提出了指导性意见与建议。

项目进展汇报会后，

房喻院士应邀作题为 Sensors–Driven Innovation in Molecular Materials 的学术报告，介绍了课题组在薄膜基荧光传感方向取得的最新研究进展，兰州化学物理研究所所长周峰研究员主持报告。刘凯强教授主持了第二个时段的报告会。

On June 19, 2025, Prof. Fang Yu and Prof. Liu Kaiqiang from the Institute

of New Concept Sensors and Molecular Materials were invited to attend the seminar on “Innovation Integration Project of Lanzhou Institute of Chemical Physics - Ganjiang Innovation Research Institute”.

Fang Yu presided over the project progress report meeting, listened to the report of the project’s interim results, and offered guidance and suggestions on the project’s research challenges.

Following the project progress report, Fang Yu presented a report titled “Sensors-Driven Innovation in Molecular Materials,” in which he introduced the latest research progress achieved by his research group in the field of film-based fluorescent sensing. The report was chaired by Zhou Feng, researcher and director of the Lanzhou Institute of Chemical Physics. Liu Kaiqiang chaired the second session of the report meeting.

房喻院士出席第四届西安市科普讲解大赛总决赛并为获奖选手颁奖

Fang Yu attends final contest of 4th Xi’an Science Popularization Presentation Competition and presents awards to winners

2025 年 6 月 25 日，新概念传感器与分子材料研究院房喻院士作为评委出席在西安广播电视台石榴花剧场举办的第四届西安市科普讲解大赛总决赛并为一等奖获奖选手颁发证书和奖杯。

此次大赛总决赛共有 30 位选手同台竞技，考察选手的科普知识掌握程度、语言表达能力、整体形象及临场应变能力，最终产生一等奖 5 名，二等奖 10 名，三等奖 15 名及优秀奖 47 名，优秀选手将被推荐参加省赛和国赛。

第四届西安市科普讲解大赛作为 2025 年西安市科技活动周的一项重要主场活动，自 3 月启动以来，吸引了众多科普爱好者和专业人士的关注和参与。66 家预赛单位推荐的 187 位选手进入半决赛，以专业的讲解和多样的表现形式为公众带来一场科学与人文交融的知识盛宴。

本届大赛由西安市科学技术局、中共西安市委宣传部、西安市人力资源和社会保障局、西安市总工会、共青团西安市委、西安市科学技术协会主办，西安科技产业发展中心、西安市职工科技创新中心承办。

On June 25, 2025, Pro. Fang Yu of the Institute of New Concept Sensors and Molecular Materials attended the final contest of the 4th Xi’an Science Popularization Presentation Competition held at the Pomegranate Flower Theater of Xi’an Broadcasting and Television Station as a judge and presented certificates and trophies to the first-prize winners.

A total of 30 contestants competed in the finals of this competition, which assessed their mastery of scientific knowledge, language expression skills, overall image, and ability to respond to unexpected situations. Ultimately, five



first prizes, ten second prizes, fifteen third prizes, and forty-seven honorable mention awards were awarded. The outstanding contestants will be recommended to participate in the provincial and national competitions.

As an important main event of the 2025 Xi’an Science and Technology Activity Week, the competition has attracted the attention and participation of many science popularization enthusiasts and professionals since its launch in March. A total of 187 contestants recommended by 66 preliminary competition units advanced to the semi-finals, delivering a knowledge feast that blends science and humanities through professional presentations and diverse performance formats.

This competition is hosted by Xi’an Science and Technology Bureau, Publicity Department of the CPC Xi’an Municipal Committee, Xi’an Human Resources and Social

Security Bureau, Xi'an Federation of Trade Unions, the Communist Youth League of Xi'an Municipal Committee, and Xi'an Association for Science and Technology, and organized by Xi'an Science and Technology Industry Development Center and Xi'an Workers Science and Technology Innovation Center.

房喻院士应邀出席 2025 年上海食品安全与消毒技术研讨会

Fang Yu presents at 2025 Shanghai Food Safety and Disinfection Technology Seminar

2025 年 6 月 27 日，新概念传感器与分子材料研究院房喻院士、彭军霞教授及研发工程师王佩参加了 2025 年上海食品安全与消毒技术研讨会。

房喻院士应邀作题为“面向先进技术的分子材料创新：从高性能传感器到 ClO₂ 控制释放”的报告。本次研讨会由上海市食品安全工作联合会食品安全与消毒专业委员会主办，相关事业单位、协会、食品生产、餐饮、消毒企业、检测机构代表等百余人参会。

On June 27, 2025, Prof. Fang Yu, Prof. Peng Junxia, and R&D Engineer Wang Pei from the Institute of New Concept Sensors and Molecular Materials attended the 2025 Shanghai Food Safety and Disinfection Technology Seminar.

Fang Yu presented a report titled “Innovation in Molecular Materials for Advanced Technologies: From High-Performance Sensors to Controlled Release of ClO₂.” The seminar was hosted by the Food Safety and Disinfection Professional



Committee of the Shanghai Food Safety Joint Working Committee, and attended by over 100 representatives from relevant institutions, associations, food production, catering, disinfection companies, and testing agencies.

薄鑫参加 2025 第四届高端制造电子电镀论坛并作报告

Bo Xin participates in 4th China Forum of Electronic Plating for Advanced Manufacturing

2025 年 6 月 27 至 29 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厦门举行的“2025 第四届高端制造电子电镀论坛”，并作了题为“精细电 / 化学镀与应用”的学术报告。

From June 27th to 29th, 2025, Assoc. Prof. Bo Xin from the Institute of New Concept Sensors and Molecular Materials participated in the “4th China Forum of Electronic Plating for Advanced Manufacturing” held in Xiamen and presented a report titled “Fine Electro/Electroless-Plating and Application”.

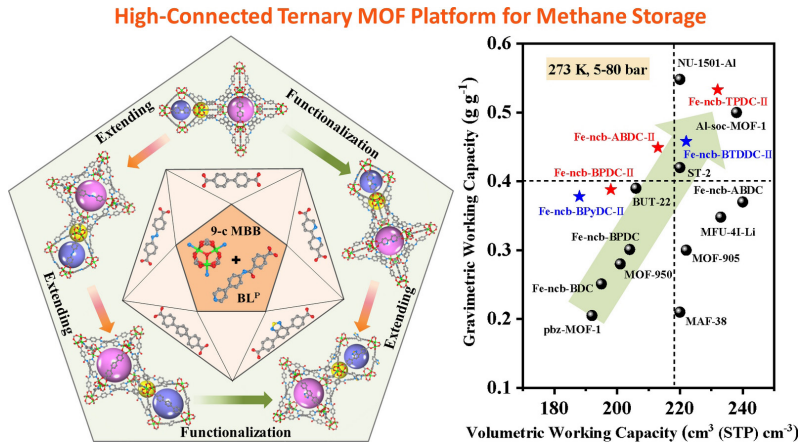


High-Connected Ternary Metal–Organic Framework Platform: Synthesis, Structure, and Methane Storage Capacity

Jie Zhou, Ya-Nan Ma, Yu-Feng Zhang, Bin Zheng, Ke Zheng, Shan Liu, Xin-Ai Guo, Yue-Biao Zhang, and Dong-Xu Xue*

高连接三基元 MOF 平台：合成、结构与甲烷存储

Jie Zhou, Ya-Nan Ma, Yu-Feng Zhang, Bin Zheng, Ke Zheng, Shan Liu, Xin-Ai Guo, Yue-Biao Zhang, and Dong-Xu Xue*. J. Am. Chem. Soc. 2025, ASAP. DOI: <https://doi.org/10.1021/jacs.5c04567>.



设计合成兼具高质量比和体积比甲烷存储工作能力的单一 MOF 材料对于推动天然气用于车辆运输具有重要的意义，但是具有很大的挑战性。这是由于单一多孔材料的质量比和体积比甲烷总吸附量之间存在着 trade-off 效应。高连接三基元 MOF 结构在同网络扩展时，晶体密度往往下降缓慢，材料的质量比表面积和体积比表面积往往都高，有望获取质量比和体积比总甲烷吸附量同高的多孔材料。

在这里，通过合成一个全新的吡啶–羧酸配体，联合三核铁簇及其系列不同长度或功能化的二羧酸配体，使用双溶剂体系和双调制剂的溶剂热

原理，我们成功构建了一个九连接三基元 MOF 平台。通过单晶 X 射线衍射技术，对制备的五个 MOF 材料的结构进行了解析。结果表明，均为 ncb 型拓扑网络，含有笼子–通道双孔多级孔结构，且不含开放金属位点。

通过多步溶剂交换并结合超临界二氧化碳活化法，该系列材料得到了成功活化，获得了可观的多孔性。其中孔体积在 1.90 cm³ g⁻¹ 以上，质量比表面积超过 4800 m² g⁻¹，体积比表面积也大于 1600 m² cm⁻³。80 巴高压甲烷吸附性能测试表明，系列材料呈现较高的总质量比和体积比甲烷吸附能力。特别地，当测试温度降低

至 273K，这些材料的总质量比和体积比甲烷吸附量增加显著。其中，通过最长二羧酸连接体构筑的 Fe-ncb-TPDC-II，其质量比和体积比甲烷存储工作能力分别达到 0.533 g g⁻¹，232 cm³ (STP) cm⁻³，相似条件下在报道的多孔材料中表现非常突出。该研究为制备高效天然气存储材料提供了新的思路。

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通讯作者：陕西师范大学薛东旭教授
全文链接：<https://doi.org/10.1021/jacs.5c04567>

The design and synthesis of a single metal-organic framework (MOF) that simultaneously achieve high gravimetric

and volumetric working capacities for methane storage is crucial for advancing the use of natural gas as a vehicular fuel. However, this presents a significant challenge due to the inherent trade-off effect between the gravimetric and volumetric total methane adsorption capacities of a single porous material. High-connected ternary MOF structures often exhibit slower crystal density reduction during isoreticular expansion, resulting in higher gravimetric and volumetric surface areas, thus holding promise to attain both high gravimetric and volumetric total methane adsorption capacities.

In this study, we initially synthesized a novel pyridine-carboxylic acid ligand and combined it with a trimeric iron cluster along with a series of dicarboxylic acid ligands of varying lengths or functionalities. Employing a dual-solvent system and dual-modulator solvothermal principles, we successfully constructed a 9-c ternary MOF platform. The structures of five prepared MOF materials were analyzed using single-crystal X-ray diffraction technique, revealing that they all feature a ncb-type topological network with a cage-channel biporous hierarchy and do not contain open metal sites.

Through a multi-step solvent exchange followed by supercritical carbon dioxide drying method, we successfully activated this series of materials, achieving substantial porosity, with pore volumes exceeding $1.90 \text{ cm}^3 \text{ g}^{-1}$, gravimetric surface areas surpassing $4800 \text{ m}^2 \text{ g}^{-1}$, and volumetric surface areas greater than $1600 \text{ m}^2 \text{ cm}^{-3}$. High-pressure methane adsorption tests at 80 bar demonstrated that the series of materials exhibited high total gravimetric and volumetric methane adsorption capacity. Notably, when the testing temperature was lowered to 273 K, these materials showed significant increases in total gravimetric and volumetric methane adsorption. Particularly, the Fe-ncb-TPDC-II constructed using the longest dicarboxylate linker achieved gravimetric and volumetric methane storage working capacities of 0.533 g g^{-1} and 232 cm^3

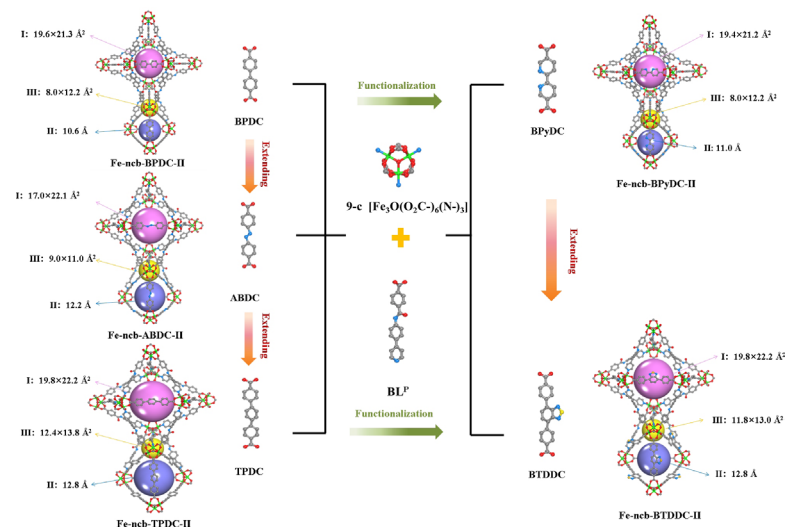


图1. 九连接 ncb 型 MOF 平台构建示意图。
Figure 1. Schematic representation showing the construction of 9-c ncb MOF platform.

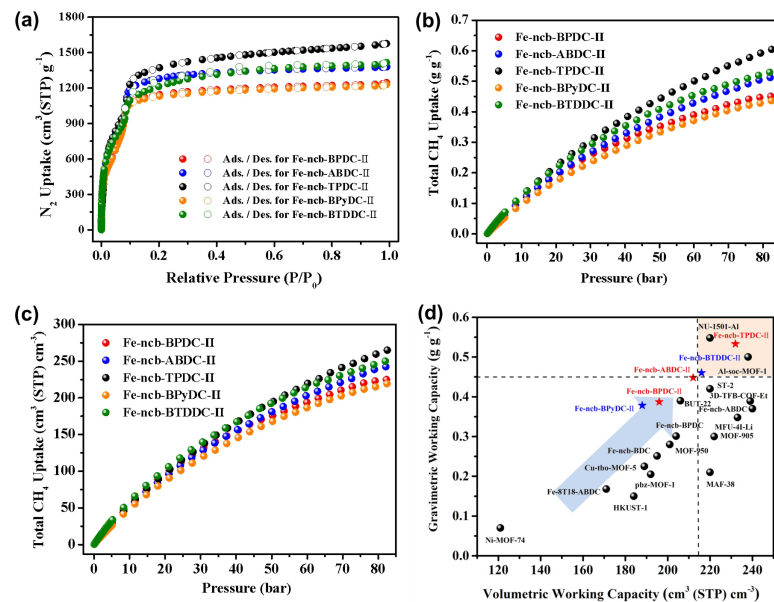


图2. 系列材料的 (a) 氮气吸附等温线; (b) 和 (c) 分别为总质量比和总体积比在 273K 的高压甲烷吸附等温线; (d) 质量比和体积比甲烷存储工作能力对比图。
Figure 2. (a) N_2 sorption isotherms, (b) total gravimetric and (c) volumetric methane adsorption isotherms at 273 K, and (d) comparison of the gravimetric and volumetric methane storage working capacities at 80 bar and 273 K for the five Fe-ncb-MOFs-II with some top-performing porous materials.

(STP) cm^3 , respectively, performing exceptionally well compared to reported porous materials under similar conditions. This study provides new insights into the preparation of efficient NG storage materials.

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台湾大学周必泰教授和新加坡科技设计大学刘晓刚副教授 应邀作报告

NTU's Pi-Tai Chou and SUTD's Liu Xiaogang invited to give presentations



2025 年 6 月 11 日上午, 应新概念传感器与分子材料研究院房喻院士邀请, 台湾大学周必泰教授和新加坡科技设计大学刘晓刚副教授在研究院报告厅分别作了题为“Innovative Functional Molecules/Materials, Their Fundamentals and Unique Properties”和“以构效关系为指导的荧光染料分子设计”的学术报告。

周必泰教授的报告聚焦分子设计理论和光谱技术等发光材料和能源中的应用, 阐释了“能隙定律”, 从理论和实验两方面证明了激子离域、氛同位素和分子自组装低频相干运动

的结合对内部重组能的抑制创新策略。这一突破跨越了能隙定律限制, 开辟了通过分子内激子离域来追求近红外有机发射体的新领域。

刘晓刚副教授通过理论计算与化学大数据相结合的方式, 系统总结和探究了荧光染料的工作原理及构效关系, 提出开发新型染料的设计法则, 并探索其在生物成像、生化检测、化学教育方面的应用。

报告会由房喻院士主持, 研究院师生近 80 余人参加了报告会, 并与两位报告人在光物理技术理论与应用方面进行了讨论。

当日下午, 刘晓刚副教授在题为“如何写好科研论文: 我的‘三板斧’方法论”的专题学术报告中, 分享科研论文撰写技巧与经验, 拓宽了同学们的学术视野, 激发了他们对科学研究的兴趣。本次报告由彭浩南教授主持。

On the morning of June 11, 2025, at the invitation of Prof. Fang Yu of the Institute of New Concept Sensors and Molecular Materials, Prof. Pi-Tai Chou from China's National Taiwan University and Assoc. Prof. Liu Xiaogang from Singapore University of Technology and



Design presented reports in the institute’s lecture hall, under the titles of “Innovative Functional Molecules/Materials, Their Fundamentals and Unique Properties” and “Fluorescent Dye Molecular Design Guided by Structure-Activity Relationships” respectively.

Prof. Chou’s report, focusing on the application of molecular design theory and spectral technology in luminescent materials and energy, expounded the “energy gap law”, and demonstrated from both theoretical and experimental perspectives an innovative strategy for suppressing internal recombination energy by the combination of exciton

delocalization, deuterium isotopes, and low-frequency coherent motion of molecular self-assembly. This breakthrough transcends the limitations of the energy gap law and opens up a new field of pursuing near-infrared organic emitters through intramolecular exciton delocalization.

A/Prof. Liu systematically summarized and explored the working principle and structure-activity relationship of fluorescent dyes by combining theoretical calculations with chemical big data, proposed design rules for developing new dyes, and explored their applications in biological imaging,

biochemical detection, and chemical education.

The reports were presided over by Prof. Fang Yu. Nearly 80 teachers and students from the institute attended the meeting and had discussions with the two speakers on the theory and application of optical physics technology.

In the afternoon of the same day, A/Prof. Liu Xiaogang shared the skills and experiences of writing research papers in a special report titled “Effective Science Writing”, broadening the academic horizons of the students and stimulating their interest in scientific research. This report was hosted by Prof. Peng Haonan.

华南理工大学胡斌教授应邀作报告

Prof. Hu Bin from South China University of Technology invited to give a report



2025年6月28日下午，华南理工大学材料科学与工程学院胡斌教授应邀来新概念传感器与分子材料研究院访问，并作题为《利用光物理自旋物理实验手段揭示激发态动力学深层次次光电子学行为》的学术报告。

胡斌教授围绕激发态过程中的“自旋-极化-能量”三参量耦合关系，

介绍了其团队在多个前沿体系中的研究进展，包括分子聚集诱导的反常电-声子耦合效应、光诱导分子极化激发的自增强光伏行为、手性激子螺旋序转变、以及电荷转移态引发的自旋激子反常发光行为等重要发现，还重点展示了圆偏振激子磁学响应等最新实验成果，拓展了新型光电子学材料的

设计思路。

On June 28, 2025, Prof. Hu Bin from the School of Materials Science and Engineering of South China University of Technology was invited to visit the Institute of New Concept Sensors and Molecular Materials and presented a report titled “Revealing the Deep-level

Photoelectronic Behaviors of Excited State Dynamics by Utilizing Optical and Spin Physical Experimental Approaches”.

Hu Bin presented the coupling relationship among “spin-polarization-energy” parameters during the excited state process and introduced the research

progress of his team in several frontier systems, including the abnormal electron-phonon coupling effect induced by molecular aggregation, the self-enhanced photovoltaic behavior of photo-induced molecular polarization excitation, the chiral exciton helical order transition, and

the abnormal luminescence behavior of spin excitons triggered by charge transfer states. He also highlighted the latest experimental results such as the circularly polarized exciton magnetic response in the report, which expanded the design ideas of new optoelectronic materials.

无锡市新吴区领导章金伟、顾国栋一行来访

Wuxi City Xingwu District officials Zhang Jinwei and Gu Guodong received



2025年6月30日，无锡高新区党工委副书记、管委会副主任、新吴区委副书记、区长章金伟，高新区党工委副书记、管委会副主任、新吴区委常委、副区长顾国栋一行到访新概念传感器与分子材料研究院。

房喻院士和研究院副院长杨小刚与章金伟、顾国栋一行进行了座谈交流，介绍了研究院基本情况和发展理念。

研究院副院长丁立平教授带领来宾参观了综合展厅，介绍了研究院科研方向、技术优势、研究成果及战略布局。

章金伟、顾国栋对研究院在新概念传感器与分子材料两个领域取得的

成果表示高度赞赏，并表达了未来开展深度合作的意愿。

On June 30, 2025, Zhang Jinwei, deputy secretary of the Party Working Committee and deputy director of the Administrative Committee of Wuxi High-Tech Zone, deputy secretary of the Party Working Committee and district chief of Xinwu District, and Gu Guodong, deputy secretary of the Party Working Committee and deputy director of the Administrative Committee of Wuxi High-Tech Zone, member of the Standing Committee of the Party Working Committee and deputy district chief of Xinwu District, visited the Institute of New Concept Sensors and Molecular Materials.

Prof. Fang Yu and INCSMM vice dean Yang Xiaogang held a discussion with Zhang Jinwei, Gu Guodong, and their delegation, introducing the basic situation and development philosophy of the institute.

INCSMM vice dean Prof. Ding Liping led the guests on a tour of the exhibition hall and introduced the institute’s research directions, technological advantages, research achievements, and strategic layout.

Zhang Jinwei and Gu Guodong highly praised the achievements made by the institute in the fields of new concept sensors and molecular materials, and expressed their willingness to engage in in-depth cooperation in the future.







