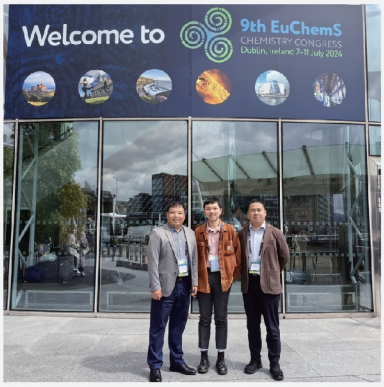
陕西师范大学 SHAANXI NORMAL UNIVERSITY

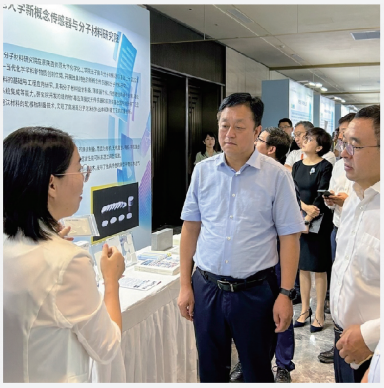
化学化工学院 School of Chemistry & Chemical Engineering

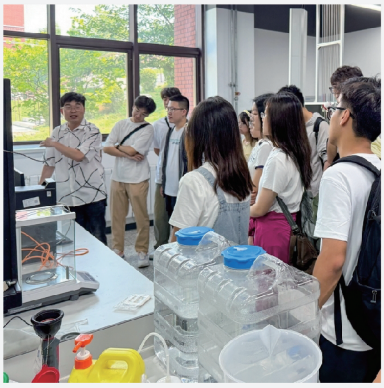
新概念传感器与分子材料研究院 INSTITUTE OF NEW CONCEPT SENSORS AND MOLECULAR MATERIALS

新概念传感器与分子材料研究院 简报 07 2024

Institute of New Concept Sensors and Molecular Materials Newsletter







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房喻院士参加《痕量炸药 / 毒品探测仪通用技术要求》修订会

Fang Yu attends meeting on revision of General Technical Requirements for Trace Explosives / Illicit Drug Detectors

2024 年 7 月 5 日，房喻院士赴上海参加由公安部第三研究所主办的《基于荧光聚合物传感技术的痕量炸药 / 毒品探测仪通用技术要求》行业标准立项启动暨征求意见讨论会，与公安部相关业务局人员及相关研发、生产、管理、应用等相关单位代表一起讨论修改完善这一行业标准。

On July 5, 2024, Prof. Fang Yu participated in the industry standard project launch and consultation meeting for the "General Technical Requirements for Fluorescent Polymer Sensing Technology-based Trace Explosives / Illicit Drug Detectors" in Shanghai, which was sponsored by the Third Institute of the Ministry of Public Security, discussing the modification and improvement of this industry standard with the staff of relevant bureaus of the Ministry of Public Security and representatives of relevant units of research and development, production, management and application.

房喻院士参加第十届全国高校物理化学课程教学讨论会并作报告

Fang Yu speaks at 10th National Seminar on the Teaching of Physical Chemistry in Colleges and Universities

2024年7月5日至8日，“第十届全国高等学校物理化学（含实验）课程教学研讨会”在沈阳召开，房喻院士应邀参会并作题为《从基础研究的重要性看教育与人才培养》的主题报告。

本次会议由南开大学、沈阳化工大学、科学出版社联合主办，参会的国内物理化学课程教学领域知名专家、教学名师讲授了物理化学（含实验）课程中的难点、重点、教学改革动态、物理化学基本原理的应用及学科前沿内容，研讨了物理化学（含实验）课程教学内容、教学方法改革思路以及数字教材建设、数字资源建设、课程思政建设等。彭灵雅老师参加了会议。

From July 5 to 8, 2024, the 10th National Seminar on the Teaching of Physical Chemistry (including Experiments) in Colleges and Universities was held in Shenyang, and Prof. Fang Yu attended the seminar and gave a keynote speech titled "Education and Talent Cultivation from the Perspective of the Importance of Basic Research".

The seminar was co-sponsored by Nankai University, Shenyang University of Chemical Technology and Science Press. Experts and teachers in the field of physical chemistry teaching taught and discussed the difficulties and key points of physical chemistry (including experiments), the recent development of teaching reform, the application of basic principles of physical chemistry and the frontiers of the discipline, as well as the teaching content, teaching method reform ideas, digital textbook development, digital resources construction, curriculum ideological and political construction. Dr. Peng Lingya attended the seminar.

房喻院士在学院党委理论学习中心组（扩大）学习会议上进行宣讲

Fang Yu delivers lecture at Theoretical Learning Center Group learning meeting of SCCE Party Committee

2024 年 7 月 10 日上午，化学化工学院召开党委理论学习中心组（扩大）集体学习会议，房喻院士受邀出席会议并对习近平总书记在全国科技大会、国家科学技术奖励大会、两院院士大会上的重要讲话精神进行宣讲。

党委书记高玲香主持会议并领学了习近平总书记在大会上的重要讲话原文，学院党委中心组成员、省部级以上高层次人才、教工党支部书记、教研室主任参加了此次学习会议。

房喻院士分享了参加大会的切身感受。房院士谈到，距离 2035 年建成科技强国的目标仅剩十一年时间，科技发展进入了很关键的阶段，深切感受到科研工作者身上肩负的重担和为国家发展贡献力量的责任。他指出，现阶段科研工作面临着重大变革，不能再用固有的眼光去看新的问题。一方面，国家加强了对科学研究的支持力度，加速推动科技成果转移转化；另一方面，人工智能的出现使得科研方法、研究手段发生了巨大的改变。结合学院学科发展实际，他强调科研工作者第一要善于运用创新性思维，接受新改变、利用新事物、产出新成果；第二要做有目的的研究，有价值的研究，基础研究就要“纵向到底”、挖深挖透，应用研究就要“横向到边”、主动对接企业需求；第三要攥指成拳，集合能集合的所有力量，有导向性的进行顶层谋划，以解决实际问题为目标，将研究做深做强。

On July 10, 2024, Fang Yu was invited to attend the collective learning meeting (expanded) of the Theoretical Learning Center Group of the Party Committee of School of Chemistry and Chemical Engineering, and delivered a lecture on the spirit of the important speech made by Xi Jinping, general secretary of the Communist Party of China Central Committee at a meeting conflating the National Science and Technology Conference, the National Science and Technology Award Conference, the 21st General Assembly of Academicians of the Chinese Academy of Sciences, and the 17th General Assembly of Academicians of the Chinese Academy of Engineering.

SCCE Party Committee secretary Gao Lingxiang presided over the meeting and led the study of the important speech. Members of the central group of SCCE Party Committee, high-level talents at the provincial and ministerial level or above, secretary of the Party branch of the faculty, and director of the Teaching and Research Office participated in the study meeting.

Fang Yu shared his personal reflection on attending the conference. He said that with only 11 years to go before the goal of building a powerful country in science and technology by 2035, the development of science and technology has entered a very critical stage, and he deeply felt the burden of scientific research workers and the responsibility of contributing to the development of the country. He pointed out that scientific research at this stage is facing major changes and can no longer look at new problems with the unchanged vision. On the one hand, the state has strengthened its support for scientific research and accelerated the transfer and transformation of scientific

and technological achievements. On the other hand, the emergence of artificial intelligence has made great changes in scientific research methods and research methods. Combined with the actual development of the school's disciplines, he stressed that researchers should first be good at using innovative thinking, accepting new changes, using new things, and producing new results; Second, to do purposeful research, valuable research, basic research should be "vertical to the end", dig deep and dig through, applied research should be "horizontal to the edge", take the initiative to meet the needs of enterprises; Third, to clench the fingers into a fist, gather all the forces that can be

gathered, carry out top-level planning with orientation, and solve practical problems as the goal, and make research deeper and stronger.

刘太宏、刘忠山副教授参加第九届欧洲化学大会并作报告

Liu Taihong and Liu Zhongshan present at 9th European Chemistry Congress

2024 年 7 月 7 日至 11 日，新概念传感器与分子材料研究院刘太宏、刘忠山副教授参加了在爱尔兰都柏林会议中心举行的第九届欧洲化学大会（9th EuChems Chemistry Congress），并分别作了题为 Distinct two-photon excited squaraines for bright and selective bioimaging 和 The shaping of covalent organic frameworks 的口头学术报告。

欧洲化学大会是每两年举行一次的化学家国际会议，第一届大会于 2006 年在匈牙利布达佩斯召开。本次第九届大会由爱尔兰化学研究所组织承办，参会人数达到 1650 余人，会议共设 8 个会议主题、8 个大会特邀报告、84 个邀请报告和 534 个口头报告，以及墙报展示等。

From July 7 to 11, 2024, associate professors Liu Taihong and Liu Zhongshan from the Institute of New Concept Sensors and Molecular Materials attended the 9th EuChems Chemistry Congress held at the Dublin Convention Center, Ireland, and presented oral reports titled "Distinct two-photon excited squaraines for bright and selective bioimaging" and "The shaping of covalent organic frameworks" respectively.

The EuChems Chemistry Congress is an international conference of chemists held every two years, which started in Budapest, Hungary, in 2006. The 9th Congress was organized by the Institute of Chemistry of Ireland, with more than 1650 participants, and there were 8 conference themes, 8 special invited reports, 84 invited reports and 534 oral reports, as well as wall posters.

房喻院士受邀担任中国化学会科普工作委员会化学科普专家团成员

Fang Yu to serve as an expert member of CCS's Science Popularization Work Committee

2024 年 7 月 17 日，房喻院士收到中国化学会科普工作委员会的邀请函，受邀担任科普工作委员会“化学科普专家团”成员，对委员会的科普活动提供指导、咨询和帮助，并参与相关活动。

中国化学会科普工作委员会于 6 月 16 日成立，唐勇院士担任首届主任委员。

On July 17, 2024, Prof. Fang Yu received an invitation from the Science Popularization Work Committee of the Chinese Chemical Society and was invited to serve as a member of the “Chemistry Science Popularization Expert Group” of CCS's Science Popularization Work Committee, to provide guidance, consultation and help for the science popularization activities of the committee, and to participate in related activities.

The Science Popularization Work Committee of the Chinese Chemical Society was established on June 16, and Academician Tang Yong serves as the first chairman.

舒远红通过博士后出站答辩

Shu Yuanhong passes postdoctoral report defense

2024 年 7 月 18 日下午，新概念传感器与分子材料研究院在研究院报告厅举行了舒远红博士后出站答辩，舒远红博士进行了题为“基于吡喃鎓盐化学的聚合物薄膜的创制及应用研究”的答辩报告。

西北工业大学介万奇教授担任答辩委员会主席，陕西师范大学丁立平教授、西北工业大学徐亚东教授和王红月研究员以及西安交通大学的何刚教授担任委员，陕西师范大学的彭灵雅讲师担任秘书。

答辩委员会就舒远红博士后工作的创新性、实验结果、报告内容等方面进行了讨论，并对相关工作的后续开展提出了建议，同意舒远红通过博士后出站答辩。

On July 18, 2024, the Institute of New Concept Sensors and Molecular Materials held postdoctoral report defense session for Dr. Shu Yuanhong in the lecture hall of the Institute, at which Dr. Shu presented his defense report titled “Preparation and Application of Polymer Films Based on Pyrylium Salt Chemistry”.

Prof. Jie Wanqi from Northwestern Polytechnical University served as the chairman of the defense committee, Prof. Ding Liping from Shaanxi Normal University, Prof. Xu Yadong and Prof. Wang Hongyue from Northwestern Polytechnical University, and Prof. He Gang from Xi'an Jiaotong University served as members, and Dr. Peng Lingya from Shaanxi Normal University served as secretary.

The defense committee discussed the innovation, experimental results and content of Shu Yuanhong's postdoctoral work, and put forward suggestions for the follow-up work, and gave their consent to Shu Yuanhong's postdoctoral report defense.

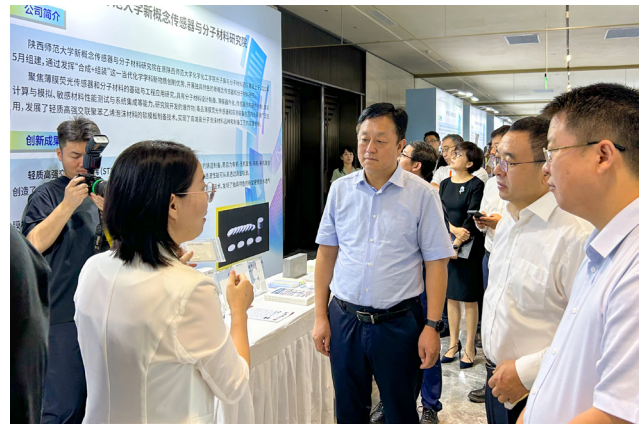
研究院四项科研成果参展陕西省技术交易大会

Four INCSMM research projects showcased at Shaanxi Technology Trade Fair

2024 年 7 月 17 日，陕西省技术交易大会在西安开幕，新概念传感器与分子材料研究院工程技术人员罗艳彦、刘姣姣等携带介电梯度材料、便携式苯系物检测仪、透气不透水材料和 STPS 泡沫材料等四项科研成果参展。

陕西省政协副主席高岭、中国工程院院士王玉明等多位领导专家来到展位，了解研究院科研成果及转化应用情况，并对研究院工作给予高度评价。

此次活动由陕西省科学技术协会主办，聚焦陕西省在智能感知技术方面的最新突破和产业化实践，吸引了众多业内专家和企业代表前来交流。



On July 17, 2024, research assistants Luo Yanyan and Liu Jiaojiao of the Institute of New Concept Sensor and Molecular Materials showcased four research projects including dielectric gradient materials, portable benzene series detector, breathable and impermeable material, and STPS foam materials at the Shaanxi Province Technology Trade Fair held in Xi'an.

Gao Ling, vice chairman of the Shaanxi Provincial Committee of the Chinese People's Political Consultative Conference, Wang Yuming, academician of the Chinese Academy of Engineering, and many other leaders and experts came to the INCSMM booth to learn about the its research achievements and the transformation and application and highly appreciated its work.

Organized by the Shaanxi Provincial Science and Technology Association, the event focuses on the latest breakthroughs and industrialization practices in intelligent sensing technology in Shaanxi Province, attracting many industry experts and business representatives to participate

房喻院士出席第五届国际聚合物发泡与多孔材料高峰论坛并作报告

Fang Yu presents at 5th Int'l Polymer Foam and Porous Materials Summit Forum

2024 年 7 月 17 至 18 日，第五届国际聚合物发泡与多孔材料高峰论坛在上海举行，新概念传感器与分子材料研究院房喻院士与彭军霞教授、专职科研人员王佩及何怡楠参加了会议。

房喻院士作了题为“高性能交联聚苯乙烯泡沫与多孔纳米膜——从密度可调块材到功能膜材料”的大会特邀报告。房喻院士指出，与物理发泡、化学发泡、空心微珠填充相比较，凝胶乳液模板法是一类全新的高强度泡沫材料制备技术，为高品质梯度高分子泡沫材料的增材制造提供了可能；作为多孔高分子材料的一种特殊形式，多孔纳米膜结构多样、性质特殊，有望在众多领域获得重要而又广泛应用。

此次会议由 SAMPE 中国大陆总会聚合物发泡与多孔材料专业委员会主办，华东理工大学、北京莱特沃德会展有限公司共同承办，近 300 名国内外发泡与多孔材料领域的专家学者参会。

From July 17 to 18, 2024, the 5th International Polymer

Foam and Porous Materials Summit Forum was held in Shanghai. Prof. Fang Yu and Prof. Peng Junxia, and full-time research assistants Wang Pei and He Yinan of the Institute of New Concept Sensors and Molecular Materials attended the meeting.

Prof. Fang Yu gave an invited report titled "High Performance Cross-linked Polystyrene Foams and Porous Nanomembranes - From Density Tunable Blocks to Functional Membrane Materials". Fang Yu said that when compared with physical foaming, chemical foaming and hollow microbead filling, gel emulsion template method is a new kind of high-strength foam material preparation technology, which provides the possibility of additive manufacturing of high-quality gradient polymer foam material; and as a special form of porous polymer material, porous nano-film has various structures and special properties, which is expected to gain important and wide application in many fields.

The forum was organized by the Polymer Foam and Porous Materials Committee of SAMPE China Mainland Chapter, co-organized by East China University of Science and Technology and Beijing Light World Convention and Exhibition Co., Ltd., and participated by nearly 300 domestic and foreign experts and scholars in the field of foaming and porous materials.

薄鑫副研究员率 2023 级化学笃学班赴中国科学院大连化物所游学

Bo Xin leads Class 2027 Duxue Chemistry students to visit CAS Dalian Institute of Chemical Physics

2024 年 7 月 18 至 20 日，薄鑫副研究员作为班主任带领陕西师范大学化学化工学院 2023 级化学笃学班 10 名同学前往中国科学院大连化学物理研究所开展了为期 3 天的游学活动。

7 月 18 日，笃学班一行前往大连化物所星海所区，听取了所招生办杨华、张文豪老师对研究所情况的介绍。随后同学们参观了李灿院士、刘中民院士、张涛院士、李先锋研究员、金玉奇研究员、吴凯丰研究员、许国旺研究员、徐兆超研究员和邓德会研究员实验室，了解各个团队的研究特色并与团队老师和研究生交流。

7 月 19 日，笃学班同学前往大连化物所能源学院所区，与兰州大学 2022 级萃英班同学一起参观了黄延强研究员、王峰研究员、陈萍研究员、陈忠伟院士、王方军研究员和冯亮研究员实验室，并与团队老师和研究生进行了座谈交流。

7 月 20 日，同学们参观了旅顺博物馆和旅顺日俄监狱旧址，接受了爱国主义教育。

From July 18 to 20, 2024, Dr. Bo Xin, as the head teacher, led 10 students from Class 2027 Duxue Chemistry Class of School of Chemistry and Chemical Engineering of Shaanxi Normal University to Dalian Institute of Chemical Physics, Chinese Academy of Sciences for a three-day study tour.

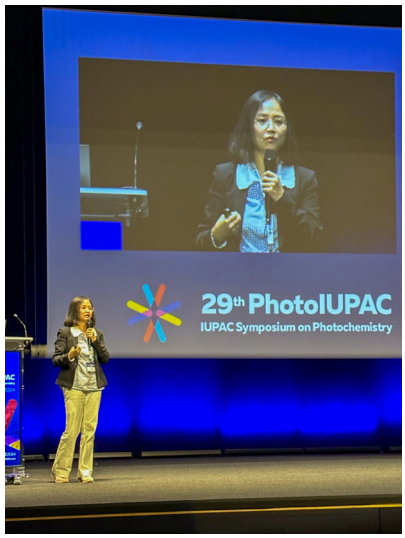
On July 18, the Duxue Class students went to Xinghai Campus of Dalian Institute of Chemical Physics and listened to the introduction of the institute by admission office's Yang Hua and Zhang Wenhao. The students then visited the laboratories of Academician Li Can, Academician Liu Zhongmin, Academician Zhang Tao, Researcher Li Xianfeng, Researcher Jin Yuqi, Researcher Wu Kaifeng, Researcher Xu Guowang, Researcher Xu Zhaochao and Researcher Deng Dehui to learn about the research characteristics of each team and communicate with the team teachers and graduate students.

On July 19, the students went to DICP's Energy College and visited the laboratories of Researcher Huang Yanqiang, Researcher Wang Feng, Researcher Chen Ping, Academician Chen Zhongwei, Researcher Wang Fangjun and Researcher Feng Liang together with the students of the Class 2026 Cuioying Class of Lanzhou University, and had a discussion with the team teachers and graduate students.

On July 20, the students visited the Lushun Museum and the site of the Russo-Japanese Prison in Lushun for patriotic education.

马佳妮教授参加 29 届 IUPAC 光化学会议并作报告

Ma Jiani presents at 29th IUPAC Symposium on Photochemistry



2024 年 7 月 14 至 19 日，新概念传感器与分子材料研究院马佳妮教授参加了在西班牙瓦伦西亚举办的 29 届 IUPAC 光化学会议，并作题为 Reaction Mechanism Studies on Selected Photochemical Reactions 的学术报告。

该会议由国际纯粹与应用化学联合会（IUPAC）组织，旨在召集国际光化学研究领域的知名专家和学者进行学术交流，共同探讨光化学研究领域的瓶颈科学问题，提出研究领域的未来发展方向。

From July 14 to 19, 2024, Prof. Ma Jiani of the Institute of New Concept Sensors and Molecular Materials participated in the 29th IUPAC Symposium on Photochemistry in Valencia, Spain, and presented a report titled Reaction Mechanism Studies on Selected Photochemical Reactions.

The symposium brings scientists and engineers from all over the world with expertise in photochemistry to tackle contemporary issues and highlight cutting edge methodologies and new theoretical and experimental developments.

房喻院士出席第五届中学化学思维课堂暨“核心素养教育”教学研究成果交流会议

Fang Yu presents at 5th Conference on Middle School Chemistry Thinking Classroom and Teaching Research Achievements Exchange

2024 年 7 月 26 至 27 日，第五届中学化学思维课堂暨“核心素养教育”教学研究成果交流会议在广东省佛山市佛山一中举办，房喻院士出席会议并作题为《构建新发展格局背景下教育与基础研究的作用》的主题报告。

本次会议由陕西师范大学出版总社中学化学教学参考编辑部主办，旨在增进专业理解，实施核心素养教育，促进中学化学教育高质量发展。

From July 26 to 27, 2024, the 5th Conference on Middle School Chemistry Thinking Classroom and Teaching Research Achievements Exchange on “Core Literacy Education” was held in Foshan No. 1 Middle School, Foshan City, Guangdong Province, where Prof. Fang Yu presented a keynote report titled “The Role of Education and Basic Research in the Context of Building a New Development Pattern”.

The conference was organized by the Editorial Department of Middle School Chemistry Teaching Reference of Shaanxi Normal University, aiming to enhance professional understanding, implement core literacy education, and promote the high-quality development of middle school chemistry education.

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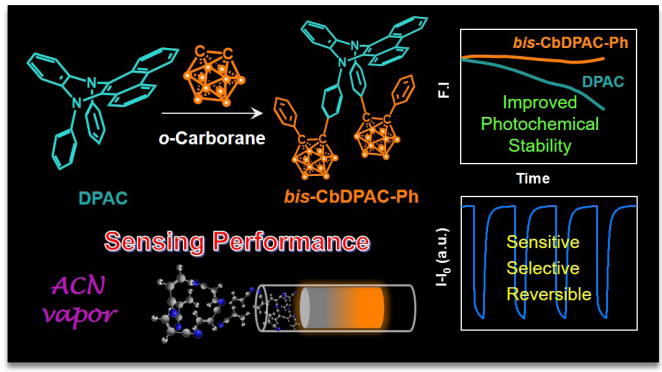
Hitting two birds with one stone: DPAC derivatization with *o*-carborane resulted in improved photochemical stability and enhanced sensing performance

Yangtao Shao, Rongrong Huang *, Yan Luo, Hexi Wei, Haonan Peng *, Yu Fang *

Key Laboratory of Applied Surface and Colloid Chemistry (Ministry of Education), School of Chemistry and Chemical Engineering, Shaanxi Normal University, Xi'an 710119, PR China

一石二鸟：DPAC 与邻碳硼烷的衍生物改善了光化学稳定性并且增强传感性能

Yangtao Shao, Rongrong Huang, Yan Luo, Hexi Wei, Haonan Peng, Yu Fang. Sensor Actuator B-Chem. 2024, 418, 136285.



薄膜基荧光传感是国际公认的新一代微量物质的超灵敏检测技术。它在公共安全、食品质量监督和疾病的早期诊断方面具有独特的优势和巨大的应用潜力。荧光膜传感器（FFSs）的核心是荧光传感单元，其中低分子量荧光单元因其精确的化学结构和灵活的分子构型而引起了广泛的关注。因此，传感材料的创新设计是开发高性能荧光薄膜传感器的关键。

在该工作中，通过在 DPAC 的对位引入邻碳硼烷 (图 1a) 并合成两个新的 DPAC 衍生物 CbDPAC–Ph 和 bis–CbDPAC–Ph。实验结果证明在固体状态下，这些化合物表现出典型的聚集

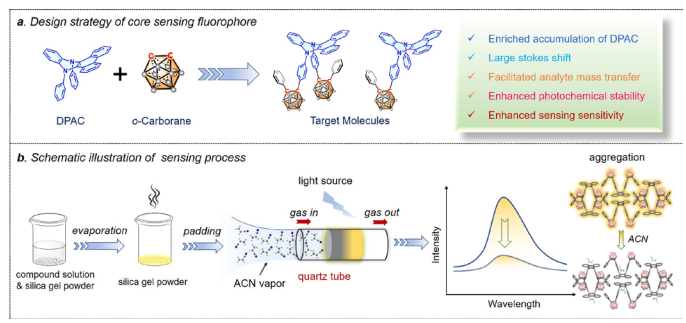


图 1. (a) 目标分子的设计策略和相关性质。(b) 使用便携式荧光管式传感器检测 ACN 蒸气的示意图。利用了邻碳硼烷功能化的 DPAC 衍生物 (bis–CbDPAC–Ph) 制备了荧光敏感管状传感器，暴露于气态 ACN 后，管状传感器中 bis–CbDPAC–Ph 的荧光明显猝灭。

Figure 1. (a) Design strategy and associated properties of the target molecule. (b) Schematic representation of ACN vapor detection using a portable fluorescence tubular sensor. A fluorescent-sensitive tubular sensor was fabricated using an o-carborane-functionalized DPAC derivative (bis-CbDPAC-Ph). The fluorescence of bis-CbDPAC-Ph in the tubular sensor is significantly quenched upon exposure to gaseous ACN.

诱导发射 (AIE) 和大斯托克斯位移。进一步对比发现与 DPAC 相比，邻碳硼烷的引入不仅显著提高了它们的光化学稳定性，同时也丰富的分子间的相互作用，产生新的发射中心，从而增大了斯托克斯转移。两种非平面结构的结合显著改善了分子在固体状态下的孔隙率。另外，与挥发性的有机化合物 (VOCs) 接触促进 DPAC 的构象弛豫和邻碳硼烷的旋转，增加了非辐射衰减，从而提高了传感灵敏度 (图 2)。在此基础上，我们开发了一种概念荧光管式传感器，并成功用于空气中丙烯腈 (ACN) 气体的检测 (图 1b)。

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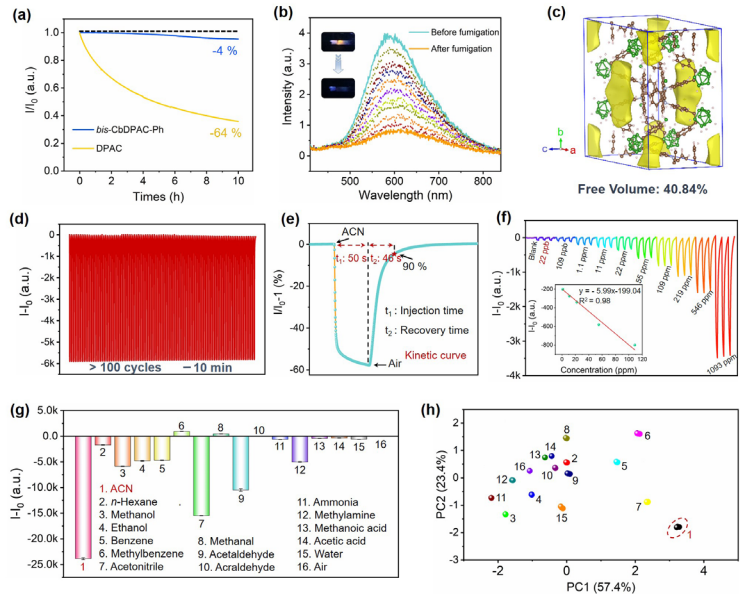

图 2. 基于 bis−CbDPAC−Ph 管式传感器的气相传感性能。(a) 利用 DPAC 和 bis−CbDPAC−Ph 构建的传感器的光化学稳定性。(b) 基于 bis−CbDPAC−Ph 的管式传感器在 590 nm (λ ex = 370 nm) 处的荧光发射强度随气体 ACN 暴露时间的变化。(c) 计算出 bis−CbDPAC−Ph 在结晶状态下的自由体积。使用 Multiwfn 和 VESTA 程序进行可视化，以黄色表示晶格中的孔隙空间 (网格间距 :0.25 Å，等值 :0.50)。(d) 管式传感器对 ACN 蒸气的传感在超过 100 圈时的可逆性和稳定性。(e) 详细分析了管式传感器对 ACN 蒸气的响应和恢复行为。(f) 传感器对不同浓度 ACN 蒸气的响应。附图显示了猝灭效率随浓度的变化曲线。(g) 传感器对 ACN 和其他潜在干扰气体的响应。(h) 二维 PCA 区分被测化学品的计分图。

Figure 2. The gas sensing performance of the bis-CbDPAC-Ph-based tubular sensor. (a) Photochemical stability of the sensor constructed from DPAC and bis-CbDPAC-Ph. (b) Fluorescence emission intensity changes of the bis-CbDPAC-Ph-based tubular sensor at 590 nm (λex = 370 nm) as a function of exposure time to gaseous ACN. (c) Calculated free volume of bis-CbDPAC-Ph in its crystalline state. Visualization was performed using the Multiwfn and VESTA programs, with yellow representing the pore space in the crystal lattice (grid spacing: 0.25 Å, iso-value: 0.50). (d) Reversibility and stability of the tubular sensor towards ACN vapor over 100 sensing cycles. (e) Detailed analysis of the response and recovery behavior of the tubular sensor to ACN vapor. (f) Sensor response to varying concentrations of ACN vapor. The inset shows the plot of quenching efficiency against concentrations. (g) Sensor responses to ACN and other potential interfering gases. (h) Two-dimensional PCA score plot for discriminating the tested chemicals.

Film-based fluorescence sensing is internationally recognized as a new generation of ultra-sensitive detection technology for trace substances. It has unique advantages and great potential applications in public safety, food quality supervision, and early diagnosis of diseases. The core of fluorescent film sensors (FFSs) is the fluorescence sensing unit, among which low molecular weight fluorescent units have attracted widespread attention due to their precise chemical structures and flexible molecular configurations. Therefore, the innovative design of sensing materials is pivotal for the development of high-performance fluorescence film sensors (FFSs).

In this work, two new DPAC derivatives, CbDPAC-Ph and bis-CbDPAC-Ph, were synthesized by introducing o-carborane to the para-positions of the DPAC moiety (Figure 1a). Experimental results demonstrate that in the solid state, these compounds exhibit typical aggregation-induced emission (AIE) and large Stokes shifts. Furthermore, compared to DPAC, the introduction of o-carborane not only significantly enhances their photochemical stability, but also fosters a rich network of intermolecular interactions that generates novel emission centers, thereby broadening the Stokes shift. The combination of two non-planar structures notably improves the porosity of the molecular packings in the solid state. Additionally, the contact with volatile organic compounds (VOCs) promotes the relaxation of the excited-state conformation of DPAC and the rotation of o-carborane, increasing non-radiative decays and thereby enhancing sensing sensitivity (Figure 2). On this basis, a conceptual fluorescent tube sensor was developed and successfully used for airborne acrylonitrile (ACN) detection (Figure 1b).

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RESEARCH ARTICLE

Dynamic response and discrimination of gaseous sarin using a boron-difluoride complex film-based fluorescence sensor

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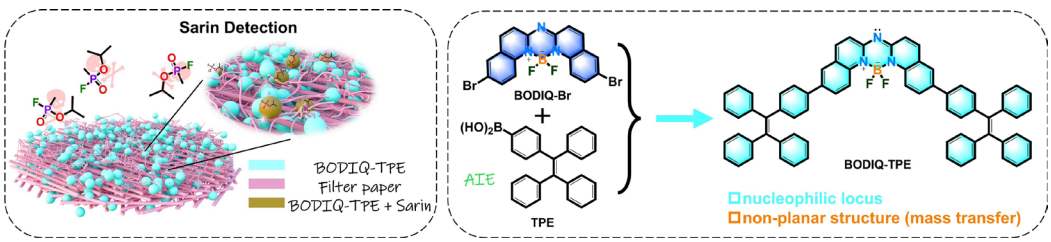
动态响应和鉴别沙林蒸汽的二氟化硼衍生物基纳米薄膜荧光传感器

Zhijie Zhou, Lei Zhang, Lingya Peng, Yingjie Li, Xiaolin Zhu, Yidi Wu, Zebiao Qiu, Gang He, Molin Qin, Haonan Peng, Yu Fang. Aggregate 2024, e629.



沙林是一种极具毒性的神经毒剂，能够对人体的神经系统造成严重危害，甚至危及生命。其次，沙林挥发性强且制备相对简单，使其潜在的危险性更加突出。因此发展沙林毒气迅速、准确、选择性的检测手段，有助于提升应急响应能力和处置效率，保障社会大众的健康与安全，维护社会稳定和和谐。薄膜荧光传感是目前公认最具潜力的微痕量物质探测技术。薄膜荧光传感被认为是最具潜力的微痕量物质探测技术，但要实现荧光物质与沙林之间的高效特异性相互作用，并精准区分沙林与其他酸性物质，仍是一个关键技术挑战。

本研究开发了一种基于二氟化硼衍生物的荧光纳米膜传感器，用于检测环境中的沙林蒸气并通过荧光信号进行反馈。该传感器的关键在于采用平面的二氟化硼衍生物（aza–BODIQ）作为荧光识别单元，其独特的化学结构赋予了探针能够与沙林发生有效相互作用。同时，引入四苯乙烯作为立体结构骨架，在显著促进了分子间的传质效率的同时，进一步增强了探针的稳定性，使沙林分子能够快速、充分地与探针发生作用，提高了检测的灵敏度和响应速度。此外，利用传感响应动力学差异，成功实现了沙林和

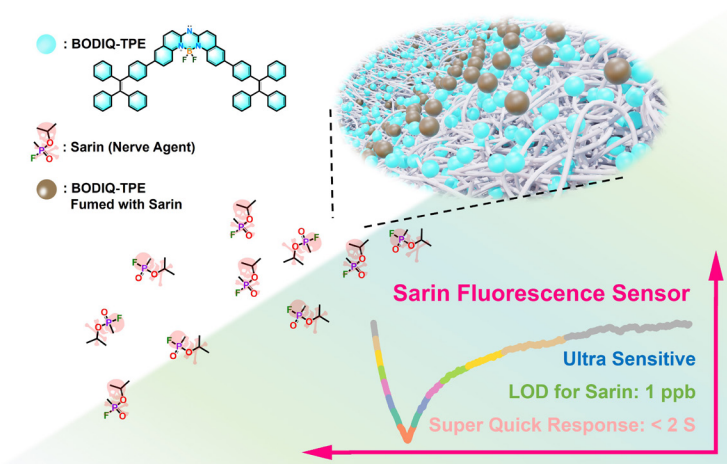


图 1. 二氟化硼衍生物基纳米薄膜及其沙林传感示意图
Figure 1. Scheme of the nanofilm based on boron-difluoride derivatives for sarin sensing

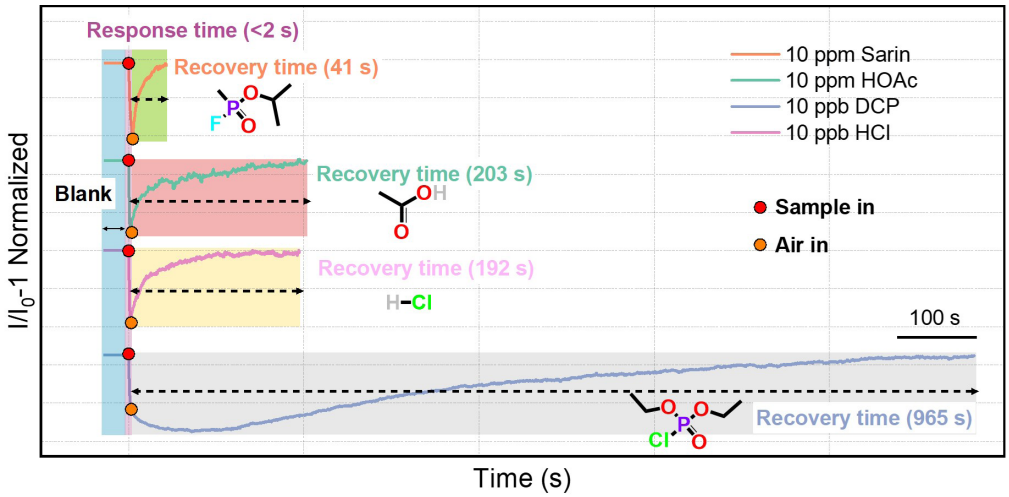


图 2. 传感响应动力学曲线

Figure 2. Sensing response kinetic curve

干扰酸性物质的精确区分。

该传感器在理论和实际应用中对沙林蒸气的检测限分别为 0.7 ppb 和 1 ppb，在各种干扰气体存在的情况下仍能保持极高的灵敏度。其响应时间小于 2 秒，能够迅速检测到沙林蒸气的存在。检测范围从 1 ppb 到 1000 ppm，覆盖了广泛的浓度范围，适用于多种环境条件。通过传感动力学分析，该传感器能够区分沙林、氯磷酸二乙酯和 HCl 蒸气，展示了其在复杂环境中的应用潜力。这为可持续、低成本和环保的便携式设备以及环境监测和跟踪应用开辟了新途径。

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Sarin is an extremely toxic nerve agent that can cause severe harm to the human nervous system, potentially even leading to death. Furthermore, its high volatility and relatively simple production process make it a particularly dangerous threat. Therefore, the development of rapid, accurate, and selective detection methods for sarin gas is crucial for enhancing emergency response capabilities and efficiency, safeguarding public health and safety, and maintaining social stability and harmony. Film-based fluorescence sensing is currently recognized as one of the most promising technologies for detecting trace amounts of substances. However, achieving efficient and specific interactions between fluorescent materials and sarin, as well as accurately distinguishing sarin from other acidic substances, remains a significant technical challenge.

This study developed a fluorescent nanomembrane sensor based on boron-difluoride derivatives for detecting sarin vapor in the environment and providing feedback through fluorescence signals. The sensor's key feature is the use of planar difluoroboron derivatives (aza-BODIQ) as the fluorescent recognition unit. Its unique chemical structure allows effective interaction with sarin. Additionally, tetraphenylethylene was introduced as a steric structural framework, significantly enhancing molecular mass transfer efficiency and further stabilizing the probe. This structural design enables rapid and complete interaction between sarin molecules and the probe, thereby improving detection sensitivity and response speed. Moreover, by leveraging differences in sensor response kinetics, the system successfully distinguishes sarin from interfering acidic substances with high precision.

The sensor demonstrates a theoretical and practical detection limit of 0.7 ppb and 1 ppb for sarin vapor, respectively. It maintains exceptionally high sensitivity even in the presence of various interfering gases. With a response time of less than 2 seconds, it can rapidly detect the presence of sarin vapor. The detection range spans from 1 ppb to 1000 ppm, covering a wide range of concentrations and making it suitable for diverse environmental conditions. Through sensor kinetics analysis, the device can distinguish between sarin, diethyl chlorophosphate, and HCl vapor, showcasing its potential for applications in complex environments. This paves the way for sustainable, low-cost, and eco-friendly portable devices, as well as applications in environmental monitoring and tracking.

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马佳妮教授参加西安光机所女科技工作者协会主题活动

Ma Jiani presents at event of XIOPM Women S&T Workers Association

2024 年 7 月 11 日，新概念传感器与分子材料研究院马佳妮教授参加了中国科学院西安光机所女科技工作者协会举办“抢占科技高地，共享智慧之光”主题活动暨第四期“西光她力量·成长圆桌派”活动并作题为“光笼分子反应机制的时间分辨光谱研究”的报告。

在报告中，马佳妮教授阐述了有机分子光化学反应机理研究在绿色化学合成和光功能分子开发领域中的重要价值，以及研究过程中面临的主要挑战和解决方案。

西安光机所女科技工作者协会会长梁峻，副会长苏秀琴、陈凤以及来自各部门的职工、研究生参加活动。

On July 11, 2024, Prof. Ma Jiani of the Institute of New Concept Sensors and Molecular Materials participated in the theme activity of “Seize the Science and Technology Highland, Share the Light of Wisdom” and the fourth “Her Power of XIOPM, Round Table for Growth” activity organized by the Women Science and Technology Workers Association of Xi’an Institute of Optics and Precision Mechanics of the Chinese Academy of Sciences and presented a report titled “Time-resolved spectroscopic study of reaction mechanism of light-cage molecules”.

In the report, Ma Jiani expounded the important value of the photochemical reaction mechanism of organic molecules in the field of green chemical synthesis and the development of light functional molecules, as well as the main challenges and solutions in the research process.

XIOPM Women Science and Technology Association president Liang Jun, vice presidents Su Xiuqin, Chen Feng and faculty members and graduate students from various XIOPM departments participated in the event.

陕西电子信息集团黄峰一行来访座谈

Shaanxi Electronic Information Group visitors received

2024 年 7 月 22 日下午，陕西电子信息集团党委委员黄峰一行到访新概念传感器与分子材料研究院，参观了综合展厅，并与房喻院士团队进行了座谈交流。

陕西电子信息集团刘戈专家介绍了集团情况及合作意向，研究院副院长丁立平教授介绍研究院基本情况，双方进行了交流讨论，最后房喻院士和黄峰分别总结讲话。

陕西电子信息集团高级专家千学著，科技部部长党胜茂、传感器产业推进办公室干事杨宸等陪同来访。

研究院刘静教授、彭军霞教授、对外联络与行政办公室主任杨小刚和秘书左振男参加了座谈交流。

On July 22, 2024, Shaanxi Electronic Information Group visitors led by SEIG Party Committee member Huang Feng visited the Institute of New Concept Sensors and Molecular Materials, had a discussion meeting with Prof. Fang Yu and his team, before touring its comprehensive exhibition room.

After SEIG expert Liu Ge introduced the group and cooperation intention, INCSMM vice dean Prof. Ding Liping briefed about the institute, the two sides had an exchange and discussion, and finally Prof. Fang Yu and Huang Feng summed up the meeting.

SEIG senior expert Qian Xuezhu, Department of Science and Technology chief Dang Shengmao, and Sensor Industry Promotion Office staff member Yang Chen accompanied Huang Feng during the visit.

Prof. Liu Jing, Prof. Peng Junxia, Liaison and Administrative Office director Yang Xiaogang and secretary Zuo Zhennan participated in the meeting.

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