第四届国际纳米功能材料和应用学术会议

4th International Symposium for Frontiers of Nanostructured Functional Materials and Applications

24-26 Nov 2017
Dongshan Hotel Suzhou

4th International Symposium for Frontiers of Nanostructured Functional Materials and Applications

Dongshan Hotel Suzhou, China, 24-26 Nov 2017

第四届国际纳米功能材料和应用学术会议

苏州东山宾馆，11 月 24-26, 2017

The aim of this international symposium is to discuss recent advances in nanostructured functional materials and their applications in catalysis, energy, environment, sensing, biomedical and electronic and optoelectronic devices. The key objective of this symposium is to build long-term scientific links and collaborations in these topics among all these parties, and to bring excellent scientists to discuss the recent progress and breakthroughs in these fields.

会议主席

张克勤 教授（苏州大学） **徐庆锋** 教授（苏州大学）
陈　伟 教授（新加坡国立大学）**霍峰蔚** 教授（南京工业大学）
王欣然 教授（南京大学） **倪振华** 教授（东南大学）
赖　敏 教授（南京信息工程大学）

会议国际学术委员会

许国勤（新加坡国立大学），**刘云圻**（中科院化学所），**黄维**（南京工业大学），**范滇元**（深圳大学），**路建美**（苏州大学），**俞书宏**（中国科学技术大学），**张华**（新加坡南洋理工大学），**肖韶荣**（南京信息工程大学）

会议组委会

陈冬赟（苏州大学），**牛天超**（南京理工大学）

会议秘书

孔金晶（新加坡国立大学苏州研究院），洪正琳(苏州大学)，尹菲（苏州大学）

会议主办单位

苏州大学，苏州纳米科技协同创新中心，新加坡国立大学苏州研究院，
新加坡国立大学，江苏省化学化工会

会议承办单位

苏州大学，新加坡国立大学苏州研究院，新加坡国立大学

会议协办单位

江苏先进生物与化学制造协同创新中心，南京大学，东南大学，南京信息工程大学，深圳大学教育部二维材料光电科技国际合作联合实验室

会议赞助单位

岛津企业管理(中国) 有限公司， 汉宣检测公司，江苏迈纳德微纳技术有限公司， 威格气体纯化科技（苏州），深圳市欧弗德光电科技有限公司， 南京心地天益光电科技有限公司， 上海恩谱莱真空科技有限公司， 牛津仪器科技(上海) 有限公司，布鲁克（北京）科技有限公司，南京诺派激光技术有限公司， 泰州巨纳科技， 杭州捷诺飞公司，上海厚先生物科技有限公司，上海顺测电子有限公司，北京理化赛思科技有限公司

致 谢

本届纳米功能材料及应用学术会议组委会向下列赞助单位对本次会议的鼎力支持表示衷心感谢！（排名不分先后）。

苏州汉宣检测公司

岛津公司

江苏迈纳德微纳技术有限公司

南京心地天益光电科技有限公司

上海恩谱莱真空科技有限公司

威格气体纯化科技（苏州）股份有限公司

牛津仪器（上海）有限公司

深圳市欧弗德光电科技有限公司

泰州巨纳新能源有限公司

布鲁克（北京）科技有限公司

杭州捷诺飞生科技股份有限公司

上海厚先生物科技有限公司

上海顺测电子有限公司

南京诺派激光技术有限公司

北京理化赛思科技有限公司

会议日程安排

	11 月 24	11 月 25	11 月 26
8:15-8:30		开幕式 (主持人：陈伟) 许国勤 致辞 路建美 致辞 鸿禧厅-1F	鸿禧厅-1F
8:30-9:50		大会报告 主持人：许国勤	大会报告 主持人：汪联辉
8:30-9:00		俞书宏	刘云圻
9:00-9:30		张锦	张华
9:30-9:40		威格	心地天益
9:40-9:50		岛津	诺派激光
9:50-10:20 Tea Break			
10:20-11:40		主持人：路建美	主持人： 张浩力
10:20-10:50		朱永法	唐智勇
10:50-11:20		李和兴	胡文平
11:20-11:30			迈纳德
11:30-11:40			恩谱莱
11:40-13:00 Lunch Break			
13:00-15:00		邀请报告	13:00-17:00: Panel discussion on four different research subjects
15:30-18:10		邀请报告	
	Reception (晚宴 1) 亿湖轩-**1F**	**晚宴 2** 郁金香-**1F**	**晚宴 3** 鸿运厅-**1F**

11 月 25

	Room1 会贤厅-2F	Room2 会融厅-3F	Room 3 (环境) 鸿源厅-1F	Room 4 鸿禧厅-1F
11:40-13:00 Lunch Break				
13:00-15:00	**主持人:吴迪**	**主持人:王欣然**	**主持人:徐梽川**	**主持人:刘小钢**
13:00-13:20	张铁锐	熊启华	Antonio Marcomini	王强斌
13:20-13:40	李振	于霆	ONG Choon Nam	汪联辉
13:40-14:00	陈虹宇	缪峰	郝郑平	林君
14:00-14:20	霍峰蔚	张学骜	周保学	陈志钢
14:20-14:40	张浩力	周鹏	邓积光	高明远
14:40-15:00	陈志宽	吕俊鹏	刘艳彪	范曲立
15:00-15:30 Tea Break				
15:30-18:10	**主持人:楼雄文**	**主持人:王立**	**主持人:周保学**	**主持人:黄岭**
15:30-15:50	王昕	朱俊发	徐梽川	黄岭
15:50-16:10	范红金	邹勃	延卫	王铁
16:10-16:30	刘彬	游雨蒙	王殳凹	邓人仁
16:30-16:50	杨艳辉	唐建新	包志豪	黄渤龙
16:50-17:10	张其春	黄进	钟羽武	卢宪茂
17:10-17:30	唐永炳	梅永丰	牛天超	陈润锋
17:30-17:50	彭扬	倪振华	陈冬赟	谢小吉
17:50-18:10	苏陈良	邓昭		浦侃裔
	晚宴 2 **郁金香-1F**			

新加坡国立大学苏州研究院简介

新加坡国立大学苏州研究院（以下简称“研究院”）创建于2010年，是中国首家世界一流大学在华开设并自主运营的研究院。母校新国大希望通过研究院提升其国际影响，增进与中国的交流互动。苏州工业园区希望通过研究院集聚国际科技资源，为地方产业升级提供科技支持。研究院的建设，深化了中新两国在科教领域的合作。研究院的性质为事业单位独立法人，举办单位是苏州工业园区管理委员会。

研究院的科研工作注重原创性和创新性。围绕“纳米材料、生物医学、能源与环保科技、先进电子器件、软件工程、农业与食品科技”6个自然科学领域，已建立14个科研小组。作为一所多学科、综合型的国际研究院，我院还在人文社科领域建设了“中国商务研究中心”、“李光耀公共政策学院苏州中心”、“普洛斯（城市化发展）研究中心”及“风险管理暨量化金融中心”。

目前，研究院从事基础研究人员共计95人，其中35人具有高级职称。这些学者的学术背景来自剑桥大学、普林斯顿大学、麻省理工学院、斯坦福大学、加州大学伯克利分校、加州大学洛杉矶分校、哥伦比亚大学等世界名校。研究院已承担包括国家自然科学基金和省部级在内的67项科研项目，提交44项国际专利申请，在国际SCI著名期刊发表了380篇有影响力的科研论文，其中7篇发表在Nature子刊。

研究院非常注重产研结合，已孵化高科技企业49家，并帮助6家企业获得千万级别的融资。重点建设的“新－中苏州创新中心”是中国科技部和新加坡贸工部签约进行的双边合作项目。该中心将新加坡国立大学成熟的国际知识转移服务体系软件输出到苏州，结合园区产业升级需求，在园区打造适合国际知识成果孵化、落地的生态环境，从而推动区域创新能力提升和转型升级。

在人才培养方面，研究院重点推进学生项目。一方面组织西班牙、法国、美国、澳大利亚、

新加坡、日本、印度等国的 400 余名国际学生来华学习；另一方面，组织中国的本科学生利用暑期时间到新国大学习专业课。这些项目提升了学生的国际视野、激发了他们的创新精神，使之适应全球化经济对高层次人才的需求。研究院还在国内率先尝试进行“工业联合培养博士计划”，将国际一流大学的博士培养计划与中国工业界的人才需求结合，为地方培养高层次科研人才。在短期培训方面，研究院围绕新加坡成功经验打造核心课程体系，为中国政府及国企高管提供“领导力提升”、“园区规划建设”与“和谐社会管理”等培训课程，2016 年累计培训 3890 余人次。

苏州大学 智能纳米环保新材料及检测技术国际联合研究中心简介

中心主任：路建美副校长（兼）； 中心首席外国科学家：Barry Sharpless

大学、日本信州大学、加拿大阿尔伯塔大学共同成立的国际合作研究平台中心将国际知名的化学、环境、材料、生物及物理的科学家们集聚，从材料源头分子设计出发，以材料的智能化、纳米结构化为目标，重点研发智能型环境吸附材料、微纳结构材料、生物医用材料及功能材料表面精准修饰等。中心目前拥有国家技术发明奖获得者，国家“千人计划”教授，“青年千人”，“优秀青年”基金获得者等优秀成员，中心80％的成员拥有海外留学经历。

近五年承担了863重点项目、国家科技支撑计划项、国际合作项目、环保部公益项目、国家自然科学基金重点项目、面上项目等20余项科研，经费超6000万元。获国家技术发明二等奖、国家科技进步二等奖各1项，省部级一等奖项3项，已实现成果转化30余项，促进了科技转化为生产力，为地方经济、科技创新做出了重要贡献。

研究中心的国际学术交流

合作学校

The Scripps Research Institute

NUS National University of Singapore

南洋理工大學 Nanyang Technological University

Università Ca'Foscari Venezia

UCL Université catholique de Louvain

Shinshu University Founded 1949

二维材料光电国际实验室

2014 年 6 月，深圳大学与新加坡国立大学在深圳签署成立“光电科技协同创新中心”备忘录，确定联合组建深圳大学 - 新加坡国立大学光电科技协同创新中心。2016 年 1 月，美国罗格斯大学与深圳大学协商，同意加入“光电科技协同创新中心”，并于 2016 年 3 月达成签署联合备忘录的共识。2017 年 1 月，“二维材料光电科技国际合作联合实验室”通过教育部立项考察，并予以正式立项建设。

目前，实验室在深圳大学有固定科研人员 20 余名，其中中国工程院院士 1 名，新加坡自然科学院院士 1 名，亚太材料材料科学院院士 1 名，新加坡最高科学荣誉总统奖获得者 1 名，国家青年千人 3 名，全部具有博士学位；在站博士后 80 余名，研究生 20 余名。主要研究方向为 :1）二维光电功能材料的可控制备；2）二维材料光电基础特性的探测与调控研究；3）新一代光电子器件、系统及应用研究。实验室拥有钕玻璃高功率激光系统、高功率中红外激光产生及放大系统、宽波段光谱测量和分析系统、微波光子技术、涡旋光通信系统、化学气相沉积系统（管式炉 CVD，PECVD）、低温超导、共焦拉曼光谱系统、 Leica 显微镜、半导体电学特性表征系统、双粒子束溅射薄膜沉积系统等大型仪器设备 40 余套，100 万以上大型设备 10 余套，设备总值超 5000 万元。覆盖了从材料的制备、结构和光电等特性表征以及应用等研究需要，形成了一个系统完整的科研平台和人才培养基地。近三年，实验室共获得科研项目和人才计划资助近百项，总经费近亿元，基本覆盖国家基金委重大项目、重点项目、面上项目、青年项目；国家科技重大专项、863、973 计划等所有国家级课题。研究团队四年来已申请专利 20 余项，发表 Nature Communications, PRL 等高水平科研论文 200 余篇。

南京信息工程大学
Nanjing University of Information Science & Technology

物理与光电工程学院
School of Physics and Optoelectronic Engineering

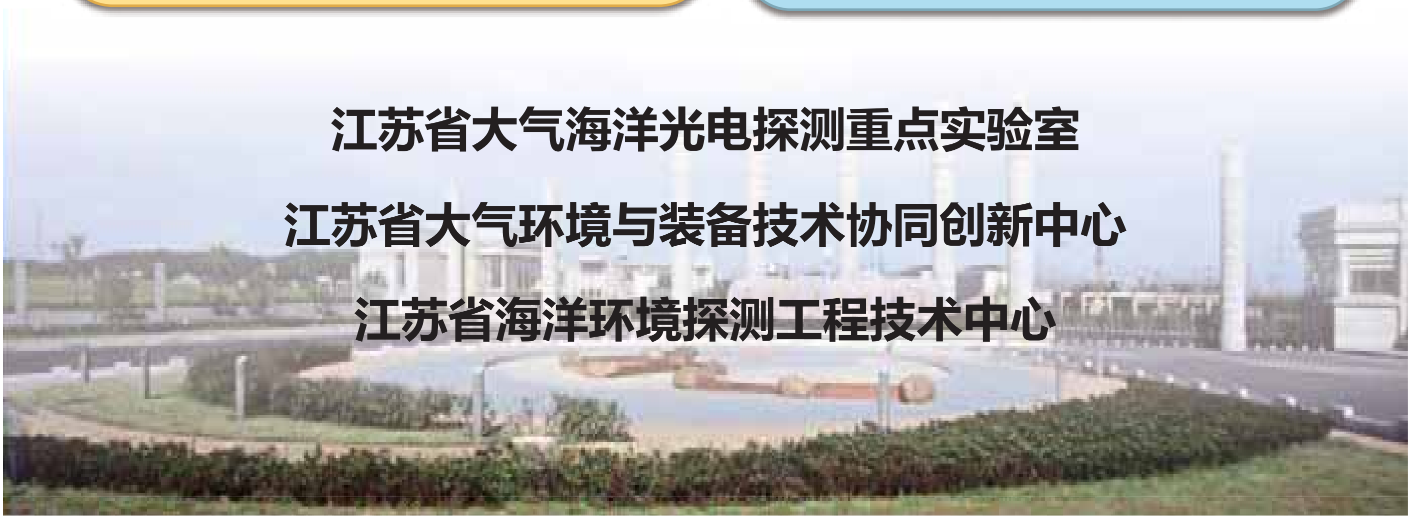
南京信息工程大学物理与光电工程学院设有物理学、应用物理学、材料物理、光电工程等四个系和物理实验教学中心、光电信息技术实践教育中心、大学物理部及多个研究所，拥有**光学工程**、**材料科学与工程**、**空间天气学**等一级学科点。学院现有教授11人，校聘教授5人，副教授23人，入选国家青年千人、江苏省特聘教授、江苏省“双创人才” 等国家级和省部级人才计划10余人次。学校**大气科学**学科进入国家“**双一流**”学科建设，学院针对**大气海洋环境探测**需求开展**材料、器件以及仪器系统**等方面的特色研究。

光学工程

- **光电功能材料与器件**
- **大气海洋光学与光电探测技术**
- **光电系统与智能仪器**
- **光通信与光纤传感技术**

材料科学与工程

- **信息功能材料**
- **材料设计与计算**
- **材料加工与表面工程**



Macroscopic Nanoparticle Assemblies: Integration, Functionalization and Applications

Shu-Hong Yu *

Division of Nanomaterials and Chemistry, Hefei National Laboratory for Physical Sciences at Microscale, Department of Chemistry, University of Science and Technology of China

** Email: shyu@ustc.edu.cn*

Hierarchical micro-/nano- rigid structures in biological systems is increasingly becoming a source of inspiration of materials scientists and engineers to create next generation advanced functional materials. Although the properties of nanomaterials are frequently superior to those of their bulk counterparts, translating the unique characteristics of nanoscale components into macroscopic functional devices still remains a challenge. In this lecture, we discuss how to synthesize high quality nanoscale building blocks with specific shape and size, how to assemble nanoscale building blocks into bio-inspired assemblies and their functionalities, and how to integrate them with already existing macroscopic structures and realize new functions. A family of nanowire or nanoplate assemblies in form of integrated nanocomposites and structures can be generated, demonstrating that it is possible to access a variety of nanocomposites with tunable mechanical property and other functions. These macroscopic nanoparticle assemblies are emerging as a new material system, showing enormous application potentials in diverse fields.

References

(1) L. B. Mao, H. L. Gao, H. B. Yao, L. Liu, H. Cölfen, G. Liu, S. M. Chen, S. K. Li, Y. X. Yan, Y. Y. Liu, S. H. Yu, Science 2016, 354, 107-110.

(2) J. Ge, L. A. Shi, Y. C. Wang, H. Y. Zhao, H. B. Yao, Y. B. Zhu, Y. Zhang, H. W. Zhu, H. A. Wu, S. H. Yu, Nat. Nanotechnol. 2017, 12, 434-440.

(3) H. L. Gao, S. M. Chen, L. B. Mao, Z. Q. Song, H. B. Yao, H. Cölfen, X. S. Luo, F. Zhang, Z. Pan, Y. F. Meng, Y. Ni, S. H. Yu, Nat. Commun. 2017, 8, 287.

Biography

Shu-Hong Yu studied chemistry in Hefei University of Technology and received BS in 1988 and got MS from Shanghai Research Institute of Chemical Industry in 1991. He completed PhD in inorganic chemistry in 1998 from USTC. From 1999 to 2001, he worked in Tokyo Institute of Technology as a Postdoctoral Fellow, and was awarded the AvH Fellowship (2001-2002) in the Max Planck Institute of Colloids and Interfaces, Germany. He was appointed as a full professor in 2002 and the Cheung Kong Professorship in 2006. He serves as the Director of the Division of

Nanomaterials and Chemistry, Hefei National Laboratory for Physical Sciences at Microscale. He is a senior editor for Langmuir, and on the editorial board or advisory board of journals Accounts of Chemical Research, Chemistry of Materials, Chemical Science, Materials Horizons, Nano Research, ChemNanoChem. He received the Roy-Somiya Medal of ISHA and Chem. Soc. Rev Emerging Investigator Award. His research interests include bio-inspired synthesis of inorganic nanostructures, self-assembly of nanoscale building blocks, nanocomposites, their related properties and applications. His research work has been cited more than 31,290 citations (H index 97), named as a Highly Cited Researcher by Thomson Reuters.

Graphdiyne: Synthesis and Applications

Jin ZHANG*

Center for Nanochemistry, College of Chemistry and Molecular Engineering, Peking University Beijing, 100871, China

** Email: jinzhang@pku.edu.cn*

Graphdiyne (GDY), a novel two-dimensional (2D) carbon allotrope composed of sp-sp2 carbon atoms, is predicted to exhibit extraordinary properties. Synthesizing GDY with a well-defined structure is of great challenge. Herein, we developed several rational approaches to synthesize structure-controlled GDY with a high quality. We demonstrated that the morphology of GDY could be finely controlled by using a modified Hay-Glaser coupling reaction under optimized reaction conditions. Unique vertically grown GDY nanowalls (~200nm) were fabricated on either copper foils or foams. Especially, single or few-layered GDY-contained films were obtained by using graphene as a surface template. Raman spectra and TEM results confirmed the features of GDY. These GDY films also exhibited excellent conductivity. Towards practical applications, various GDY-based hierarchical architectures were designed. As one example, a 3D GDY foam was used for oil/water separation, exhibiting both high efficiency and good recyclability. Considering the intriguing physicochemical properties of GDY, it also shows promise in various potential applications, such as water splitting cell and solar steam generation.

References

[1]. Z. F. Liu, J. Zhang et al., Adv. Mater. 2017, 29, 1700421.

[2]. Z. F. Liu, J. Zhang et al., Adv. Mater. 2017, 29, 1604665.

[3]. Z. F. Liu, J. Zhang et al., J. Am. Chem. Soc. 2016, 138, 3954-3957.

Biography

Prof. Jin ZHANG received his PhD from Lanzhou University in 1997. After a two year postdoctoral fellowship at the University of Leeds, UK, he returned to Peking University where he was appointed Associate Professor (2000) and promoted to Full Professor in 2006. In 2013, he was appointed as Changjiang professor. He also is the Fellow of RSC. His research focuses on the controlled synthesis and spectroscopic characterization of carbon nanomaterials. Dr. Zhang has published over 220 peer-reviewed journal articles. And he now is the editor of Carbon.

Micro–Nanocomposites in Environmental Management

Jianmei Lu*

College of Chemistry, Chemical Engineering and Materials Science

Collaborative Innovation Center of Suzhou Nano Science and Technology

Soochow University, Suzhou, 215123, China

** E-mail: lujm@suda.edu.cn*

Water pollution, a worldwide issue for the human society, has raised global concerns on environmental sustainability, calling for high-performance materials for effective treatments. Since the traditional techniques have inherent limitations in treatment speed and efficiency, nanotechnology is subsequently used as an environmental technology to remove the pollutants through rapid adsorption and degradation process. Therefore, in our group, we have prepared various adsorbent and photodegradation composite materials leading to effective water remediation. Meanwhile, we outline recent advances in simultaneous adsorption and photodegradation micro-nanocomposites, which could not only completely adsorb and remove contaminants, but the micro-nanocomposites could also be directly reused without further treatment. Finally, the future development of this unique system is discussed.

References

[1] D. Chen, H. Zhu, S. Yang, N. Li, Q. Xu, H. Li, J. He and J. Lu,* Adv. Mater., 2016, 28, 10443–10458.

[2] S. Yang, D. Chen,* N. Li, Q. Xu, H. Li, J. He and J. Lu,* Adv. Mater., 2016, 28, 2916–2922

[3] Q. Gu, J. He, D. Chen, H. Dong, Y. Li, H. Li, Q. Xu,* and J. Lu,* Adv. Mater., 2015, 27, 5968–5973.

[4] P. Gu, F. Zhou, J. Gao, G. Li, C. Wang, Q. Xu, Q. Zhang,* and J. Lu,* J. Am. Chem. Soc., 2013, 135, 14086–14089.

Biography

Prof. Jianmei Lu received her Ph.D. degree in polymer chemsitry from Zhejiang University in China and appointed as a full professor in 2000 at College of Chemistry, Chemical Engineering and Materials Science, Soochow University. She has research interests in oils adsorption materials, nonvolatile electronic memory devices, organic sensors, and smart materials.

Performance Enhancement of C3N4 viaπ-πAction and Nanostructure

Yongfa Zhu*

Department of Chemistry, Tsinghua University, Beijing 100084, China

* *Email: zhuyf@tsinghua.edu.cn*

TCNQ–g-C3N4 organic composite photocatalysts, C60 modified graphitic carbon nitride composite photocatalysts C60/g-C3N4 and P3HT-g-C3N4 photocatalysts were prepared. The phenol mineralization ability for g-C3N4 composite was dramatically enhanced via decreasing the valence position of the composite by adjusting the mass fraction of TCNQ,C60 and P3HT. The transition of photogenerated electrons from the valence band of C3N4 to the LUMO of TCNQ was promoted by the charge transfer between C3N4 donor and TCNQ, C60 and P3HT acceptor. The separation and immigration efficiency of photoinduced charge carriers was greatly enhanced and the catalytic activity of the composite was increased about 8.4 times for phenol degradation[1-3]

Single-layered g-C3N4 nanosheets and nanoporous g-C3N4 with high surface area were successfully synthesized. The nanostructured g-C3N4 can exhibit enhanced photocatalytic activity due to the improved separation of photogenerated electron-hole pairs and higher efficiency of charge carriers transfer. The photocatalytic activity and the photocurrent response of g-C3N4 nanorods were about 1.5 and 2.0 times as that of g-C3N4 nanoplates, respectively.

Three dimension and oxygen doped C3N4 were prepared and the photocatalytic activity can be enhanced greatly. The band structure of C3N4 can be adjusted via π-πaction, oxygen doped, K doped and nanostructure.

References

(1)Jing Xu, Liwu Zhang, Rui Shi, Yongfa Zhu*,Chemical exfoliation of graphitic carbon nitride for efficient heterogeneous Photocatalysis,Journal of Materials Chemistry A, 2013, 1 (46), 14766

(2)Mo Zhang; Jing Xu; Rui L Zong; Yongfa Zhu*,Enhancement of Visible Light Photocatalytic Activities via Porous Structure of g-C3N4, Applied Catalysis B: Environmental,2014, 147,229

(3)Xiaojuan Bai, Ruilong Zong, Di Liu, Yongfa Zhu*,Enhancement of Visible Photocatalytic Activity Promoted via Ag@C3N4 Core-Shell Plasmonic Composite, Applied Catalysis B: Environmental 147 (2014) 82

Biography

Dr. Zhu Yongfa is currently a Professor (2001-) in Chemistry Department at Tsinghua University. He received his Bachelor’s degree in Chemistry from Nanjing University in 1985, Master Degree from Peking University in 1988, Ph.D. degree from Tsinghua University in 1995. His current research is photocatalysis, environmental catalysis and nanomaterials. He is the author and co-author of 295 original research papers published in SCI journals. The total cited numbers reached about 16800 and the H-index arrived at 70. About 27 papers was selected as High-Cited Papers by Essential Science Indicators. Besides, he has written about 5 books and applied about 22 patents.

Hierarchical Assembly of New Photocatalysts and Study on Their controlling Environmental Pollution

Hexing Li

Shanghai University of Electric Power, Shanghai 200234

Email: HeXing-Li@shnu.edu.cn

Photocatalysis has been received increasing interests due to its potential in hydrogen production and the environmental cleaning. Both the composition and the structure play key roles in determining photocatalytic performances. Herein, we report the design of new photocatalysts with controlled compositions and nanostructures by supercritical conditions, solvothermal alcoholysis and microwave-assisted self-assembly. Those materials exhibit high efficiencies in photocatalytic degradation of organic pollutants, reduction of heavy-metal ions, water-splitting to produce H2, green organic synthesis, and energy storage. The efficiency-structure correspondence is examined and the practical applications are explored.

Selected publication

[1] Zhenfeng Bian, Colin Nuckolls*, and Hexing Li*, J. Am. Chem. Soc., 2012, 134, 2325

[2] Dieqing Zhang, Hexing Li*, and Yunfeng Lu*, J. Am. Chem. Soc., 2012, 134, 14283

[3] Jian Zhu, Shengxiong Xiao, Colin Nuckolls*, Hexing Li*, J. Am. Chem. Soc., 2013, 135, 4719

[4] Zhenfeng Bian, Hexing Li*, and Yunfeng Lu*， Angew. Chem. Int. Ed., 2011, 50, 1105

[5] Zheng Chen, Hexing Li*, and Yunfeng Lu*, Adv. Mater., 2012, 24, 2030.

[6] Zhenfeng Bian,* Fenglei Cao, Jian Zhu, Hexing Li*, Environ. Sci. Technol., 2015, 49, 2418

[7] Zheng Chen, Yiting Peng, Yunfeng Lu, and Hexing Li*, Nano Lett., 2015, 15, 6802

[8] Shuning Xiao, Peijue Liu, Dieqing Zhang*, Hexing Li*, Nano Lett., 2015, 15, 4853

[9] Y. Peng, Z. Le, M. Wen, Hexing Li*, Yunfeng Lu*, Nano Energy, 2017, 35, 44

[10] Guisheng Li*, Zichao Lian, Hexing Li*, Nano Energy, 2016, 19, 446

Biography

Dr. Hexing Li received his PhD in chemistry from Fudan University in 1998. Now, he is working as a professor in SUEP, an associated editor of Appl. Catal. B: Environ., the director of Chinese Education Ministry Key Laboratory, and a vice-director of Chinese Photocatalysis Committee. His research interests are related to amorphous alloy catalysts for hydrogenation, photocatalysts for environmental purification and clean energy, mesoporous catalysts for water-medium organic reactions. Up to now, more than 200 papers have been published. His H-index is 56.

High-Performance Polymeric Field-Effect Transistors and Circuits

Yunqi Liu

Institute of Chemistry, Chinese Academy of Sciences

Beijing 100190, China

E-mail: liuyq@iccas.ac.cn

Polymer semiconductors have been widely studied in organic field-effect transistors (FETs), as they are flexible, light weight, transparent, solution-processable and modifiable. Compared to the inorganic semiconductors, the solution-processable polymer semiconductors have been recognized as promising candidates for commercial application due to the low cost. Among the polymer semiconductors, the third-generation donor−acceptor (D−A) conjugated polymers are more attractable than all donor and all acceptor conjugated polymers because of their relative favourable charge transporting with low bandgap. In this presentation[1−5], we report the design and synthesis of some copolymers with D−A structures exhibiting p-tpye, n-type and ambipolar behavior. These polymers show high mobilities together with solution-processability and high thermal stability. FET-based circuits are fabricated and their functionalities are investigated and optimized.

References

[1] Zhiyuan Zhao, Zhihong Yin, Huajie Chen, Liping Zheng, Chunguang Zhu, Long Zhang, Songting Tan, Hanlin Wang, Yunlong Guo, Qingxin Tang, and Yunqi Liu, Adv. Mater., 2017, 29(4), 1602410.

[2] Zhiyuan Zhao, Zhihong Yin, Huajie Chen, Yunlong Guo, Qinxin Tang, and Yunqi Liu, J. Mater. Chem. C, 2017, 5(11), 28922896.

[3] Jie Yang, Hanlin Wang, Jinyang Chen, Jianyao Huang, Yingying Jiang, Jianqi Zhang, Longxian Shi, Yunlong Sun, Zhixiang Wei, Gui Yu, Yunlong Guo, Shuai Wang, and Yunqi Liu, Adv. Mater, 2017, 2017, 29(22), 1606162.

[4] Jie Yang, Zhiyuan Zhao, Hua Geng, Changli Cheng, Jinyang Chen, Yunlong Sun, Longxian Shi, Yuanping Yi, Zhigang Shuai, Yunlong Guo, Shuai Wang, and Yunqi Liu, Adv. Mater., 2017, 29(36), 1702115.

[5] Hanlin Wang, Hongtao Liu, Qiang Zhao, Zhenjie Ni, Ye Zou, Jie Yang, Lifeng Wang, Yanqiu Sun, Yunlong Guo, Wenping Hu, and Yunqi Liu, Adv. Mater., 2017, 29(32), 1701722.

Biography

Dr. Yunqi Liu was graduated from Nanjing University in 1975, received a doctorate from Tokyo Institute of Technology, Japan in 1991. Presently, he is a Professor at the Institute of Chemistry, Chinese Academy of Sciences (CAS), and an Academician of CAS. His current research interests include design and synthesis of molecular materials, including -conjugated small molecules, polymers, and graphene, fabrication of related devices, including field-effect transistors and molecular electronics, and investigation of their electronic properties. He has published more than 600 papers in SCI journals (in which, over 130 of papers with IF>10), cited by other researchers for more than 25,000 times with an h-index of 80. He was recognized as “Highly Cited Researchers” by Thomson Reuters in Materials Science in 2014, 2015, 2016 and 2017. In addition, he has obtained 70 of granted patents, published two books and 17 book chapters. He received the National Natural Science Award (2nd) in 2007 and 2016.

Crystal Phase-Engineering of Novel Nanomaterials

Hua Zhang[1,*]

[1]*Center for Programmable Materials, School of Materials Science and Engineering,Nanyang Technological University,50 Nanyang Avenue, Singapore 639798, Singapore*

** Email: hzhang@ntu.edu.sg*

In this talk, I will summarize the recent research on the crystal phase-engineering of novel nanomaterials in my group. It includes the first-time synthesis of hexagonal-close packed (hcp) Au nanosheets (AuSSs) on graphene oxide, surface-induced phase transformation of AuSSs from hcp to face-centered cubic (fcc) structures, the first-time synthesis of 4H hexagonal phase Au nanoribbons (NRBs) and their phase transformation to fcc Au RNBs, the epitaxial growth of 4H Ag, Pt, Pd, PtAg, PdAg, PtPdAg, Rh, Ir, Ru, Os and Cu on 4H Au NRBs, and the phase transformation of two-dimensional transition metal dichalcogenide (TMD) nanomaterials. In addition, we start to investigate the crystal phase-based properties and applications in catalysis, surface enhanced Raman scattering, waveguide, photothermal therapy, chemical and biosensing, etc., which we believe are unique and critically important not only fundamentally, but also practically. Importantly, the concept of crystal-phase heterostructure is proposed.

Biography

Dr. Hua Zhang is currently a Professor (2013-now) in School of Materials Science and Engineering, Nanyang Technological University (NTU). He received his B.S. and M.S. degrees at Nanjing University in 1992 and 1995, respectively, and completed his Ph.D. with Prof. Zhongfan Liu at Peking University in July 1998. His current research interests include the synthesis of ultrathin two-dimensional nanomaterials (e.g. metal nanosheets, graphene, metal dichalcogenides, metal-organic frameworks, covalent organic frameworks, etc.) and their hybrid composites for applications in nano- and biosensors, clean energy, (opto-)electronic devices, catalysis, and water remediation; controlled synthesis, characterization and application of novel metallic and semiconducting nanomaterials, and epitaxial growth of heterostructures; etc.

Nanoscale Metal-Organic Frameworks: Emerging Materials for Catalysis

Zhiyong Tang

National Center for Nanoscience and Technology, Beijing, 100190, China

** Email: zytang@nanoctr.cn*

Distinct from classic inorganic nanoparticles of solid cores, nanoscale metal-organic frameworks (NMOFs) are of ordered crystalline pores with tunable composite, size and volume, which provide an ideal platform not only to manipulate the reaction active sites but also to understand the structure-functionality relationship. In this presentation, we will introduce two recent works involving catalytic application of NMOFS.

Biography

Dr. Zhiyong Tang is currently a Professor(2006-) in National Center for Nanoscience and Technology, China. He obtained his Bachelor and Master degree from Wuhan University in 1996. He then moved to Changchun Institute of Applied Chemistry of Science, Chinese Academy of Sciences with Professor Erkang Wang and obtained a Ph.D. degree in 1999. After six years as a postdoctoral fellow in Swiss Federal Institute of Technology Zurich, Oklahoma State University and University of Michigan, in November 2006 he won the 100-Talent Program, Chinese Academy of Sciences and started his current position.

Professor Tang's research interests are mainly focused on controllable synthesis, property manipulation and practical application of inorganic nanomaterials. He developed the general and fundamental methods for preparation of inorganic nanoparticle assemblies with different dimensions, structures and functionalities, and explored their applications in the field of energy and environment. In the past several years, he has published more than 200 peer-reviewed papers, and among those 90 papers have been published in the journals of the impact factor higher than 8. For instance, as the first author he published 2 papers in Science and 1 paper in Nature Materials; while as the corresponding author he has already published 1 paper in Nature, 1 paper in Nature Nanotechnology, 2 paper in Nature Communications, 1 paper in Chemical Society Reviews, ect. Because of the pioneering work in nanostructured materials, Prof. Tang's work has been extensively reported by both world-renown news magazines and academic journals including The New York Times, The Washington Times, Nature, Nature Materials, Nature Nanotechnology, Science News, Chemical & Engineering News, etc.

有机半导体微纳晶电子学的研究

胡文平[1，2*]

[1]天津大学理学院，天津市南开区卫津路 92 号 310072；

[2]中国科学院化学研究所，北京市中关村北一街 2 号，100190

*Email: huwp@iccas.ac.cn

自导电高分子被发现以来，有机半导体得到了全世界的广泛关注。然而，有机半导体的本征性能难于揭示、材料的理性设计富于挑战，高迁移率材料获取困难。如何克服这一挑战，推动有机电子学的发展，是当时面临的瓶颈问题之一。这里，我们就有机半导体微纳晶的研究做一个汇报，重点就材料的本征性能揭示与分析，材料的理性设计及高迁移率有机半导体材料与器件进行介绍。

胡文平，天津大学副校长，天津大学理学院教授，天津市分子光电科学重点实验室主任。国家杰出青年科学基金获得者，教育部长江学者特聘教授，国家“万人计划”创新领军人才，享受国务院特殊津贴的专家。

1993 年本科毕业于湖南大学化学化工系，1996 年硕士毕业于中国科学院金属研究所，1999 年博士毕业于中国科学院化学研究所（导师朱道本院士、刘云圻院士）。在德国洪堡基金会和日本学术振兴会的支持下 1999-2003 年在日本大阪大学和德国斯图加特大学从事研究，2003 年加入日本电话电讯株式会社，同年 9 月，入选科学院“百人计划”，回到中国科学院化学研究所工作。2013 年任天津大学校长助理、理学院院长，2016 年任天津大学副校长。

主要从事有机光电子的研究，在国内率先开展了有机场效应晶体管的研究，在国际上率先开展了有机半导体微纳晶电子学的研究，出版中英文专著 4 本，发表 SCI 论文 480 余篇，其中 IF>10 的约 130 篇， 论文被 SCI 引用 16,000 次 (H index=65). 曾任 Polymer Chemistry (RSC, 2013-2016) 副主编，现任 Adv. Energy Mater., Adv. Electron. Mater., Nano Research, Sci. China Chem., Sci. Bull., Sci. China Mater. 等期刊的编委

Prof. Xu Guo Qin

National University of Singapore

Office: S7-04-13 (Chemistry)

Tel: 65 6516 3595 (Chemistry); 65 6516 2833 (Dean's Office)

Fax65 6779 1691

Email: chmxugq@nus.edu.sg

Working experience:

Professor, Associate Professor, Senior Lecturer, Lecturer, Department of Chemistry, National University of Singapore, Singapore

1989-1991 Research Associate with Prof. J. C. Polanyi, Department of Chemistry, University of Toronto, Ontario, Canada

1987-1989 Research Associate with Dr. J. Hrbek, Department of Chemistry, Brookhaven National Lab, Upton, Long Island, NY, U.S.A

Education:

1982-1987 Ph.D. in Surface Chemistry with Prof. S. L. Bernasek, Department of Chemistry, Princeton University, Princeton, NJ 08544

1978-1982 B.Sc. in Physical Chemistry, Department of Chemistry, Fudan University, Shanghai, ChinaBiography

Research:

My long-term research objective is to provide the fundamental understanding of chemical and physical processes occurring on solid surfaces. In particular, we are interested in the surface chemistry related to semiconductor processing and heterogeneous catalysis. In addition, our program is extended to the synthesis and optical applications of nanomaterials. At present, the laboratory is equipped with a relatively wide range of sophisticated surface science techniques, including Temperature-programmed Desorption Spectroscopy (TDS), X-ray Photoelectron Spectroscopy (XPS), Auger Electron Spectroscopy (AES), Low Energy Electron Diffraction (LEED), Ultra-violet Photoelectron Spectroscopy (UPS), High Resolution Electron Energy Loss Spectroscopy (HREELS), and Variable-Temperature UHV Scanning Tunneling Microscopy (STM). In addition, Eximer laser and 1000-W UV lamps can be employed as photon sources for studying photo-induced surface chemical and physical processes. Recently, we obtained multi-mode Scanning Probing Microscope with the capabilities of scanning tunneling microscopy, atomic force microscopy, scanning magnetic and electric force microscopy in both solution and air with temperature variation. This is particularly useful for the characterization and fabrication of nano-materials, as well as for studying surface biochemistry.

The Nanosafety in Europe: state-of-the-art and perspective development

Antonio Marcomini

[1] *Department of Environmental Sciences, Informatics & Statistics, University Ca' Foscari of Venice, Italy*

** Email: marcom@unive.it*

Nanotechnology is one of the Key Enabling Technologies identified in the European Union 2020 Strategy. It has enormous potential for innovation, which has fostered large investments in developing novel nano-enabled industrial applications and consumer products. However, there are large uncertainties around the safety of engineered nanomaterials, which are raising societal concerns about the adequacy of their regulation. Indeed, currently the widely-accepted view is that there are many unanswered questions on the potential environmental, health and safety (EHS) risks associated with the manufacture, use, distribution and disposal of nanomaterials. To answer these questions the European Commission invested over 200 million euros in research projects under the 6th and 7th Framework and H20202 Programmes. These projects aimed to address (but were not limited to) the following areas:

- Physicochemical characterization of engineered nanomaterials and products including nanomaterials in their formulation
- Fate, biodistribution, degradation of engineered nanomaterials at cellular and body level and in the environment.
- Assessment of toxicity and risk of engineered nanomaterials to humans and the environment
- Modelling of the exposure-dose-response relationship and extrapolation of results from in vitro to in vivo and to human situations
- Metrology, cross validation and standardization of assays, protocols and models for physicochemical analysis and assessment of (eco)toxicity
- Data management: including the creation and implementation of common databases

Nanosafety research remains a centrally important topic to ensuring Europe's vision of the knowledge economy and the safe implementation of nanotechnologies for the benefit of society. Currently, there is an increased emphasis on advanced materials and materials as they exist in products and following environmental transformation & ageing, as well as on research with a regulatory and/or market focus, including Safety-by-design and Life Cycle Assessment approaches.

The most recent calls for proposals focused on high throughput, predictive toxicology and grouping approaches for risk assessment, and the results of these calls are expected imminently. The call topics for the second phase of Horizon2020 (2018-2020) include governance of nanomaterials, an increased focus on nanobioinformatics, and calls for Innovation Hubs, for which nanosafety is a potential element needed to support commercialization of nano-enabled products.

Biography

Prof. Antonio Marcomini is Professor of Environmental Chemistry at the Department of

Environmental Sciences, Informatics and Statistics of Ca' Foscari University, Venice (Italy).

Graduated from the University of Padua, he was post-doctoral fellow at the University of Toronto, Lash Miller Chemical Institute, Canada, and then research associate at the Polytechnic of Zurich, ETH-EAWAG, Switzerland. Coordinator/ partner of several international and national research projects, he is author/ coauthor of >250 papers published in international peer reviewed journals, editor and coauthor of two books; Scopus H-index: 48; G-Scholar H-index: 54. His current research interests include Environmental sustainability of nanotechnologies, Effects of climate change on the environmental behavior of persistent chemicals, Risk assessment and management of contaminated sites.

Health Related Research on Nanomaterial at the National University of Singapore

ONG Choon Nam

NUS Environmental Research Institute (NERI) National University of Singapore

Singapore 117411

Email: eridir@nus.edu.sg

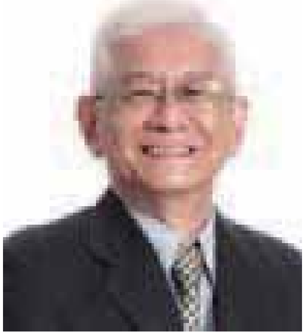
As nanotechnology is experiencing rapid development and the benefits are widely publicized, the discussions on environmental and health impacts are just beginning to emerge. Recent studies have shown that engineered nanomaterials can enter the human body more readily than larger particles and several types of nanoparticles have been reported to interfere with cellular and physiological functions. More comprehensive studies are needed to systematically establish the potential environmental and human health effect of exposure to nanoparticles. The questions that need to be addressed include how size, number, chemical composition and surface characteristics of nanomaterials affect their interactions with various systems of the body. The answers to these questions are important for understanding how nanomaterials either as food ingredients, environmental pollutants, or occupational hazard, that could affect human health. It is apparent that these complex problems could best be addressed by a multidisciplinary approach, drawing on the expertise in engineering, science and medicine. This presentation attempts to provide an update on some recent research at NUS with regards to the environmental and health effects of exposure to nanomaterials. The talk will also demonstrate how an integrated approach using cell lines and animal models, together with "Omics" technologies could offer a better understanding of the toxic mechanisms of some of the nano-materials.

Key words: toxic, cell system, metabolomics, nanoparticles, risk.

Professor ONG Choon Nam

Director, NUS Environmental Research Institute Professor, Saw Swee Hock School of Public Health National University of Singapore

Email: eridir@nus.edu.sg; ephocn@nus.edu.sg



Ong Choon Nam is the Director of the NUS Environmental Research Institute (NERI) and a professor at the Saw Swee Hock School of Public Health, National University of Singapore. Dr Ong has published more than 300 papers in international peer - reviewed journals with an h - index of 82, and over 20,000 citations.

His main research interest is Environmental Health, and is nursing a lifelong passion of all matters related to environment on health. Since 1985, he has served as a consultant to the World Health Organization (WHO) on many occasions, and was involved in 12 of its Health Criteria publications. He is an editorial board member of several international journals on environment and sustainability. He has been a visiting professor to several overseas universities and serves as a Scientific Advisor to the China Center of Disease Control and Prevention (CDC). He is the recipient of Astra - Zeneca American Toxicology Society Award, 2002. Dr Ong chaired the International Expert Panel which advised the Ministry of the Environment and Water Resources of Singapore on the NEWater study. He also served as an advisor to the OECD, US National Water Research Institute, and has been consulted often by international health agencies on issues related to environmental health. He has been a member of the WHO Guidelines for Drinking Water Quality Expert Panel since 2003. In 2015, his team received the TechConnect Innovation award (Washington, 2015) for their on - line senor to monitor surface water Quality. His recent research focuses on the use of Omics technology for biomedical and environmental research. Some of his research works were presented at the World Economic Forum Innovation Section in 2016.

Nanoporous Catalysts for Elimination of Trace Ethylene at Low or Ambient Temperatures

Zhengping Hao [1,2,*]

[1] *Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing, 100085, China*

[2] *National Engineering Laboratory for VOCs Pollution Control Material & Technology, University of Chinese Academy of Sciences, Beijing, 100049, China*

** Email:zpinghao@.rcees.ac.cn*

Nanoporous catalysts are successfully synthesized, these catalysts with mesoporous and microporous structure can make the reaction of ethylene oxidation happened at low temperature or ambient temperature, and show high catalytic activities. For ethylene oxidation mechanism is from carbonic acid to carbon dioxide and water. It is these kind nanoporous catalysts to make pollutant ethylene bonds of C-H and C-C activated and C-C broken, and realized at low- temperatures.

References

[1] "Mesoporous Co3O4 and Au/Co3O4 Catalysts for Low-Temperature Oxidation of Trace Ethylene" Ma, CY, Mu, Z, Li, JJ, Jin, YG, Cheng, J, Lu, GQ, Hao, ZP*, Qiao, SZ, Journal of the American Chemical Society 132, 2608 (2010)

[2] "Efficient Elimination of Trace Ethylene over Nano-Gold Catalyst under Ambient Conditions" Li, JJ, Ma, CY, Xu, XY, Yu, JJ, Hao, ZP*, Qiao, SZ, Environmental Science & Technology 42, 8947 (2008)

[3] "Understanding the active sites of Ag/zeolites and deactivation mechanism of ethylene catalytic oxidation at room-temperature" Yang, HL, Ma, CY, Zhang, X, Li, Y, Cheng, J, Hao, ZP*, ACS Catalysis (in revision)

Biography

Dr. Zhengping Hao is the professor of Research Center for Eco-Environmental Science (RCEES), Chinese Academic Sciences (CAS). He is currently the director of National Engineering Laboratory for VOCs Pollution Control Material & Technology, department head of Environmental Nano-Materials, RCEES, CAS. He received his PhD degree in Physical Chemistry from the Lanzhou Institute of Chemical Physics, CAS in 1996. His research interests include nano materials, green catalysis, pollution control technologies, hazardous material treatment and environmental chemistry.

TiO2 nanotube arrays COD sensor & environmental monitoring

Baoxue Zhou*

School of Environmental Science and Engineering, Shanghai Jiao Tong University, Shanghai 200240 (PR China).

** Email: zhoubaoxue@sjtu.edu.cn*

Chemical oxygen demand or simply "COD" for short indicates the total concentration of organic pollutants in water environment, which is used as a critical parameter for water-quality assessment widely. Today, measurement of COD is still based on the traditional standard potassium dichromate oxidation method (CODCr). However, this method is unsuitable for COD determination of water body with refractory organics or low organics concentration wastewater because of the limited oxidation ability of $K_2Cr_2O_7$. A further drawback is that the analysis is lengthy, and produces highly toxic chemicals which can cause secondary pollution. In terms of this issue, a rapid (3-5 min), accurate, and environmentally friendly PEC new method for COD determination was established based on TiO_2 nanotube arrays sensor owing to its high oxidation ability and superior photoelectric properties[1-3]. COD determination in this system is based on an exhaustive degradation model, in which all of the organic compounds in the thin-cell reactor are rapidly photoelectrocatalytically oxidized and the signals generated captured by an electrochemical analyzer connected to a computer.

References

(1) Baoxue ZHOU*, Jing Bai, Jinhua Li, Applying nanophotoelectrocatalytic oxidation of organic pollutants to COD sensing, Science, 2016, 351(6278): 1223(30-31) (Special Issue)

(2) Jing Bai and Baoxue ZHOU*, Titanium Dioxide Nanomaterials for Sensor Applications, Chemical Reviews, 2014, 114 (19), 10131–10176.

(3) Qing Zheng, Baoxue ZHOU*, Jing Bai, Longhai Li, Zhujing Jin, Jialing Zhang, Jinhua Li, Yanbiao Liu, Weimin Cai, and Xinyuan Zhu. Self-organized TiO2 nanotube array sensor for the determination of chemical oxygen demand, Advanced Materials, 2008, 20 (5), 1044-1049.

Biography

Prof. Baoxue Zhou is professor(2003 -) and head of the environmental function material group at School of Environmental Science and Engineering, Shanghai Jiao Tong University. He received his doctoral degree from Harbin Institute of Technology. His research is focused on photocatalytic/photoelectrocatalytic technology of nanomaterials for organic pollutants treatments, hydrogen production from water decomposition and environmental sensor.

催化净化挥发性有机污染物的研究

*谢少华，刘雨溪，戴洪兴，郭广生，邓积光 **

北京工业大学环境与能源工程学院 / 区域大气复合污染防治北京市重点实验室

** Email: jgdeng@bjut.edu.cn*

挥发性有机物（VOC）具有很高的大气化学反应活性，对光化学烟雾和细颗粒物 PM2.5 的形成起着至关重要的作用，严重危害大气环境和人身健康，其污染控制已成为我国大气污染控制优先方向之一。催化氧化法是消除低浓度 VOC 的有效手段之一。我们 1) 通过构筑有序多孔结构，减少 VOC 和 O2 在反应体系中的传质阻力，增加 VOC 和 O2 与催化剂表面活性中心接触几率，大幅度提升了催化剂催化净化 VOC 的效率；2) 通过化学剪裁等，精准调控催化剂表面氧缺陷结构，促进 VOC 和 O2 分子的吸附、活化和转化，大幅度提升了催化剂催化净化 VOC 的活性；3) 初步探究了 VOC 在负载型贵金属纳米催化剂上的催化净化过程，发现活性组分贵金属纳米粒子的组成和配位环境对 VOC 净化效率以及催化剂的热稳定性、抗水性、耐积碳性和抗硫中毒性有显著影响。

References

1)S.H. Xie, Y.X. Liu*, J.G. Deng*, et al. Effect of transition metal doping on the catalytic performance of Au-Pd/3DOM Mn2O3 for the oxidation of methane and o-xylene, Appl. Catal. B: Environ., 2017, 206, 221−232.

2)S.H. Xie, Y.X. Liu*, J.G. Deng*, et al. Efficient Removal of Methane over Cobalt-Monoxide-Doped AuPd Nanocatalysts, Environ. Sci. Technol., 2017, 51, 2271–2279.

3)S.H. Xie, Y.X. Liu*, J.G. Deng*, et al. Three-dimensionally ordered macroporous CeO2-supported Pd@Co nanoparticles: Highly active catalysts for methane oxidation, J. Catal., 2016, 342, 17−26.

4)J.G. Deng*, S.N. He, S.H. Xie, et al. Ultralow loading of silver nanoparticles on Mn2O3 nanowires derived with molten salts: A high-efficiency catalyst for the oxidative removal of toluene, Environ. Sci. Technol., 2015, 49, 11089−11095.

5)Z.X. Wu, J.G. Deng*, Y.X. Liu, et al. Three-dimensionally ordered mesoporous Co3O4 supported Au-Pd alloy nanoparticles: High-performance catalysts for methane combustion, J. Catal., 2015, 332, 13−24.

个人简介

邓积光，2010 年 6 月毕业于北京工业大学，获环境科学专业博士学位。2010 年 7 月至今，先后担任北京工业大学环境与能源工程学院讲师、副教授和研究员，主要从事挥发性有机物（VOC）污染控制和环境催化化学领域的研究。兼任中国环境科学学会环境化学分会委员、中国环境科学学会挥发性有机物污染防治专业委员会委员、中国环保产业协会废气净化委员会技术专家和 Chinese Journal of Catalysis 青年编委。发表 SCI 论文 110 余篇，被引用 2800 余次。曾获得 2011 年北京市优秀博士学位论文、2012 年全国优秀博士学位论文、2014 年北京市科技新星、2016 年北京市青年拔尖人才、2016 年国家自然科学基金优秀青年科学基金资助和 2017 年中国催化新秀奖等荣誉。

Electro-active Filter Technology for Environmental Applications

Yanbiao Liu[1,2,*] and Choon Nam Ong[2*]

Yanbiao Liu[1,2,*] and Choon Nam Ong[2*]

[1] *School of Environmental Science and Engineering, Donghua University, Shanghai 201620, China.*

[2]*Environmental Research Institute, National University of Singapore, 117411 Singapore*

** Email: yanbiaoliu@dhu.edu.cn and ephocn@nus.edu.sg*

Development of highly-efficient and cost-effective water treatment techniques is critical to tackle global water crisis and membrane processes are promising among state-of-the-art water treatment technologies. We recently developed a few novel carbon-based electro-active filter technologies that could not only physically adsorb, but also electrochemically oxidize various refractory chemical contaminants.[1] The efficacy and efficiency towards organic compounds electrooxidation were examined by several commonly detected organic pollutants (e.g. antibiotic tetracycline, refractory dyes and phenols).[2,3] The filter materials we are currently working on include graphene, carbon nanotubes and other conductive nanofibers. The energy consumption per volume for our electroc-active filters were calculated to be only <0.1 kW·hr/ m3,[3-5] which is better than other recently developed electrochemical systems, as well as other advance oxidation processes for water purification.

In this presentation, we will share some of our recent experimental results that exemplified the advantages of contaminants removal using filters constructed with various nanomaterials integrated with a novel electrochemical approach in a flow-through system. The overall findings demonstrate that this integrated strategy is attractive and useful for both waste water treatment and drinking water purification.

References

(1) Liu YB, et al. Degradation of the common aqueous antibiotic tetracycline using a carbon nanotube electrochemical filter, Environmental Science & Technology 49, 7974-7980 (2015).

(2)Liu YB, et al. Electrochemical wastewater treatment with carbon nanotube filters coupled with in situ generated H2O2, Environmental Science: Water Research & Technology 1, 769-778 (2015).

(3)Liu YB*, et al. Golden carbon nanotube membrane for continuous flow catalysis, Industrial & Engineering Chemistry Research 56, 2999-3007 (2017).

(4)Liu YB, et al. Graphene-based electrochemical filter for water purification. Journal of Materials Chemistry A 2, 16554-16562 (2014).

（5）Liu YB*, et al. Nitrogen doped graphene nanosheets as reactive water purification membranes, Nano Research 9, 1983-1993 (2016).

Biography

Dr. LIU Yanbiao received his Ph.D. degree in environmental science from Shanghai Jiao Tong University, China. He pursued his postdoctoral training at the

NUS Environmental Research Institute (NERI) of National University of Singapore (NUS) during 2012−2016. He joined Donghua University as a Professor since 2017. His current research interests are engineering functional nanomaterials for environmental and catalytic applications.

Oxygen Electrocatalysis on Transition Metal Spinel Oxides

Zhichuan J. Xu (徐梽川) [1,2,3*]

[1] *School of Materials Science and Engineering, Nanyang Technological University, 639798, Singapore*

[2] *Solar Fuels Laboratory, Nanyang Technological University, 639798, Singapore*

[3] *Energy Research Institute@NTU, ERI@N, Nanyang Technological University, 639798, Singapore*

** Email: xuzc@ntu.edu.sg*

Exploring efficient and low cost oxygen electrocatalysts for ORR and OER is critical for developing renewable energy technologies like fuel cells, metal-air batteries, and water electrolyzers. This presentation will presents a systematic study on oxygen electrocatalysis (ORR and OER) of transition metal spinel oxides.[1] Starting with a model system of Mn-Co spinel, the presentation will introduce the correlation of oxygen catalytic activities of these oxides and their intrinsic chemical properties. The catalytic activity was measured by rotating disk technique and the intrinsic chemical properties were probed by synchrotron X-ray absorption techniques. It was found that molecular orbital theory is able to well-explain their activities.[2] The attention was further extended from cubic Mn-Co spinels to tetragonal Mn-Co spinels and it was found that the molecular theory is again dominant in determining the catalytic activies. This mechanistic principle is further applied to explain the ORR/OER activities of other spinels containing other transition metals (Fe, Ni, Zn, Li, and etc.). References

(1)Wei C, Feng Z, Scherer G, Barber J, Shao-Horn Y, Xu Z, Adv. Mater. 2017, DOI: 10.1002/adma.201606800.

(2)Suntivich J, May KJ, Gasteiger HA, Goodenough JB, Shao-Horn Y, Science 334 (2011) 1383.

(3) Wei C, Feng Z, Baisariyev M, Yu L, Zeng L, Wu T, Zhao H, Huang Y, Bedzyk M, Sritharan T, Xu Z, Chemistry of Materials, 2016, 28, 4129–4133.

Biography

Zhichuan is an associate professor in School of Materials Science and Engineering, Nanyang Technological University. He received his PhD degree in Electroanalytical Chemistry at 2008 and B.S. degree in Chemistry at 2002 from Lanzhou University, China. His PhD training was received in Lanzhou University (2002-2004), Institute of Physics, CAS (2004-2005), and Brown University (2005-2007). Since 2007, he worked in State University of New York at Binghamton as a Research Associate and from 2009 he worked in Massachusetts Institute of Technology as a Postdoctoral Researcher. Dr. Xu is member of International Society of Electrochemistry (ISE), The Electrochemistry Society (ECS), and The Royal Society of Chemistry (RSC).

Study on the Adsorption behavior and Mechanisms of Typical Pollutants in Wastewater by PANI/TiO2

Wang Ning Feng Jiangtao Yan Wei*

Department of Environmental Science & Engineering ,Xi'an Jiaotong University, Xi'an 710049, China

** Email: yanwei@xjtu.edu.cn*

As a result of rapid economic development, the industrial wastewater discharge shoots up in recent years. The effluent without treatment would endanger human health and global environment. The pollutant emission limits in china have been continuously declined, and the wastewater treatment industries are facing crucial challenges. As one of the traditional water treatment technologies, adsorption method has been widely used for its simple operation, low cost properties. In this talk, I will summarize and discuss our recent work for PANI/TiO2, a novel organic-inorganic composite adsorbent. Firstly, the adsorption performances of PANI/TiO2 for five typical pollutants were introduced, including methylene blue (MB), acid red G (ARG), phosphate (P), hexavalent chromium (Cr(VI)) and pentavalent antimony (Sb(V)). Secondly, the adsorption mechanism and possible adsorption sites of PANI/TiO2 were proposed. Finally, the adsorption contribution and mechanism of each group on PANI/TiO2 were evaluated with molecular group masking method.

References

(1)"Adsorption mechanism of phosphate by polyaniline/TiO2 composite from wastewater". Ning Wang, Jiangtao Feng, Wei Yan*, et al. Chemical Engineering Journal. 316 (2017) 33-40.

(2)Synthesis of Polyaniline/TiO2 Composite with Excellent Adsorption Performance on ARG. Ning Wang, Jingjing Li, Wei Yan*, et al. RSC Advances, 5(2015), 21132-21141.

Biography

Dr. Yan Wei is currently a Professor (2008 -) in Department of Environmental Science & Engineering at Xi'an Jiaotong University. He received his Bachelor's degree in Physical Chemistry from Nankai University (China) in 1991, Ph.D. degree in Polymer Chemistry and Physics from Nankai University in 1997 under the supervision of Academician He Binglin and Prof Huang Wenqiang. His current research interests include Water Treatment, Adsorption Materials, Environmental Toxicology, Nano Materials, Conducting Polymer, Electrochemistry, Photocatalysis and Preservation Techniques of Fruit and Vegetables.

Metal-Organic Frameworks for Efficient Detection and Remediation of Radioactive Contamination from the Nuclear Fuel Cycle

Yanlong Wang,[1] Yaxing Wang,[1] Chengliang Xiao,[1] Tao Zheng,[1] Long Chen,[1] Lanhua Chen,[1] Daopeng Sheng,[1] Wei Liu,[1] Lin Zhu,[1] Yuxiang Li,[1] Jian Xie,[1] Zhuanling Bai,[1] Juan Diwu,[1] Zhifang Chai,[1] and Shuao Wang [1*]

[1] *School for Radiological and Interdisciplinary Sciences (RAD-X), Soochow University, 199 Ren'ai Road, Suzhou 215123, China*

* Email: shuaowang@suda.edu.cn

During the past three years, our group in Soochow University has deeply looked into two parallel research directions, both combining two fields of radiochemistry and metal-organic frameworks (MOFs). The first one is the synthesis and characterizations of actinide MOF compounds. This system is unique not only because compared to the transition metal and lanthanide systems , the actinide based MOFs are substantially less explored, but also that these compounds cannot be simply mimicked /predicted based on those analogues of transition metals and lanthanides owing to the uniqueness of actinide ions in bonding and coordination. In addition, we have found many interesting potential applications for these compounds including actinide waste form design for geological disposal, ion-exchange for remediation of radioactive contamination, and detection of extremely low-dose ionization radiations, further highlighting the bright future of adopting actinide ions in building of unique MOFs with potential applications in the nuclear industry.[1,2] The other research direction is the design and build of non-radioactive MOFs for rapid, efficient, and selective removal and detection of soluble radioisotope ions including UO_2^{2+}, Sr^{2+}, Cs^+, and TcO_4^- from aqueous solutions. Specifically, I will talk about three interesting examples within this direction: several single-crystalline zirconium phosphonate MOFs that are able to survive from fuming acids including aqua regia and can remove large amounts of uranium even from acidic solutions;[3] a luminescent mesoporous MOF equipped with abundant Lewis basic sites, which can be used for sequestration and detection of trace amounts of uranyl ion in the natural water systems including seawater;[4] the first experimental investigation of $^{99}TcO_4^-$ removal by a cationic MOF material showing many promises over the traditional anion-exchange materials.[5] These works clearly reveal that all the possible advantages for ideal radioisotope sorbent materials including high capacity, fast kinetics, excellent selectivity, and great stability and recyclability etc. can be indeed integrated in the MOF system.

References

(1) a) Y. Wang, Z. Liu, Y. Li, Z. Bai, W. Liu, Y. Wang, X. Xu, C. Xiao, D. Sheng, J. Diwu, J. Su, Z. Chai, T. E. Albrecht-Schmitt, **S. Wang***, *J. Am. Chem. Soc.*, **2015**, *137*, 6144. b) J. Xie, Y. Wang, W. Liu, X. Yin, L. Chen, Y. Zou, J. Diwu, Z. Chai, T. E. Albrecht-Schmitt, G. Liu, **S. Wang***, *Angew. Chem. Int. Ed.*, **2017**, *56*, 7500. c) Y. Li, Z. Yang, Y. Wang, Z. Bai, Tao Z., X. Dai, S. Liu, D. Gui, W. Liu, M. Chen, L. Chen, J. Diwu, L. Zhu, R. Zhou, Z. Chai, T. E. Albrecht-Schmitt, **S. Wang***, *Nat. Commun.*, **2017**, *8*, 1354.

(2) T. Zheng, Z. Yang, Z. Liu, D. Gui, X. Dai, S. Liu, L. Zhang, Y. Gao, L. Chen, D. Sheng, Y. Wang, J. Diwu, J. Wang, R. Zhou, Z. Chai, T. E. Albrecht-Schmitt, **S. Wang***, *Nat. Commun.*, **2017**, *8*, 15369.

(3) W. Liu, X. Dai, Z. Bai, Y. Wang, Z. Yang, L. Zhang, L. Xu, L. Chen, Y. Li, D. Gui, J. Diwu, J. Wang, R. Zhou, Z. Chai, **S. Wang***, *Environ. Sci. Technol.*, **2017**, *51*, 3911.

(4) a) D. Sheng, L. Zhu, Cha. Xu, C. Xiao, Y. Wang, Y. Wang, L. Chen, J. Diwu, J. Chen, Z. Chai, T. E. Albrecht-Schmitt, **S. Wang***, *Environ. Sci. Technol.*, **2017**, *51*, 3471. b) L. Zhu, D. Sheng, C. Xu, X. Dai, Mark A. Silver, J. Li, P. Li, Y. Wang, Y. Wang, C. Xiao, J. Chen, R. Zhou, C. Zhang, Omar K. Farha, Z. Chai, T. E. Albrecht-Schmitt, **S. Wang***. *J. Am. Chem. Soc.*, **2017**, *139*, 14873. c) L. Zhu, C. Xiao, X. Dai, J. Li, D. Gui, D. Sheng, L. Chen, R. Zhou, Z. Chai, T. E. Albrecht-Schmitt, **S. Wang***, *Environ. Sci. Technol. Lett.*, **2017**, *4*, 316.

Biography

Prof. Shuao Wang earned B.S. degree in Materials Chemistry from University of Science and Technology of China, and Ph.D. in Environmental Radiochemistry from University of Notre Dame. He did his postdoctoral training at University of California, Berkeley and Lawrence Berkeley National Laboratory. He joined Soochow University as a full professor of Environmental Radiochemistry in 2013 and became the director of the Center of Nuclear Environmental Chemistry in 2014. He has received many prestigious awards including Young Investigator Award (American Chemical Society), National One Thousand Young Talents Award (China), National Excellent Young Researcher Award (National Science Foundation of China), and Young Chemist Award (Chinese Chemical Society). His research interests have focused on the chemistry of the key radionuclides in the nuclear fuel cycle. Particularly, he is interested in solid state chemistry, environmental chemistry, and material chemistry of actinides and fission products aiming at the sustainable development of nuclear energy in China.

Synthesis of Nanostructured Materials via Metallothermic Reduction for Energy Storage

Zhihao Bao *

School of Physics Science and Engineering, Tongji University, Shanghai, 200092, China

** Email: zbao@tongji.edu.cn*

Oxides (e.g. SiO2, CO2) are abundant materials on the earth however their applications are limited by their oxide nature. Meanwhile, their element counterparts (e.g. silicon, carbon) with porous structure are attractive for energy-storage applications. In this talk, I will summarize and discuss our work on conversion of the oxides into corresponding nanostructured materials (porous silicon, graphene) via metallothermic reduction combined with chemical etching. We will focus on the mechanism for the formation of porous nanostructure during the reduction and the influence of the structure on their electrochemical performance.

References

(1) (1)"A magnesiothermic reaction process for the scalable production of mesoporous silicon for rechargeable lithium batteries" An Xing, Jing Zhang, Zhihao Bao*, Yongfeng Mei, Ari S. Gordin, and Kenneth H. Sandhage, Chemical Communications 49, 6743 (2013)

(2)"Bio-derived calcite as a sustainable source for graphene as high-performance electrode material for energy storage" .Huang Tang, Peibo Gao, Xianmin Liu, Huanggua Zhu, Zhihao Bao*, Journal of Materials Chemistry A, 2, 15734-15739 (2014)

(3)"Conductive resilient graphene aerogel via magnesiothermic reduction of graphene oxide assemblies" Huang Tang, Peibo Gao, Zhihao Bao*, Bin Zhou, Yongfeng Mei, Guangming Wu*. Nano Res.,1-8(2015)

Biography

Dr. Zhihao Bao is currently a professor (2009 -) in School of Physics Science and Engineering at Tongji University. He received his Bachelor and master degrees in Physics from Nanjing University (China) in 1999 and 2002, respectively. He got his Ph.D. degree in Materials Science and Engineering at Georgia Institute of Technology in 2008. His current research interests include nanostructured materials for energy and environmental applications.

Stimuli-Responsive Materials Based on Optoelectronic Transition-Metal complexes

Yu-Wu Zhong*

Institute of Chemistry, Chinese Academy of Sciences, Beijing 100190, China

**Email: zhongyuwu@iccas.ac.cn*

Transition-metal complexes have received broad interest due to their appealing electrochemical, photophysical, and optoelectronic properties. For instance, ruthenium complexes are classical dyes for sensitized solar cells. Iridium and platinum complexes are widely used in light-emitting devices and bioimaging. We are particularly interested in the potentials of metal complexes as stimuli-responsive smart materials. In this talk, I will summarize and discuss our research progress on the applications of metal complexes in near-infrared electrochromism, resistive memories, and light-emitting crystals with pseudopolymorphic properties. In addition, our recent endeavors on the synthesis and optoelectronic studies of self-assembled nanostructures based on metal complexes will be discussed.

References

(1) (1)"Electronic coupling in cyclometalated ruthenium complexes" Yu-Wu Zhong*, Zhong-Liang Gong, Jiang-Yang Shao, Jiannian Yao, Coord. Chem. Rev. 2016, 312, 22-40.

(2)"Regulation of Intra- and Intermolecular Pt-Pt and π-π Interactions of a U-Shaped Diplatinum Complex to Achieve Pseudo-Polymorphic Emissions in Solution and Crystalline States" Zhong-Liang Gong, Yu-Wu Zhong* and Jiannian Yao, J. Mater. Chem. C 2017, 5, 7222-7229.

(3)"Resistive memory devices based on a triphenylamine-decorated non-precious cobalt(II) bis-terpyridine complex" Jian-Hong Tang, Tian-Ge Sun, Jiang-Yang Shao, Zhong-Liang Gong and Yu-Wu Zhong*, Chem. Commun. 2017, DOI: 10.1039/c7cc05806c.

Biography

Dr. ZHONG Yu-Wu is currently a Professor (2009 -) in the Institute of Chemistry, Chinese Academy of Sciences. He received his Bachelor's degree in Chemistry from Nankai University (China) in 1999, Ph.D. degree from Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences in 2004 under the supervision of Prof Guo-Qiang Lin. His current research interests include the synthesis of electro-active and photofunctional transition-metal complexes for fundamental electron/energy transfer studies and applications in electrochromism, molecular electronics, and light-emitting devises.

Role of Oxygen in the Activation of Surface Catalysis

Tianchao Niu [1,*]

[1] *Herbert Gleiter Institute of Nanoscience, Nanjing University of Science and Technology*

** Email: tianchaoniu@njust.edu.cnn*

Oxygen is both the key oxidant and activation element in many surface reactions. Here, based on the in-situ reactor scanning tunneling microscopy and X-ray photoelectron spectroscopy, we studied the oxygen promoted C-H dissociation on copper surface, and the CO reduction on oxygen pre-adsorbed FeO/Au(111) surface. Activation of methane at 300 K and "moderate pressures" was only observed on oxygen pre-covered Cu(111) surfaces. Density functional theory calculations reveal that the lowest activation energy barrier of C-H on Cu(111) in the presence of chemisorbed oxygen is related to a two-active-site, four-centered mechanism, which stabilizes the required transition-state intermediate by dipole-dipole attraction of O-H and Cu-CH3 species. The activation of CO on O-FeO/Au(111) is characterized by the reversible transition of the moire pattern of FeO island on Au(111).

Biography

Nanoscience, Nanjing University of Science & Technology. He received his PhD degree in Chemistry from National University of Singapore (NUS) in July 2013 under the supervision of Prof. Chen Wei. His current research interests include molecular-scale interface engineering for molecular electronics, and the construction of model catalysts to explore mechanism of energy related reactions by complimentary in-situ microscopy, and also the characterization of the growth of two-dimensional nanomaterials based on the in situ CVD method combined with LT-STM.

Micro-Nanomaterials with enhanced and selective adsorption performance for environmental remediation

Dongyun Chen, Jianmei Lu

College of Chemistry, Chemical Engineering and Materials Science

Soochow University, Suzhou, 215123, China

** E-mail: dychen@suda.edu.cn, lujm@suda.edu.cn*

Environmental pollution, induced by some contaminants, such as organic pollutants and heavy metals from release of industrial production, has been the subject of much concern. Many useful methods and techniques have been developed for environmental remediation. Among them, removal of pollutants by the method of adsorption using an adsorbent is an important and effective way. In this case, the key issue is highly efficient absorbents. Absorbents with high surface activity, high specific surface area, and strong selective adsorption are needed. Hierarchical micro/nanostructured materials, which are composed of microsized objects with nanostructures, could overcome such disadvantages. These materials with micro/nano-architectures possess large surface/ volume ratios, high stability against aggregation and are very easily separated from solution during application in environmental remediation, and hence can be used for highly efficient removal of contaminants. Recently, we have reported various micro/nanostructured materials (e.g., MOFs, hollow porous C3N4, three dimensional (3D) flowerlike Bi2O2CO3/MoS2, etc.) for enhanced and selective adsorption performance for environmental remediation.

References

[1] D. Chen, H. Zhu, S. Yang, N. Li, Q. Xu, H. Li, J. Lu,* Adv. Mater., 2016, 28, 10443–10458.

[2] S. Yang, D. Chen,* N. Li, Q. Xu, H. Li, J. He, J. Lu,* Adv. Mater., 2016, 28, 2916–2922.

[3] H. Sheng, D. Chen*, N. Li, Q. Xu, H. Li, J. He, J. Lu,* Chem. Mater., 2017, 29, 5612-5616.

[4] H. Zhu, D. Chen*, N. Li, Q. Xu, H. Li, J. He, J. Lu*, Adv. Funct. Mater., 2015, 25, 597-605

Biography

Prof. Dongyun Chen received her Ph.D. degree in applied chemistry from Soochow University in 2012 and appointed as an associate professor in 2015 at College of Chemistry, Chemical Engineering and Materials Science, Soochow University. He has research interests in absorbent and catalytic micro-nanomaterials for environmental remediation.

Regulation of stem cell fate by nanostructure mediated physical signals for tissue engineering and regeneration

Hong Liu [1,2,*]

[1]*Institute for Advanced Interdisciplinary Research,University of Jinan,250022, China*

[2]*State Key Laboratory of Crystal Materials, Shandong University, Jinan 250100,China*

** Email: ifc_liuh@ujn.edu.cn*

Besides the biological growth factors, small organic molecules, and chemical ions, physical signals is the other category of very important factors to tune/regulate the fate of stem cells. Recent years, more attention has been paid on the differentiation of stem cells on the physical signal, including, localized electric or magnetic field, surface topology of biomaterials, photo irradiation, and even pressure and strain from the materials. With progress of research in this field, some cues of connection between physical signal and bio pathway for differentiation have been discovered. However, more phenomena have still not been understood. Because the physical signals possess controllability and can be localized in a specific area, they are benefit to be used in tissue engineering for tissue regeneration. Therefore, finding new physical approaches for regulation fate of stem cells is a great challenge for alive biomaterials design and applications.

Recent year, some novel phenomena about the effect of physical signal on stem cell differential has been noticed. For example, nano-network morphology of HAp film can induce differentiation of bone marrow mesenchymal stem cells (MSCs) to vascular endothelial cells, surface charges on $LiNbO_3$ wafer can regulate MSCs differentiate to osteogenic cells, and a pressure from biomaterials can differentiate MSCs to neural cells.

In this talk, we will report the above works, and try to explain the reasons for physical signal induced differentiation from both physical mechanism and bio pathways. We believe that the regulation effect of physical signal will attract more attention, and will have great impact for design and application of biomaterials, especially for tissue engineering scaffold, and will bring great progress in tissue regeneration medicine.

References

[1]"Cellular internalization of LiNbO3 nanocrystals for second harmonic imaging and the effects on stem cell differentiation" Li J, Qiu J, Guo W, Wang S, Ma B, Mou X, Tanes M, Jiang H, Liu Hong*, Nanoscale 14, 7416-7422 (2016)

[2]"Self-Powered Electrical Stimulation for Enhancing Neural Differentiation of Mesenchymal Stem Cells on Graphene–Poly (3,4-ethylenedioxythiophene) Hybrid Microfibers" Guo W, Zhang X, Yu X, Wang S, Qiu J, Tang W, Li L, Liu Hong*, Wang Z, ACS Nano 10, 5086-5095 (2016)

[3]"TiO2 Nanorod Array Constructed Nanotopography for Regulation of Mesenchymal Stem Cells Fate and the Realization of Location-Committed Stem Cell Differentiation" Qiu J, Li J, Wang S, Ma B, Zhang S, Guo W, Zhang X, Tang W, Sang Y, Liu Hong*, Small 12, 1770-1778 (2016)

[4]“Localized committed differentiation of neural stem cells based on the topographical regulation effects of TiO2 nanostructured ceramics” Mou X, Wang S, Guo W, Ji S, Li D, Zhang X, Zhou J, Tang W, Wang C, Liu [4]Hong*, Nanoscale 8, 13186-13191 (2016)

[5]“Static pressure-induced neural differentiation of mesenchymal stem cells” Mou X, Wang S, Liu X, Guo W, Li J, Qiu J, Yu X, Wang Z, Liu X, Liu Hong*, Nanoscale (2017)

Biography

Dr. LIU Hong is currently a Professor in both Institute for Advanced Interdisciplinary Research at University of Jinan and State Key Laboratory of Crystal Materials Shandong University. He received his Ph.D. degree in 2001 from Shandong University (China). His current research is focused mainly on tissue engineering, nanomaterials and nanodevices, especially the application of nanomaterials and nanodevices in gas and biosensors, environmental protection, and new energy sources.

Advanced In Vivo Fluorescence Imaging: Seeing is Believing

Qiangbin Wang
CAS Key Laboratory of Nano-Bio Interface, Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences, Suzhou 215123 China

** Email: qbwang2008@sinano.ac.cn*

Fluorescent imaging in the second near-infrared window (NIR-II, 1.0~1.4 μm) is appealing in in vivo imaging due to minimal autofluorescence and negligible tissue scattering in this region, affording maximal penetration depth for deep tissue imaging with high feature fidelity. Herein, for the first time, we reported a new type of NIR-II QDs-Ag2S QDs and executed a series of in vivo imaging studies by using Ag2S QDs. The results show that, by using Ag2S QDs, the tissue penetration length can reach 1.5 cm, and the spatial and temporal resolution of the in vivo imaging can down to 25 μm and 10 ms, respectively, which are improved several to dozens of times in comparison with those using conventional fluorescence nanoprobes in the visible and the first near-infrared window (650-900 nm), offering in situ, real-time visualization of the biological events in vivo. With the advanced NIR-II fluorescence of Ag2S QDs, high signal to noise ratio imaging of tumor growth and angiogenesis, imaging-guided targeting drug-delivery and therapeutics, imaging-guided precision surgery of glioma, and stem cell tracking and regeneration in vivo, etc, have been achieved.

References

[1]“Near-Infrared Photoluminescent Ag2S Quantum Dots from a Single Source Precursor” Yaping Du, Bing Xu, Tao Fu, Miao Cai, Feng Li, Yan Zhang, and Qiangbin Wang*, , J. Am. Chem. Soc. 132, 1470 (2010).

[2]“Real-Time Monitoring Surface Chemistry-Dependent In Vivo Behaviors of Protein Nanocages via Encapsulating an NIR-II Ag2S Quantum Dot" Chunyan Li, Feng Li*, Yejun Zhang, Wenjing Zhang, Xian-En Zhang, Qiangbin Wang*. ACS Nano. 9, 12255 (2015).

[3]“Engineered Multifunctional Nanomedicine for Simultaneous Stereotactic Chemotherapy and Inhibited Osteolysis in an Orthotopic Model of Bone Metastasis”, Chunyan Li, Yejun Zhang, Guangcun Chen, Feng Hu, Kui Zhao, Qiangbin Wang*, Adv. Mater. DOI: 10.1002/adma.201605754 (2017).

Biography

Dr. Wang is a Professor of Chemistry in Suzhou Institute of Nano-Tech and Nano-Bionics (SINANO), Chinese Academy of Sciences. He got his Ph.D from East China University of Science and Technology in 2002. He worked as a Postdoc Associate and later as an Assistant Research Professor at Arizona State University from 2004 to 2008. In July 2008, he joined SINANO as a Professor focusing on controlled synthesis of inorganic semiconductor nanocrystals and their bioapplications.

Molybdenum disulfide-based nanocomposites: synthesis and biosensing application

*Lianhui Wang**

Key Laboratory for Organic Electronics & Information Displays (KLOEID), Institute of Advanced Materials (IAM), Nanjing University of Posts & Telecommunications, Nanjing 210023, China

** Email: iamlhwang@njupt.edu.cn*

Transition metal dichalcogenides (TMDs) are a family of layered nanomaterials, which attract increasing interest due to their novel nanoelectronic and optoelectronic properties. Therefore, TMDs and TMD-based nanocomposites have charming applications in many fields, such as biosensors, cancer therapy, capacitors, lithium batteries, and catalysts. Our group have focused on controllable synthesis of MoS2 and MoS2-based nanocomposites and their interesting bioapplication. For example, we had developed a rapid and versatile ultrasonication enhanced lithium intercalation method to prepare single-layer transition metal dichalcogenide nanosheets (such as MoS2, TiS2 nanosheets) by using n-butyllithium. Moreover, we had successfully decorated noble metal (Au, Ag, Pd, Pt) nanoparticles on the surface of MoS2 nanosheets. We used MoS2-based nanomaterials to construct sensing platform for chemical and biological molecules detection, such as DNA, CEA, ATP and thrombin. In a word, MoS2-based nanocomposite may be a candidate nanomaterial to construct sensing platform for target molecules detection.

Biography

Prof. Wang Lianhui earned his B.S. degree (1988) in Polymer Materials from Chengdu University of Science and Technology, and received his Ph.D. degree (1998) in Polymer Chemistry & Physics from Zhejiang University under the supervision of Prof. Zhiquan Shen. He joined National University of Singapore as a postdoctoral fellow from July 1998 to February 2000, he then worked as research fellow and assistant professor in Institute of Molecular and Cell Biology, National University of Singapore, Singapore from March 2000 to August 2006. He joined Fudan University (China) as a full professor in 2006. At present, he is a professor in Nanjing University of Posts and Telecommunications, China. His research interest covers nano functional materials, biooptoelectronics, biosensor. He was awarded the Distinguished Young Scholar (NSFC), and the “Changjiang Scholar” chair professor (MOE) in China.

Multifunctional luminescent nanomaterials: controlled fabrication, properties and biomedical Applications

*Jun Lin**

Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, 5625 Renmin Street, Changchun 130022, P. R. China

**Email: jlin@ciac.ac.cn*

Multifunctional luminescent nanomaterials are promising for realizing the diagnosis and therapy in one material system, which has aroused great interests in biomedical fields in recent years. So far, how to realize the controllable fabrication of multifunctional luminescent nanomaterials that meet the requests of biomedical application is still a great challenge for chemical researchers. In this presentation, we will highlight the research work in our group for the controllable preparation of multifunctional nanomaterials together with their properties and application in biomedical fields. These materials have been investigated as drug carriers and/or cell imaging agents with IBU and anticancer drug (DOX) as models; Especially, combined photo/ thermo- therapy of cancer can also be realized by the multifunctional rare earth based luminescent materials.

References

(1) "808 nm Light - Excited Lanthanide -Doped Nanoparticles: Rational Design, Luminescence Control and Theranostic Applications " Liu B, Li CX*, Yang PP, Hou ZY* and Jun Lin*, Adv. Mater. 29, 1605434 (2017)

(2) " Current Advances of Lanthanide Ion (Ln3+)-Based Upconversion Nanomaterials for Drug Delivery ", Yang DM, Ma PA, Hou ZY, Cheng ZY, Li CX* and Jun Lin*, Chem. Soc. Rev. 44, 1416(2015).

(3) "Recent Progress in Rare Earth Micro/Nanocrystals :Soft Chemical Synthesis, Luminescent Properties and Biomedical Applications " Gai SL, Li CX, Yang PP* and Jun Lin*, Chem. Rev. 114, 2343 (2014).

Biography

Dr. LIN Jun is currently a Professor (2000 -) in Changchun Institute of Applied Chemistry, Chinese Academy of Sciences (CIAC, CAS). He received his Bachelor's degree in Chemistry from Jilin University (China) in 1989, Ph.D. degree from CIAC, CAS in 1995 under the supervision of Prof Qiang Su. His research interests include bulk- and nanostructured luminescent materials and multifunctional composite materials together with their applications in display, lighting and biomedical fields.

Synthesis of inorganic-organic nanocomposites for photothermal ablation therapy of tumor

*Nuo Yu, Zhouqi Meng, Zhaojie Wang, Meifang Zhu, Zhigang Chen**
State Key Laboratory for Modification of Chemical Fibers and Polymer Materials, College of Materials Science and Engineering, Donghua University, Shanghai 201620, China

** Email: zgchen@dhu.edu.cn*

Near-infrared (NIR) laser-induced photothermal ablation therapy (PAT) has great potential to revolutionize conventional therapeutic approaches for cancers, and a prerequisite is to obtain biocompatible and efficient photothermal nanoagents. To address this problem, we have used hydrophilic polymer as surface ligands to prepare several semiconductor nanoagents, including CuS [1] and W18O49 nanomaterials [2]. Their aqueous dispersions exhibit intense NIR absorbance and excellent photothermal effects. Importantly, if we inject aqueous dispersion into the tumor in mice, cancer cells in vivo can be efficiently ablated under the irradiation of NIR laser with a safe intensity for ~10 min. To further improve the therapeutic effects, the combination of NIR-PAT and chemotherapy has been proposed for the synergic therapy. Recently, by combing semiconductor nanoagents and thermosensitive polymer nanogels, we have constructed smart nanocapsules (G-CuS-DOX) that can be switched by NIR-laser[3]. The nanocapsules exhibit the controllable and efficient photothermal/chemotherapy effect compared with single PAT or chemotherapy effect for the tumor. Furthermore, ideal theranostic nanoplatform for tumor should be one nanoparticle that has single semiconductor or metal component but contains all multi-model imaging and therapy abilities. By tuning vacancy concentrations via the morphology control or doping technology, we have developed FeS2 (size: ~350 nm) [4] and Nb-doped TiO2 [5] nanoparticle as "all-in-one" multifunctional nanoagents for the imaging guided PAT of tumor. Therefore, these inorganic-organic nanocomposites have great potential in the imaging and/or therapy of tumor.

References

[1] "Hydrophilic Flower-Like CuS Superstructures as an Efficient 980 nm Laser-Driven Photothermal Agent for Ablation of Cancer Cells. " Q. W. Tian, M. H. Tang, Y. G. Sun, R. J. Zou, Z. G. Chen*, M. F. Zhu, S. P. Yang, J. L. Wang, J. H. Wang and J. Q. Hu*. Adv. Mater., 2011, 23, 3542.

[2] "Ultrathin PEGylated W18O49 Nanowires as a New 980 nm-Laser-Driven Photothermal Agent for Efficient Ablation of Cancer Cells In Vivo " Z. G. Chen*, Q. Wang, H. L. Wang, L. S. Zhang, G. S. Song, L. L. Song, J. Q. Hu, H. Z. Wang, J. S. Liu, M. F. Zhu* and D. Y. Zhao. Adv. Mater., 2013, 25, 2095.

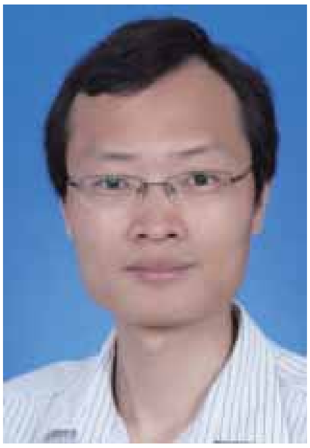
[3] "NIR-Laser-Switched In Vivo Smart Nanocapsules for Synergic Photothermal and Chemotherapy of Tumors. " Z. Meng, F. Wei, R. Wang, M. Xia, Z.G. Chen*, H. Wang* and M. Zhu*. Adv. Mater., 2016, 28, 245.

[4] "Design and Synthesis of "All-in-One" Multifunctional FeS2 Nanoparticles for Magnetic Resonance and Near-Infrared Imaging Guided Photothermal Therapy of Tumors. " Z. Meng, F. Wei, W. Ma, N. Yu, P. Wei, Z. Wang, Y. Tang, Z.G. Chen*, H. Wang* and M. Zhu*. Adv. Funct. Mater., 2016, 26, 8231.

[5] " Dynamically Tuning Near-infrared-induced Photothermal Performances of TiO2 Nanocrystals by Nb-

doping for Imaging Guided Photothermal Therapy of Tumors. " N. Yu, Y. Hu, X. Wang, G. Liu, Z. Wang, Z. Liu, Q. Tian, M. Zhu, X. Shi* and Z.G. Chen*. Nanoscale, 2017, 9, 9148.

Biography



Zhigang Chen received his B.S. and M.S. degrees from Central China Normal University in 2002 and 2005, respectively. He received his Ph.D. degree from Fudan University in Jul 2008. Afterwards, he joined Donghua University as a lecture. From Oct 2008 to Dec 2009, he carried out postdoctoral research at Max Planck Institute for Colloids and Interfaces in Germany, supported by the Alexander von Humboldt Foundation. In 2010 and 2013, he was elevated to Associate Professor and Full Professor, respectively. His researches focus on the synthesis of photothermal nanomaterials and their application in biomedical and energy fields. Dr. Chen has authored over 110 peer-reviewed papers. He was listed as one of 'Highly Cited Researchers' (Materials) by Thomson Reuters in 2016.

Functional Nanoparticles for Tumor Imaging and Therapy

Zhenyu Gao[1,2], Xiaju Cheng[3], Jianfeng Zeng[3], Yi Hou[1], Chunyan Liu[1], Haibin Shi[3], and Mingyuan Gao[,1,3]*

[1]Institute of Chemistry, Chinese Academy of Sciences, Beijing 100190, China

[2]National Center for Nanoscience and Technology, Beijing 100190, China

[3]Centre for Molecular Imaging and Nuclear Medicine, Soochow University, Suzhou 215123, China

**Email: gaomy@iccas.ac.cn*

Through either passive or active targeting, functional nanoparticles have shown great potentials in tumor diagnosis and therapy. We have spent years' efforts to develop functional nanoparticles and nanoparticle-based probes for imaging of tiny tumors and lymphatic micrometastasis, visualizing of tumor microenvironment abnormal signatures, and tumor photothermal therapies as well. In this presentation, we will present our recent results about tumor theranostic applications of functional nanoparticles.[1-3]

References

[1] "Molecular Imaging of Vulnerable Atherosclerotic Plaques In Vivo with Osteopontin-Specific Upconversion Nanoprobes" Qiao R‡, Qiao H‡, Zhang Y, Wang YB, Chi CW, Tian J, Zhang LF, Cao F*, and Gao MY*, ACS Nano 11, 1816-1825 (2015).

[2] "Light-triggered Assembly of Gold Nanoparticles for Photothermal Therapy and Photoacoustic Imaging of Tumors In Vivo" Cheng XJ, Sun R, Yin L, Chai ZF, Shi HB*, and Gao MY*, Adv. Mater. 29, 1604894 (2017).

[3] "Small is Smarter: Nano MRI Contrast Agents - Advantages and Recent Achievements" Gao ZY, Ma TC, Zhao EY‡,*, Docter D, Yang WS, Stauber‡ RH, and Gao MY*, Small 12, 556-576 (2016).

Biography

Dr. Mingyuan Gao is a full Professor of Institute of Chemistry, Chinese Academy of Sciences (CAS). He received his PhD (1995) in Polymer Chemistry and Physics at Jilin University. He worked in Germany from 1996 to 2002 and was an AvH fellow between 1996 and 1998. He took the above position upon a 'Hundred-talent Program' of CAS in 2001. He received an award for Distinguished Young Scholars from NSFC in 2002. Since 2013, he had appointed as a Chair Professor and Director of the Centre for Molecular Imaging and Nuclear Medicine, School of Radiation Medicine and Protection, Soochow University. He has published ~140 peer-reviewed articles.

Organic Semiconducting Materials for Photo-Related Bioimaging and Therapy

Quli Fan *

Key Laboratory for Organic Electronics & Information Displays and Institute of Advanced Materials, Nanjing University of Posts & Telecommunications, Nanjing 210023, China

** Email: iamqlfan@nuupt.edu.cn*

Organic semiconducting materials (OSMs) have been served as a kind of "star materials" for molecular imaging and therapy due to their good biocompatibility and excellent optoelectronic properties. In this talk, we will first introduce the design principle of molecular brush-type OSMs with excellent water-solubility and optical performances for fluorescence imaging and drug delivery. Consideration the ultraviolet absorption drawback of these materials and low tissue penetration of fluorescence imaging, we developed near-infrared (NIR) absorptive OSMs for photoacoustic imaging (PAI) which is an emerging hybrid bio-imaging modality that integrates the advantages of ultrasound with deep tissue penetration and optical imaging with high spatial resolution. Taking NIR-absorptive perylene-3,4,9,10-tetracarboxylic diimide (PDI) as an example, we presented the design principle of PDI-based OSMs for PAI of deep brain tumor, lymph node and thrombolysis in living mice. In sharp comparison with these exogenous OSMs, endogenous OSMs with good biocompatibility and biodegradability exhibits much more fascinating potential in clinical translation. Thus, we further developed ultrasmall melanin (natural OSMs) as an endogenous photoacoustic contrast agent nanoparticles (NPs) and nanoplatforms for multimodality imaging and therapeutic purposes. The intrinsic metal ions-absorbing ability of melanin not only realizes multimodality imaging with easy by chelating radionuclide 64Cu (positron emission tomography) and Fe3+ (magnetic resonance imaging) but also provides an innovative way for iron overload therapy. Besides, we found that melanin NPs can also be transferred into a drug-delivery system due to its binding capability to those drugs with aromatic structures through their π–π interaction. Our work provides a promising molecular guideline to broaden the application of OSMs especially in molecular imaging and therapy.

References

[1] "Photo-Induced Charge-Variable Conjugated Polyelectrolyte Brushes Encapsulating Upconversion Nanoparticles for Promoted siRNA Release and Collaborative Photodynamic Therapy under NIR Light Irradiation" Zhao H, Hu WB, Ma HH, Jiang RC, Tang YF, Ji Y, Lu XM, Hou B, Deng WX, Huang W, Fan Quli*, Advanced Functional Materials, DOI: 10.1002/adfm.201702592, (2017)

[2] "Organic Semiconducting Nanoparticles as Efficient Photoacoustic Agents for Lightening Early Thrombus and Monitoring Thrombolysis in Living Mice" Cui C, Yang Z, Hu X, Wu JJ, Shou KQ, Ma HH, Jian C, Zhao Y, Qi BW, Hu XM, Yu AX, Fan Quli*, ACS Nano 11, 3298-3310 (2017)

[3] "Perylene-Diimide-Based Nanoparticles as Highly Efficient Photoacoustic Agents for Deep Brain Tumor Imaging in Living Mice" Fan Quli, Cheng

K, Yang Z, Zhang RP, Yang M, Hu X, Ma XW, Bu LH, Lu XM, Xiong XX, Huang W, Zhao H, Cheng Z, Advanced Materials 27, 843-847 (2015)

[4] "Engineering Melanin Nanoparticles as an Efficient Drug–Delivery System for Imaging-Guided Chemotherapy" Zhang RP, Fan Quli*, Yang M, Cheng K, Lu XM, Zhang L, Huang W, Cheng Z, Advanced Materials 27, 5063-5069 (2015)

"Transferring Biomarker into Molecular Probe: Melanin Nanoparticle as a Naturally Active Platform for Multimodality Imaging" Fan Quli, Cheng K, Hu X, Ma XW, Zhang RP, Yang M, Lu XM, Xing L, Huang W, Gambhir SS, Cheng Z, Journal of the American Chemical Society 136, 15185-15194 (2014)

Biography

FAN Quli obtained his Ph.D. degree from National University of Singapore (NUS) in 2003 under the direction of Prof. Wei Huang. He joined the Institute of Advanced Material at Fudan University in 2003. In 2006, he moved to Nanjing University of Posts & Telecommunications and then was promoted to full professor in 2007. From 2012 to 2014, he came to Stanford University as a visiting scholar to explore the potential applications of organic semiconducting materials in theranostics. Currently, his research interests mainly focused on the development of organic semiconducting materials for theranostic applications including photoacoustic imaging, photodynamic therapy, and photothermal therapy. To date, Dr. Fan has published more than 190 journal papers with a H-index of 40.

Scandium-Based Luminescent Nanomaterials

Ling Huang *
Institute of Advanced Materials (IAM), Nanjing Tech University (NanjingTech), 30 South Puzhu Road, Nanjing 211816, China

**Email: iamlhuang@njtech.edu.cn*

In the past decades, rare earth-based upconversion luminescent nanomaterials have drawn greatly increased interest due to their superior optical properties including but not limited to narrow emission bandwidth, large anti-Stokes shifts, high photostability, weak autofluorescence from biosamples, long life-time, deep tissue penetration, and low cytotoxicity.

Fig. 1. Position of Sc in the periodic table.

However, majority of the attention has been focused on Y- and lanthanide-based nanomaterials while there is very few reports on Scandium-based nanomaterials although Sc sits at a very unique position in the periodic table, i.e., the cross junction between the top of the rare earth column and the beginning of the transition metal row.

Herein, we will summarize our advances on Sc-based luminescent nanomaterials and their potential applications.[1-3]

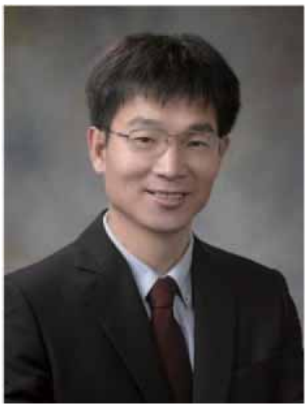
References

"Controlled Synthesis, Evolution Mechanisms, and Luminescent Properties of ScFx:Ln (x = 2.76, 3) Nanocrystals", Xie, J, Xie, X, Mi C, Gao, Z, Pan, Y, Fan, Q, Su, H, Jin, D, Huang, L*, Huang, W*, Chem. Mater., in press.

"From ScOOH to Sc2O3: Phase Control, Luminescent Properties, and Applications", Zhao, B, Xie, X, Xu, S, Pan, Y, Yang, B, Guo, S, Wei, T, Su, H, Wang, H, Chen, X, Dravid, V. P, Huang, L*, Huang, W*, Adv. Mater. 28, 6665-6671 (2016)

"Lanthanide-Doped NaxScF3+x Nanocrystals: Crystal Structure Evolution and Multicolor Tuning", Teng, X, Zhu, Y, Wei, W, Wang, S, Hu, W, Han, Y, Zhang, Q, Fan, Q, Huang, W, Capobianco, JA, Huang, L*, J. Am. Chem. Soc. 134, 8340-8343 (2012).

Biography



Dr. Ling HUANG received his PhD degree in Chemistry from Nanjing University in 2001. He continued post-doctoral research at the University of California, Berkeley (Gabor A. Somorjai), Florida State University (Seunghun Hong), and Northwestern University (Chad A. Mirkin). After that, he worked as a senior research scientist at the Biochemical Division of Corning Incorporated in 2008 and then joined Nanyang Technological University as an associate professor since 2009. Starting from August of 2012, he worked as a professor at Nanjing Tech University. His current research focuses on design, synthesis, and tuning of the optical properties of lanthanide-doped nanocrystals. He has published over 100 scientific research articles in Nature, Science, J. Am. Chem. Soc., Angew. Chem. Int. Ed., Adv. Mater., with a total citation of over 3000 times.

Analysis based on the assembled ordered structure.

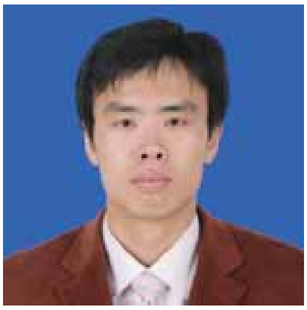
Prof. Tie Wang

Beijing National Laboratory for Molecular Sciences, Key Laboratory of Analytical Chemistry for Living Biosystems, Institute of Chemistry, The Chinese Academy of Sciences, Beijing 100190, China.

Self-assembly, driven by non-covalent interactions, is the fundamental mechanism behind the formation of cellular machineries that perform essential functions of life. To date, anisotropic nanoparticles have been used in the design of directional bonding interactions on the nanometer scale through crystal-face-specific functionalization of these particles with recognition groups and/or through shape-induced anisotropic interactions.1 Recently, we have reported that anisotropy-driven self-assembly of CdSe/CdS semiconductor core/shell nanorods can yield needle-like superparticles with a single supercrystalline domain through a kinetic process.2 However, in this process, the formation of needle-like superparticles is sensitively dependent on the level of octylamine ligands on the surface of CdSe/CdS nanorods, which requires a surface treatment for incubating CdSe/CdS nanorods in a very dilute octylamine chloroform (0.1%, v/v) solution for 6 to 7 days.2 This requirement makes it very inconvenient to use this kinetic approach for making needle-like superparticles. To overcome this difficulty, here we report a new synthesis for making needle-like CdSe/CdS supercrystals, which is based on the preparation of CdSe/CdS nanorods exhibiting a static structure with hydrophobic anisotropy through surface functionalization with 1,12 dodecanediamine.

Biography:

Tie Wang has completed his PhD at the age of 28 years from Changchun Institute of Applied Chemistry Chinese Academy of Sciences and postdoctoral studies from Florida University. He is a professor of Institute of Chemistry Chinese Academy of Sciences with the award of "Thousand Youth Talents Plan" in 2013 and "National Natural Science Foundation--Outstanding Youth Foundation" in 2014. He has published more than 60 papers in reputed journals including Scinence, JACS, Adv Mater. Angew Chem, PANS et al, and has been serving as an editorial board member of Journal of Analytical & Molecular Techniques.



Luminescence Lanthanide-doped Nanocrystals for Energy Conversion and Imaging Applications

Renren Deng*

School of Materials Science and Engineering, Zhejiang University, Hangzhou 310058, China

** Email: rdeng@zju.edu.cn*

The lanthanide-doped materials have been investigated for many years with regard to their diverse applications ranging from high pulse lasers, solar cells to optical electrodes. The unique optical properties of these materials have rendered their potential usefulness in biological applications such as biolabeling. Driven by this motivation, intense studies have recently been devoted to the development of novel nano-sized (around 1-100 nm in diameter) lanthanide-doped materials which were compliable to biological systems. My research involves the design, fabrication and mechanical studies of lanthanide upconvesion nanocrystals with either unique crystal lattice structures or novel core-shell heterogeneous structures. I am now trying to understand the energy transfer through lanthanide-doped nanoparticles for potential applications such as 3D displays, and solar energy conversion.

References

[1] R. Deng, J. Wang, R. Chen, W. Huang, X. Liu, Enabling Förster resonance energy transfer from large nanocrystals through energy migration[J], J. Am. Chem. Soc. 2016, 138, 15972.

[2] R. Deng, F. Qin, R. Chen, W. Huang, M. Hong, X. Liu, Temporal full-colour tuning through non-steady-state upconversion[J], Nature Nanotechnol. 2015, 10, 237.

Biography

Dr. Renren Deng is currently a Professor-Level Research Scientist (2016 -) supported by The Thousand Talents Plan at Zhejiang University. He earned his BS degree from Zhejiang University in 2009. He completed his PhD on enhancing multiphoton upconversion at the National University of Singapore (NUS) in 2014 under the direction of Professor Xiaogang Liu. During 2014-2016, he subsequently worked as postdoctoral researcher at NUS, as well as Cavendish laboratory in Cambridge University. His research interests are in the development of novel luminescent nanomaterials for applications such as photovoltaics and 3D displays, and understanding energy transfer through lanthanide-doped nanocrystals.

Doping of RE ions in the 2D ZnO layered system to achieve low-dimensional upconverted persistent luminescence based on asymmetric doping in ZnO systems

Bolong Huang

Department of Applied Biology and Chemical Technology, The Hong Kong Polytechnic University, Hong Hum, Kowloon, Hong Kong SAR, China

Email: bhuang@polyu.edu.hk

Abstract

Herein, we dope a low-dimensional ZnO system with a wide range of rare earth (RE) ions. Through systematic calculations, the dopable range of all ZnO systems was found to be asymmetrical, which accounts for the difficulty in achieving p-type doping. Low-dimensional ZnO systems, similar to 2D graphene-like nanosheets, have a wider doping limit. Thus, 2D ZnO is a promising candidate to achieve a wider doping range in ZnO. To further examine energy transfer in upconversion luminescence, the excited states of all lanthanide (Ln) elements in both the Ln2+ and Ln3+ ionic state in the bulk ZnO lattice were extensively studied. The probability of mixed valences of the Ln dopant ions occurring in ZnO was discussed, along with the analysis of the relative oscillator strengths. At the Ln2+ states, the heavy lanthanide elements usually dominated the energy transmission channel at high energy, the medium lanthanide elements mostly occupied the middle range of the optical fundamental gap, and the light lanthanide elements were widely spread over the optical band gap, as well as the conduction band range. However, Ln3+ ions, as the sensitizing dopant, have reduced energy barriers for excited state absorption, showing wider energy transfer channels that are evenly distributed within 3.0 eV, which is lower than the conduction band edge absorption in Ln^{2+}. Meanwhile, each energy level has an obviously stronger oscillator strength, indicating a larger probability for excitation and energy transport between the inter-levels. Thus, in physicochemical and biological terms, trivalent Ln doping follows the removal of apical dominance concept, contributing more flexible energy transfer within the biological window for in vivo imaging or other related optoelectronic devices.

Biography

Dr. Bolong Huang received his PhD in 2012 from University of Cambridge, and before that he obtained his BSc in condensed matter physics from Department of Physics, Peking University 2007. Following a systematic training period as research assistant in Chemistry Department in Peking University, and in Hong Kong, he was starting-up his independent research as PI in the Department of Applied Biology and Chemical Technology, The Hong Kong Polytechnic

University in 2015. His main research fields are DFT calculations on rare earth functional materials, defect theory of solid functional materials, DFT calculation development based on ab-initio electronic self-energy corrections on local 4f orbitals of rare earth element, and orbital corrections as an implement in time-dependent DFT theory. In his early stage of PI research, he has dedicated his time in full strength as referee in many core research journals with peer reviewed. He serves as member of American Chemistry Society.

Development of Energy Storage Devices for Small-power Energy Harvesting

Xianmao Lu [1,*]
[1] Beijing Institute of Nanoenergy & Nanosystems, Chinese Academy of Science

* Email: luxianmao@binn.cas.cn

Increasing demand for sensors including building control, industrial control, security, location tracking and many others have put forward imperative request for small power havesting devices (e.g., triboelectric nanogenerators) that is much more convenient and cost effective if they can power the sensors autonomously without expensive wires, or batteries that will need replacing over and over. Due to the intermitent nature of these power sources, efficient energy storage for small-power harvesting devices is of significant importance for continuous power supply. When charged at low and intermitent power, energy storage devices such as supercapacitors or batteries need to handle pulse energy input and have mimial leakage current. In this presentation, I will discuss our recent efforts in developing energy storage devices that are suitable for small power harvesting applications.

Biography

Dr. LU Xianmao is currently a Principal Investigator at Beijing Institute of Nanoenergy & Nanosystems (BINN). He received his Bachelor’s degree in Chemical Engineering from Tsinghua University (China), Ph.D. degree from Chemical Engineering from the University of Texas at Austin in 2005 under the supervision of Prof Keith Johnston and Prof Brian Korgel. His current research interest is to develop energy storage devices based on nanomaterials for small-power energy harvesting devices.

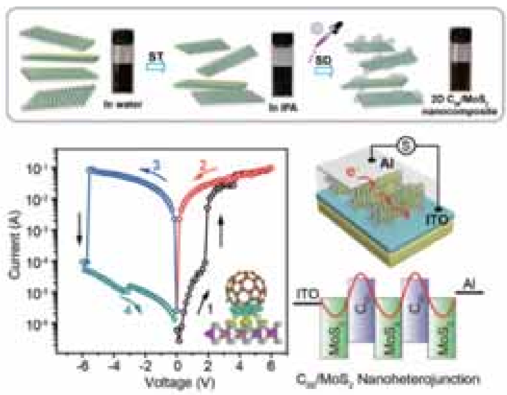
2D MoS^2／富勒烯及其衍生物范德华异质结的构筑及其电存储特性研究

陈润锋 *

南京邮电大学信息材料与纳米技术研究院，有机电子与信息显示国家重点实验室培育基地，南京市亚东新城区文苑路 9 号，210023

** Email: iamrfchen@njupt.edu.cn*

分子尺度的范德华异质结的界面耦合效应能够产生新颖的物理特性，是近两年的新兴研究领域。以 MoS2 为代表的过渡金属硫化物二维材料，具有理想的禁带宽度、优异的电学 / 光学 / 机械性质；富勒烯及其衍生物因具备独特的物理、化学、机械性质而成为光电器件的明星单元。如何构筑分子尺度的二维材料 / 富勒烯及其衍生物异质结，阐明二者之间电荷转移特性和相互作用关系具有重要意义。我们采用溶液转移和液相沉积方法将 C60 沉积到单层 MoS2 表面，成功构筑分子尺度的 MoS2/C60 异质结二极管器件。电流 - 电压特征曲线测试结果表明器件具备非易失性闪存特性，低阈值电压、长持续时间、高开关比。提出了界面内建电场导致电子越过界面势垒的模型来解释电存储特性机制，揭示了有机材料 / 二维材料界面的电荷传输、转移特性属于 II 型半导体。为了验证该方法的普适性，我们进一步构筑了 PCBM/ MoS2 异质结，研究表明器件的存储特性与 MoS2、PCBM 的相对含量关系密切，我们利用陷阱诱捕理论对该现象做出了解释。这一系列的研究工作表明该绿色简单高效的办法可以拓展到其他关于二维材料的异质结，同时也证实了理论研究和实验结合的方式对分子尺度界面物理机制研究、新型光电器件开发具有指导意义。



参考文献：

[1] Chen, R.; Lin, C.; Yu, H.; Tang, Y.; Song, C.; Yuwen, L.; Li, H.; Xie, X.; Wang, L.; Huang, W. Chem. Mater. 2016, 28, 4300-4306.

[2] Son, D. I.; Park, D. H.; Kim, J. B.; Choi, J.; Kim, T. W.; Angadi, B.; Yi, Y.; Choi, W. K. J. Phys. Chem. C. 2011, 115, 2341−2348

[3] Yuwen, L.; Xu, F.; Xue, B.; Luo, Z.; Zhang, Q.; Bao, B.; Su, S.; Weng, L.; Huang, W.; Wang, L. Nanoscale. 2014, 6, 5762-5769.

Biography

Dr. Runfeng Chen received his BE degree in Polymer Science and Engineering and MS degree in Material Science from Tongji University. He did his PhD in Fudan University with Professor Wei Huang and his postdoctoral work at the National University of Singapore with Professor Xiaogang Liu. He joined the faculty of Nanjing University of Posts and Telecommunications in 2006. Currently, he sits as an editorial board member of scientific reports. His present interests are in the research of optoelectronic materials and devices, especially organic afterglow materials, smart materials with dynamically adaptive characteristics, and host materials with high singlet/triplet exciton formation ratio for highly efficient phosphorescent OLED devices. He is also interested in introducing organic optoelectronic molecules into the surface of inorganic 2D materials, aiming to develop feasible protocols to prepare high-performance hybrid optoelectronic materials for advanced device applications.

Effects of –OH Group on Lanthanide Photon Upconversion

Xiaoji Xie

Institute of Advanced Materials (IAM), Nanjing Tech University (NanjingTech), 30 South Puzhu Road, Nanjing 211816, P.R. China

Email: iamxjxie@njtech.edu.cn

Lanthanide-doped upconversion nanoparticles hold great promise for various applications, ranging from bioimaging to photovoltaic technologies. Despite the advances, upconversion nanoparticles often suffer from low quantum efficiencies and strong luminescence quenching. For example, for upconversion nanoparticles in aqueous solvent, one of the main issues is the strong absorption of ~980 nm excitation energy caused by the –OH group, which quenches the upconversion emission and induces serious photothermal effect during bioapplications. Herein, we will firstly describe approaches, including the manipulation of excitation wavelength of upconversion nanoparticles, to avoid adverse effects caused by the –OH group.[1] We then would like to demonstrate the utilization of such quenching effect for water sensing.[2] Finally, we will give examples to show that the –OH group may not always have adverse effects on the photoluminescence of lanthanide ions.[3]

References

[1] "Mechanistic Investigation of Photon Upconversion in Nd3+-Sensitized Core−Shell Nanoparticles", Xie, X.; Gao, N.; Deng, R.; Sun, Q.; Xu, Q.; Liu, X.* J. Am. Chem. Soc. 2013, 135, 12608.

[2] "Sensitive Water Probing through Nonlinear Photon Upconversion of Lanthanide-Doped Nanoparticles", Guo, S.; Xie, X.*; Huang, L.*; Huang, W.* ACS Appl. Mater. Interfaces 2016, 8, 847.

[3] "From ScOOH to Sc2O3: Phase Control, Luminescent Properties, and Applications", Zhao, B.#; Xie, X.#; Xu, S.; Pan, Y.; Yang, B.; Guo, S.; Wei, T.; Su, H.; Wang, H.; Chen, X.; Dravid, V. P.; Huang, L.*; Huang, W.* Adv. Mater. 2016, 28, 6665.

Biography

Dr. Xiaoji Xie earned his BSc (2009) degree in Chemistry from Nanjing University. He gained his PhD (2013) at National University of Singapore with Professor Xiaogang Liu, where he studied metal nanoparticles and upconversion nanoparticles. He joined the Institute of Advanced Materials (IAM) at Nanjing Tech University (China) in 2014. He is currently investigating inorganic functional nanomaterials such as upconversion nanoparticles for bioapplications, catalysis, and sensing.

Biodegradable Polymer Nanoparticles for Molecular Imaging

Kanyi Pu

Associate Professor Kanyi Pu, School of Chemical and Biomedical Engineering, Nanyang Technological University, Singapore 637457

Email: kypu@ntu.edu.sg

The convergence of medicine and nanotechnology has been providing new opportunities to better understand fundamental biology, monitor health, perform diagnosis and treat diseases. Semiconducting polymer nanoparticles (SPNs) transformed from optically and electrically active polymers have emerged as a new class of optical nanomaterials. As those polymers are completely organic and biologically inert, SPNs essentially circumvent the issue of heavy metal ion-induced toxicity to living organisms, possessing good biocompatibility. In this talk, I will present a new kind of biodegradable SPNs for ultrasensitive molecular imaging. The potential clinical applications of these SPNs will be discussed in imaging-guided surgery including lymph node mapping and tumor imaging. In addition, these nanoparticles can be developed into useful tools for real-time in vivo evaluation of drug-induced hepatotoxicity, a long-standing concern of modern medicine.

References

1. Miao Q, Xie C, Zhen X, Lyu Y, Duan H, Liu X, Jokerst JV, Pu K*. Nature Biotechnology, 2017, Doi: 10.1038/nbt.3987.
2. Jiang Y, Upputuri PK, Xie C, Lyu Y, Zhang L, Xiong Q, Pramanik M, Pu K*. Nano Letters 2017, 17, 4964–4969
2. Zhang J, Zhen X, Upputuri PK, Pramanik M, Chen P, Pu K*. Adv. Mater. 2017, 29, 1604764.
3. Lyu Y, Cui D, Sun H, Miao Y, Duan H, Pu K*. Angew. Chem. Int. Ed. 2017, 129, 9283–9287
4. Lyu Y, Xie C, Chechetka S, Miyako E, Pu K.* J. Am. Chem. Soc. 2016, 2016, 138, 9049–9052.
5. Miao Q, Lyu Y, Ding D, Pu K.* Adv. Mater. 2016, 28, 3662–3668.

Biography

Dr. Kanyi Pu has been an Associate Professor in the School of Chemical and Biomedical Engineering (SCBE) at Nanyang Technological University since June 2015. He did his MS (2007) at Fudan University in China. He then came to Singapore and did his PhD (2011) at National University of Singapore. He moved to Stanford University School of Medicine for his postdoctoral study in 2011, and involved in the molecular imaging program at Stanford (MIPS) and the Center for Cancer Nanotechnology Excellence and Translation (CCNE-T). Dr. Pu has published more than 70 doi: 10.1038/nbt.3987journal papers, 2 book chapters and 6 patents. With a h-index of 40, his work has been highlighted by many world-renown scientific journals such as Nature Biotechnology, Nature Methods, and Cell Express el al.. He also sits on the Editorial Board of Advanced Biosystems.

Domain Manipulation and Domain Structure Effects on Polarization Switching in PZT Thin Films

Di Wu [1,2,*]

[1]*Department of Materials Science and Engineering, Nanjing University, Nanjing 210093, China*

[2]*Natioanl Lab. Of Solid State Microstructures, Nanjing University, Nanjing 210093, China*

[*] *Email: diwu@nju.edu.cn*

PZT is an important material in piezoelectric energy harvesters, which generates electrical charges at the surface of piezoelectric structures when a strain/stress/force is applied. Domain structures have great effects on the piezoelectric properties of PZT. In this talk, we report (1) the manipulation of domain structure in PZT thin films by epitaxial strain and thermal treatment parameters and (2) the effects of domain structure on polarization switching in PZT thin films. For Pb(Zr0.1Ti0.9)O3 thin films, a/c domains are observed on DyScO3 substrates which imposes an appropriate tensile strain, while single c domains are observed on SrTiO3 substrates due to the compressive strain. For the a/c multidomain films, a slow temperature descending rate generates more a domains, when cooling from above the Curie temperature. Multistep process of 180° polarization switching is observed and the polarization switching is much easier to achieve in the multidomain films.

Biography

Dr. Di Wu received his Bachelor's degree and Phd degree from Department of Physics, Nanjing University, in 1996 and 2000, respectively. From then on, he has been working in Department of Materials Science and Engineering, Nanjing University. During 2005-2007, he has also worked as a postdoc in Centre d'Elaboration des Matériaux et d'Etudes Structurales, CNRS, France. He is experienced in perovskite oxide hetero-epitaxy with atomic scale thickness control and in characterizations of electrical and magnetic properties. His current research is focused on the deposition and characterization of perovskite oxide thin films and heterostructures for memory and sensor applications.

Nanostructured Photocatalysts for Efficient Solar Fuels

Tierui Zhang *

Key Laboratory of Photochemical Conversion and Optoelectronic Materials/Technical Institute of Physics and Chemistry, Beijing, 10190, China

** Email: tierui@mail.ipc.ac.cn*

Herein, some very recent research progress in my group has been summarized on the rational design and controlled synthesis of nanostructured photocatalysts for highly efficient visible light-driven H2 evolution, photocatalytic conversion of CO2 or CO into high value-added hydrocarbons and photoreduction of N2 into NH3 by enhancing the light absorbance and separation and utilization of electron-hole pairs of photocatalysts.

References

(1)"Layered double hydroxide nanosheets as efficient visible-light-driven photocatalysts for dinitrogen fixation" Zhao YF, Zhang Tierui*, et al., Advanced Materials, 1703828 (2017)

(2)"Self-assembled Au/CdSe nanocrystal clusters for plasmon-mediated photocatalytic hydrogen evolution" Shi R, Zhang Tierui*, et al., Advanced Materials 29, 1700803 (2017)

(3)"Alkali-assisted synthesis of nitrogen deficient graphitic carbon nitride with tunable band structures for efficient visible light-driven hydrogen evolution" Yu HJ, Zhang Tierui*, et al., Advanced Materials 29, 1605148 (2017)

(4)"Oxide-modified nickel visible-light photocatalyst for hydrocarbon production" Zhao YF, Zhang Tierui*, et al., Angewandte Chemie International Edition 55, 4215 (2016)

(6)"Smart utilization of carbon dots in semiconductor photocatalysis" Yu HJ, Zhang Tierui*, et al., Advanced Materials 28, 9454 (2016)

Biography

Dr. Zhang Tierui is a full Professor in Technical Institute of Physics and Chemistry (TIPC), Chinese Academy of Sciences (CAS). He received his B.S. in Chemistry in 1998, and Ph.D. in Organic Chemistry in 2003 from Jilin University. His research activity focuses on catalyst nanomaterials for efficient and clean production and utilization of hydrogen. He has published more than 140 peer reviewed SCI journal articles in international famous journals such as Advacned Materials, Angew. Chem. and J. Am. Chem. Soc. These publications have earned him to date over 5000 citations with H-index 40. Dr. Zhang is the associate editor of Science Bulletin and also serves as an editorial board member for peer-reviewed journals including Scientific Reports (Nature Publishing). He is the recipient of a number of awards including Newton Advanced Fellowship, Alexander von Humboldt Fellowship, "Hundred Talents Program" Scholars of Chinese Academy of Sciences. In 2017 he was admitted as a Fellow of the Royal Society of Chemistry (RSC).

The Modification of the Functionality of p-Molecules through the Structural Adjustment

Zhen Li
Department of Chemistry Wuhan University, Wuhan 430072, China

** Email: lizhen@whu.edu.cn*

To construct p-molecules with different structures is one of the key points in the research field of opto-electronic materials. In many cases, the molecular structure not only affects the intramolecular p-conjugation, but also the intermolecular p-p stacking, to result in the different functionalities, in addition to the electronic properties of the single molecule. In this talk, some typical examples will be presented to partially demonstrate the interesting different properties with minor or even ignorable structural difference. Furthermore, some considerations of the structure-packing-performance relationship would be discussed, for the deep thinking of the molecular design for pi-molecules with different opto-electronic properties.

References

J. Yang, Z. Ren, Z. Xie, C. Wang, Y. Xie, Q. Peng, Z. Chi, Q. Li, Z. Li, Angew. Chem.-Int. Ed., 2017, 56, 880-884.

J. Yang, X. Gao, Z. Xie, Y. Gong, M. Fang, Q. Peng, Z. Chi, Z. Li, Angew. Chem.-Int. Ed., 2017, 56, DOI: 10.1002/anie.201708119.

Q. Li, Z. Li, Adv. Sci., 2017, 4, 1600484.

R. Tang, S. Zhou, Z. Cheng, G. Yu, Q. Peng, H. Zeng, G. Guo, Q. Li, Z. Li, Chem. Sci., 2017, 8, 340-347.

Y. Xie, Y. Ge, Q. Peng, C. Li, Q. Li, Z. Li, Adv. Mater., 2017, 29, 1606829.

Biography

Dr. Zhen Li is currently a Professor (2006 -) in Chemistry Department at Wuhan University. He received his B.Sc. and Ph.D. degrees from Wuhan University (WHU) in China in 1997 and 2002, respectively, under the supervision of Prof. Jingui Qin. In 2003-2004, he worked in the Hongkong University of Science and Technology as Research Associate in the group of Prof. Ben Zhong Tang. In 2010, he worked in Georgia Institute of Technology in the group of Prof. Seth Marder. In 2014, he worked in National University of Singapore as a visiting professor for one month. His research interests are in the development of organic molecules and polymers with new structure and new functions for organic electronics and photonics. He has published more than 200 papers, with more than 8000 citations from others and an h-index of 56. He has been awarded several prizes, including Chinese Chemical Society Award for Outstanding Young Chemist (2007), National Science Foundation for Distinguished Young Scholars (2013), and Young and middle-aged innovation leading talents (2015).

Why Nanosynthesis Should be A Specialized Field?

Hongyu Chen*
[1] *Institute of Advanced Synthesis, Nanjing Tech University, Nanjing 210009*
** Email: iashychen@njtech.edu.cn*

Nanosynthesis is an emerging field studying the creation of nanostructures. Despite tremendous progress, the synthetic capabilities are still largely limited to simple component and symmetrical nanocrystals. This talk has two parts. In the first part, I will give my vision of this new field and define the frontier and the important research directions. In the second part, I will give a brief summary of our research and discuss the mechanisms of growing specific structures onto colloidal nanoparticles. The complex phenomena are dissected into basic steps --- the "choices" between homogeneous and heterogeneous nucleation; high and low seed conditions; overcoating (core-shell) and island (Janus) growth modes; thermodynamic versus kinetic control; single- and multi-island growth modes; fast and slow island expansion; and static and dynamic ligand control during the island expansion. These specific "choices" made by the random atoms/ molecules in each growth step are explained, supported by experimental evidences and chemical logic.

References

[1].Depletion Sphere: Explaining the Number of Ag Islands on Au Nanoparticles, Feng Yuhua, Wang Yawen, Song Xiaohui, Xing Shuangxi,* and Chen Hongyu,* Chemical Science, 2016, published online, DOI:10.1039/C6SC02276F.

[2]. Achieving Site-Specificity in Multistep Colloidal Synthesis, Yuhua Feng, Yawen Wang, Jiating He, Xiaohui Song, Yee-Yan Tay, Huey Hoon Hng, Xing Yi Ling, and Hongyu Chen*, Journal of the American Chemical Society, 2015, 137 (24), pp 7624-7627.

[3]. Thermodynamics versus Kinetics in Nanosynthesis, Yawen Wang, Jiating He, Cuicui Liu, Wen Han Chong, and Hongyu Chen*, Angewandte Chemie-International Edition, 2015, Vol 54, Iss 7, pp 2022-2051.

陈虹宇，南京工业大学教授。

1998 年毕业于中国科学技术大学；2004 年获得耶鲁大学（Yale University）博士学位，2005 年起在康奈尔大学（Cornell University）从事博士后研究。2006 年加入新加坡南洋理工大学，任助理教授；2011 年升为终身教职副教授；历任化学系副主任、数理学院副院长、理学部副主任。2016 年起加入南京工业大学，创建先进化学制造研究院，并任执行院长。

主要研究方向为复合纳米合成与机理，及延伸的各种应用。致力于拓展新方法合成新型纳米结构，研究其形成机理，从而使纳米合成从传统领域转向多组分、复合结构、组装结构、非晶面控制的新型控制手段、新型晶格、低对称性及手性结构等新方向。在著名化学期刊上发表论文 90 余篇，其中以通讯作者发表 J. Am. Chem. Soc. 及 Angew. Chem. Int. Ed. 共 20 余篇。培养的博士、博士后中，有 14 位任教授，包括 2 位青千，1 位美国助理教授。

Dr. Hongyu Chen obtained his B. Sc. from University of Science and Technology of China (USTC) in 1998. He then moved to Yale University and studied Mn complexes and water oxidation chemistry under the guidance of Gary Brudvig and Robert Crabtree. After obtaining his Ph.D. degree in 2004, he worked as a post-doctoral fellow with Carl Batt in Cornell University on the topic of protein-nanoparticle hybrids. In 2006, he joined the newly founded Division of Chemistry and Biological Chemistry in Nanyang Technological University (NTU Singapore), where he is currently an Associate Professor and Associate Dean (College of Science). He is now a Professor in Institute of Advanced Synthesis (IAS), NanjingTech University, Nanjing, China (NTU China). His main research interest is in the development of new synthetic methodologies for nanostructures and of the underlying mechanisms.

Metal-Organic Framework NanoComposite Materials

Fengwei Huo
[1]Key Laboratory of Flexible Electronics (KLOFE) & Institute of Advanced Materials (IAM), Jiangsu National Synergetic Innovation Center for Advanced Materials (SICAM), Nanjing Tech University (Nanjing Tech), 30 South Puzhu Road, Nanjing 211816, P.R. China
Email: iamfwhuo@njtech.edu.cn

Metal-organic frameworks (MOFs) have crystalline structures and are typically characterized by large internal surface areas, uniform but tunable cavities, and tailorable chemistry.[1,2] MOFs have shown great promise for a variety of applications, including gas storage, chemical separation, catalysis and sensing. Particularly, the incorporation of nanoparticles in MOFs has attracted great attention because of the benefits of the novel chemical and physical properties exhibited by certain classes of nanoparticles. Recently, we developed an encapsulation strategy that allows any of several types of nanoparticles to be fully incorporated within crystals of a readily synthesized zeolitic imidazolate framework material, ZIF-8, in a well-dispersed fashion. Our strategy relies on the successive adsorption of nanoparticles onto the continuously forming surfaces of the growing MOF crystals. This allows ready control over the spatial distribution of nanoparticles within ZIF-8 crystals by adjusting the time of nanoparticle addition during the MOF-formation reaction. The as-prepared hybrid materials exhibit both active (catalytic, magnetic, and optical) properties deriving from the incorporated nanoparticles and size- and alignment-selective behavior (i.e., molecular sieving and regioselective guest reactivity) originating from the well-defined microporous nature of the MOF component. [3]

References

[1] Yaghi, O. M. et al. Nature 423, 705–714 (2003).

[2] Murray, L. J., Dincă, M. & Long, J. R. Chem. Soc. Rev. 38, 1294-1314 (2009).

[3] Lu, G.; Li, S.; Guo, Z.; Farha, O. K.; Hauser, B. G.; Qi, X.; Wang, Y.; Wang, X.; Han, S.; Liu, X.; DuChene, J. S.; Zhang, H.; Zhang, Q.; Chen, X.; Ma, J.; Joachim Loo, S. C.; Wei, D. W.; Yang, Y.; Hupp, J. T.; Huo, F. Nature Chem. 4, 310-316, (2012)

Biography

Dr. Fengwei Huo is currently a Full Professor (2014-) in the institute of advanced materials (IAM) at Nanjing Tech University. He obtained Ph.D. at Northwestern University in 2009. Then he joined Nanyang Technological University (NTU) as an Assistant Professor. He has published more than 90 papers, including first author Science, Nat. Nano., corresponding author Nat. Chem., Nat. Comm., Adv. Mater., etc. Dr. Huo's current research involves functional nanomaterials, nanolithography, and metallic-organic frameworks (MOFs) materials.

N-heteroacenes for Ambipolar Organic Thin Film Transistors

Hao-Li Zhang *

State Key Laboratory of Applied Organic Chemistry (SKLAOC), College of Chemistry and Chemical Engineering, Lanzhou University, China, 730000, P. R. China

** E-mail: haoli.zhang@lzu.edu.cn*

Organic semiconductors have attracted considerable attention because of their potential for creating low-cost portable electronic and optoelectronic devices such as OLED, OFET, flexible displays and sensors. The most fundamental issues associate with all these potential applications is to understand the charge transport mechanism organic molecules and develop efficient method to control their properties. We have been exploring the strategy of design high performance organic semiconductors based on heteroacene framework. By tuning their energy levels and packing arrangement in solid state, we successfully obtained several ambipolar organic semiconductors with high and balanced hole and electron mobilities. DFT calculation has been employed to understand the effect of molecular structure on the carrier injection barriers and molecular packing, which factors strongly affect the charge mobilities within the devices. We have also explored the nonlinear optical properties of these heteroacenes, particular two-photon absorption (TPA) and singlet fission (SF) processes.

References

[1] Z.-P. Fan, X.-Y. Li, X.-E. Luo, X. Fei, B. Sun, L.-C. Chen, Z.-F. Shi, C.-L. Sun, X. Shao, H.-L. Zhang Adv. Funct. Mater DOI: 10.1002/adfm.201702318

[2] Z.-H. Wu, Z.-T. Huang, R.-X. Guo, C.-L. Sun, L.-C. Chen, B. Sun, Z.-F. Shi, X. Shao, H. Li, H-L. Zhang Angew. Chem. Int. Ed. 2017, 56,13031

[3] Y.-D. Zhang, Y. Wu, Y. Xu, Q. Wang, K. Liu, J.-W. Chen, J.-J. Cao, C. Zhang, H. Fu, H.-L. Zhang. J. Am. Chem. Soc. 2016, 138, 6739.

[4] H. Xu, Y.-C. Zhou, X.-Y. Zhou, K. Liu, L.-Y. Cao, Y. Ai, Z.-P. Fan, H.-L. Zhang, Adv. Funct. Mater. 2014, 24, 2907.

[5] Y.-Y. Liu, C.-L. Song, W.-J. Zeng, K.-G. Zhou, Z.-F. Shi, C.-B. Ma, F. Yang, H.-L. Zhang, X. Gong, J. Am. Chem. Soc., 2010, 132, 16349.

Biography

Dr. Hao-Li Zhang received his Ph.D degree in 1999 from Lanzhou University. He then worked in the University of Leeds and Oxford University as a postdoc. In 2004, he was appointed as a full professor by the State Key Laboratory of Applied Organic Chemistry (SKLAOC) of Lanzhou University. He is a Fellow of Royal Society of Chemistry (FRSC) and an advisory board member of Chem. Soc. Rev.. He is interested in developing new organic functional materials for optoelectronic applications. He has published more than 200 research papers.

新型有机半导体受体材料及其有机太阳能电池应用

陈志宽 *
南京工业大学先进材料研究院
*iamzkchen@njtech.edu.cn

过去二十年，随着有机半导体材料以及有机太阳能电池器件的持续研究，有机太阳能电池的性能取得了长足进展。迄今为止，绝大多数有机太阳能电池材料的研究都集中在适用于体相异质结器件的给体材料，与给体材料配对使用的受体材料基本上局限于富勒烯及其衍生物。作为 n- 型材料的富勒烯存在一些明显的缺点：低的吸光效率，能级可调空间小，光化学不稳定。这些缺点严重阻碍了有机太阳能电池的进一步发展。为了解决富勒烯的上述问题，我们设计合成了一系列基于萘二酰亚胺（NDI）或者苝二酰亚胺（PDI）的非富勒烯聚合物以及具有 3D 结构的小分子受体材料。这些新型受体材料显示出低的吸收带隙，高的吸光效率以及优良的多电子传导特性。受体材料的 LUMOs，HOMOs 以及带隙易调。当使用这些新合成的受体材料与低带隙给体材料混和组成活性层薄膜时，混和层薄膜呈现出纳米互穿的纳米纤维分相结构。该项工作展示出基于萘二酰亚胺以及苝二酰亚胺的新型受体材料，特别是具有 3D 结构的受体材料是一类非常有潜力的有机太阳能电池受体材料，其电池器件的能量转化效率达到 9%。图一为两个具有三维结构的受体材料的分子结构及其构型。

References

[1] D. Chen, H. Zhu, S. Yang, N. Li, Q. Xu, H. Li, J. He and J. Lu,* Adv. Mater., 2016, 28, 10443–10458.

[2] S. Yang, D. Chen,* N. Li, Q. Xu, H. Li, J. He and J. Lu,* Adv. Mater., 2016, 28, 2916–2922

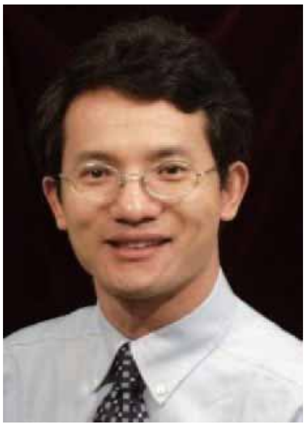
[3] Q. Gu, J. He, D. Chen, H. Dong, Y. Li, H. Li, Q. Xu,* and J. Lu,* Adv. Mater., 2015, 27, 5968–5973.

[4] P. Gu, F. Zhou, J. Gao, G. Li, C. Wang, Q. Xu, Q. Zhang,* and J. Lu,* J. Am. Chem. Soc., 2013, 135, 14086–14089.

产考文献

1. Hua Sun, Xin Song, Jian Xie, Po Sun, PeiyangGu, Changmei Liu, Fei Chen, Qichun Zhang*, Zhi-Kuan Chen*, Wei Huang*, PDI Derivative through Fine-Tuning Molecular Structure for Fullerene-Free Organic Solar Cells, ACS Appl. Mater. & Interfaces, 2017, 9 (35), 29924–29931.
2. Liang Zhao, Hua Sun, Xiaoyuan Liu, Changmei Liu, Haiquan Shan, Jiuxu Xia, Zongxiang Xu,* Fei Chen,* Zhi-Kuan Chen* and Wei Huang*, Impact of Fluorine Atoms on Perylene Diimide Derivative for Fullerene-free Organic Photovoltaics, Chem. Asian J. 2017 , 12, 2052-2056.
3. Hua Sun, Po Sun, Cong Zhang, Yingguo Yang, Xingyu Gao, Fei Chen,* Zongxiang Xu,* Zhi-Kuan Chen* and Wei Huang*, High Performance Organic Solar Cells Based on Non-Fullerene Acceptor with a Spiro Core, Chem. Asian J. 2017, 2017, 12, 721-725.

个人简历



陈志宽教授于 1989 年毕业于北京大学，获得应用化学专业学士学位，并分别于 1992 年、1995 年获得北京大学有机化学专业硕士及博士学位。1995 年，他加入新加坡国立大学化学系从事博士后工作，于 1998 年加入新加坡材料研究与工程研究院从事有机电子学的研究。陈教授与 2013 年回国加入南京工业大学先进材料研究院，目前主要从事有机太阳能电池、钙钛矿太阳能电池、有机薄膜晶体管、以及有机发光材料与器件研究。

Hollow Nanostructures for Lithium Sulfur Batteries

Xiong Wen (David) Lou[1,*]

[1]*School of Chemical and Biomedical Engineering, Nanyang Technological University, Singapore*

Email: xwlou@ntu.edu.sg

Hollow nanostructures are promising as electrode materials for electrochemical energy storage, including lithium-ion batteries, supercapacitors and lithium-sulfur batteries. The main challenges associated with lithium-sulfur batteries are low specific capacity (hence low energy density) caused by the insulating nature of sulfur, and poor stability arisen from dissolution of polysulfides into most organic electrodes. We found that hollow nanostructures as advanced sulfur hosts can remarkably confine polysulfide loss and improve the electrochemical performance of lithium-sulfur batteries. We have designed carbon hollow structures (including double-shelled hollow carbon spheres and pie-like paper) to fabricate advanced cathode materials for lithium-sulfur batteries. Most recently, we also designed some hollow structures of carbon-metal oxide including MnOx-carbon nanofibers, TiO@carbon spheres, and grape cluster-like TiO@carbon fibers for lithium-sulfur batteries. Such composite hollow structures can not only generate sufficient electrical contact to the insulating sulfur for high capacity, but also effectively confine polysulfides for prolonged cycle life. Additionally, the designed composite cathodes can further maximize the polysulfide restriction capability by using the polar shells to prevent their outward diffusion, which avoids the need for chemically bonding all polysulfides on the surfaces of polar particles.

References

[1] Z. Li, J. T. Zhang, B. Y. Guan, D. Wang, L. M. Liu, X. W. Lou, A new sulfur host based on metallic and polar TiO@carbon hollow spheres for advanced lithium-sulfur batteries, Nature Communications, 7, 13065 (2016).

[2] Z. Li, J. T. Zhang, Y. M. Chen, J. Li, X. W. Lou, Pie-like electrode design for high-energy density lithium-sulphur batteries, Nature Communications, 6, 8850 (2015).

[3] Z. Li, J. T. Zhang, X. W. Lou, Hollow carbon nanofibers filled with MnO2 nanosheets as a highly efficient sulfur host for lithium-sulfur batteries with high energy density and long cycle life, Angewandte Chemie – International Edition, 54, 12886 (2015).

[4] Z. Li, B. Y. Guan, J. T. Zhang, X. W. Lou, A compact nanoconfined sulfur cathode for high performance lithium-sulfur batteries, Joule, DOI: http://dx.doi.org/10.1016/j.joule.2017.06.003 (2017).

[5] C. F. Zhang, H. B. Wu, C. Z. Yuan, Z. P. Guo, X. W. Lou, Confining sulphur in double-shelled carbon hollow spheres for lithium-sulfur batteries, Angewandte Chemie – International Edition, 51, 9592 (2012).

A heterogeneous electrocatalyst with molecular cobalt ions serving as the center of active sites

Xin Wang *

School of Chemical and Biomedical Engineering, Nanyang Technological University, 62 Nanyang Drive, Singapore, 639798

** Email: wangxin@ntu.edu.sg*

Molecular Co2+ ions were grafted onto doped graphene in a coordination environment, resulting in the formation of molecularly well-defined, highly active electrocatalytic sites at a heterogeneous interface for the oxygen evolution reaction (OER). The S dopants of graphene are suggested to be one of the binding sites and to be responsible for improving the intrinsic activity of the Co sites. The turnover frequency of such Co sites is greater than that of many Co-based nanostructures and IrO2 catalysts. Through a series of carefully designed experiments, the pathway for the evolution of the Co cation-based molecular catalyst for the OER was further demonstrated on such a single Co-ion site for the first time. The Co2+ ions were successively oxidized to Co3+ and Co4+ states prior to the OER. The sequential oxidation was coupled with the transfer of different numbers of protons/hydroxides and generated an active Co4+=O fragment. A side-on hydroperoxo ligand of the Co4+ site is proposed as a key intermediate for the formation of dioxygen.

References

[1] "Journal of the American Chemical Society, 2017, 139 (5), 1878

Biography

Prof. Xin Wang received his Bachelor (1994) and Master (1997) degrees in Chemical Engineering from Zhejiang University, and Ph. D (2002) in Chemical Engineering from Hong Kong University of Science and Technology. From 2003 to 2005, he worked as a research fellow at University of California, Riverside, and concurrently, as R&D director for a startup fuel cell company. He joined Nanyang Technological University as assistant professor in 2005 and was promoted to associate professor with tenure in 2010 and full professor in 2016. He has been working on electrocatalysis and electrochemical technology for energy harvesting. He is currently a Fellow of Royal Society of Chemistry (FRSC).

Design and Tailoring of Bimetallic Nanostructured Electrocatalysts

Hong Jin Fan [1,*]

[1] *School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore*

** Email: fanhj@ntu.edu.sg*

Bimetallic alloys and their oxides or nitrides compounds are interesting as non-precious metal electrocatalyst materials for HER and OER applications, because of their tailorable electronic structure, electric conductivity, and surface chemistry. Our group has been actively working on nanoarray materials directly on conductive substrates as electrodes for both supercapacitor, batteries as well as electrocatalyst. In this talk, I will present two results: (1) RF nitrogen and carbon plasma as a highly effective technique for conversion reaction and surface functionalization of nanostructured electrodes. The plasma treatment not only generates hierarchical nanostructure surface, but also induces N-doping as well as hydrophilicity. This is a fast and NH3-free strategy to synthesize metal nitrides for wide applications in electrocatalysts, supercapacitors and batteries. (2) Atomic epitaxial grown Co-Ni3N nanowires array with a nanoconfinement effect at the interface. We attest by first-principle calculations that the nanoconfinement effect facilitates electron transfer at the epitaxial interface, leading to a significant enhancement in catalytic activities for both HER and OER.

References

[1] (1)Yongqi Zhang, Bo Ouyang, Jing Xu, Guichong Jia, Shi Chen, Rajdeep Singh Rawat, and Hong Jin Fan*, Fast synthesis of CoN nanowires as highly efficient and low-cost catalyst for oxygen evolution, Angew. Chem. Int. Ed., 128 (2016) 8812

(2)Yongqi Zhang, Bo Ouyang, Jing Xu, Shi Chen, Rajdeep Singh Rawat*, and Hong Jin Fan*, 3D Porous Hierarchical Nickel-Molybdenum Nitrides Synthesized by RF Plasma as Highly Active and Stable Hydrogen Evolution Reaction Electrocatalysts, Adv. Energy Mater. 6 (2016) 1600221

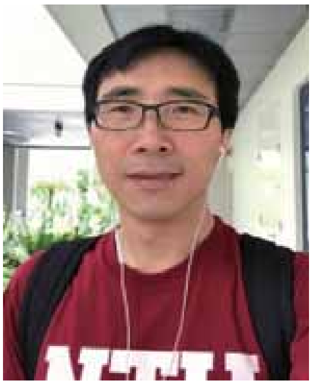
(3)Yongqi Zhang, Rajdeep Singh Rawat, Hong Jin Fan*, Plasma for Rapid Conversion Reactions and Surface Modification of Electrode Materials, Small Methods, 1 (9), 1700164 (2017)

(4)Bo Ouyang, Yongqi Zhang, Zheng Zhang, Hong Jin Fan*, and Rajdeep Singh Rawat*, Nitrogen plasma activated hierarchical nickel nitride nano-corals for energy applications, Small, 13, 1604265 (2017)

（5）Yu Zhong, Xinhui Xia*, Fan Shi, Jiye Zhan, Jiangping Tu, and Hong Jin Fan*, Transition metal carbides and nitrides in energy storage and conversion, Advanced Science, 3 (2006) 1500286

Biography

Dr. Fan is currently an associate professor (2014 -) at Nanyang Technological University (NTU). He received PhD from National University of Singapore in 2003, followed by postdoc at Max-Planck-



Institute of Microstructure Physics, Germany and University of Cambridge. He is an editorial board member of Nanotechnology, advisory board member of Advanced Science, Advanced Materials Interface, and Advanced Materials Technologies, and Associate Editor of Materials Research Bulletin. Dr. Fan's research interests include semiconductor nanowires and related heterostructures, energy conversion and storage applications of nanomaterials (including batteries and electrolysis of water, batteries) and optical properties of low-dimensional heterostructures.

Improving Electron Transport in Nanostructured TiO2 Electrode

Liu Bin*

School of Chemical and Biomedical Engineering

Nanyang Technological University

62 Nanyang Drive

Singapore 637459

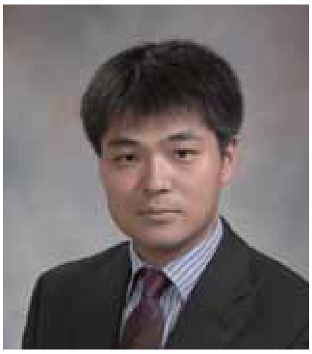
Email: liubin@ntu.edu.sg

Keywords: electron transport, mesoporous electrode, solar cells, core-shell

Titanium dioxide (TiO2) is one of the most widely used semiconductors in photovoltaics and photocatalysis because it is nontoxic, abundant, stable and photoactive. However, the wide bandgap, low electron mobility and short minority carrier diffusion length of TiO2 limit its quantum efficiency in these applications. In this work, we present a solution chemical approach for making TiO2 nanostructures for improving the electron transport in nanostructured TiO2 electrodes.

Biography

Bin Liu received his B.Eng. (1st Class Honors) and M.Eng. degrees in Chemical Engineering from the National University of Singapore, and obtained his Ph.D. degree in Chemical Engineering from University of Minnesota in 2011. Thereafter, he moved to University of California, Berkeley and worked as a postdoctoral researcher in Department of Chemistry during 2011 – 2012 before joining School of Chemical and Biomedical Engineering at Nanyang Technological University as an Assistant Professor in 2012. He is now an Associate Professor at NTU. His main research interests are electrocatalysis, photovoltaics and photoelectrochemistry. More information can be found at http://www.ntu.edu.sg/home/liubin/home.html.



Catalytic selective oxidation in biomass conversion

Yang, Yanhui

School of Chemistry and Molecular Engineering, Nanjing Tech University, Nanjing

yhyang@njtech.edu.cn

In the global attempt to reduce carbon footprint, the Chemical and Petrochemical Industry faces the problem to replace the currently used fossil feedstock with renewable resources, reduce energy consumption and to intensify and integrate the processes to be more carbon efficient. In all three issues, catalysis will be the key to a successful transformation. Knowledge-based development and implementation of catalytic technology will help to process the novel feedstock, reduce the energy required for maintaining the desired process and improve the carbon efficiency of the targeted synthesis routes. In this seminar, two examples will be discussed to illustrate our efforts in the last few years in biomass transformation.

The first example is a classic heterogeneous catalysis approach in which an integrated experimental and computational investigation reveals that the surface lattice oxygen of copper oxide activates the formyl C–H bond in glucose and incorporates itself into the glucose molecule to oxidize it to gluconic acid. The reduced CuO catalyst regains its structure, morphology and activity upon re-oxidation. The activity of lattice oxygen is shown to be superior to that of the chemisorbed oxygen on the metal surface and the hydrogen abstraction ability of the catalyst is correlated with the adsorption energy. Based on the present investigation, it is suggested that surface lattice oxygen is critical for the oxidation of glucose to gluconic acid, without further breaking down the glucose molecule into smaller fragments, due to C–C cleavage. Using CuO as the catalyst, excellent yield of gluconic acid is also obtained for the direct oxidation of cellobiose and polymeric cellulose, as biomass substrates.

The selective oxidation can be effectively catalyzed using noble metal nanoparticles. Choosing an appropriate support with well-defined structure and suitable surface chemistry is a feasible and effective approach to make metal nanoparticles with specific size, shape, structure, and to avoid agglomeration leading to catalytic deactivation. With the intention of successfully synthesizing more efficient heterogeneous catalysts for the selective oxidation, it is extremely important to elucidate the effect of metal nanoparticle configuration, the novel nano-structured support on the catalytic activity for selective oxidation with particular highlights on the interactions between both metal-metal and metal-support. The second example shows the Au-Pd bimetallic catalyst and its application in selective oxidation of HMF to FDCA. The unique structure of selected support is found to improve the stabilization of the metals in the preparation as well as the reaction process. Furthermore, surface chemistry (metal-support interaction) and synergetic effect in the case of metal alloy catalysts (metal-metal interaction) play a crucial role in controlling the catalytic performance of as-prepared catalysts. Various characterizations will be carefully conducted to look into the insights of these catalysts' physicochemical properties.

Nanostructured Conjugated Polymers as Promising Electrodes for Li-ion Batteries

Qichun Zhang [1,2,*]

[1]*School of Materials Science and Engineering,Nanyang Technological University,Singapore 639672*

[2]*Division of Chemistry and Biochemistry, School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore 637371*

** Email: qczhang@ntu.edu.sg*

Electrode materials play a critical role in approaching high energy density and long cycle life lithium-ion batteries (LIBs). The increasing concern about the traditional inorganic electrode materials on resources and environmental issues has strongly inspired scientists to switch on searching green energy electrodes. Organic compounds are potentially sustainable and renewable materials as many of them can be obtained from natural products and biomass. Additionally, the properties of organic compounds can be tuned through the modification of the structures as well as the introduction of functional groups. In this talk, I will present our recent progress on the preparation of novel conjugated polymers and their application in Li-ion batteries.

References

[1] Z.-Q. Lin, J. Xie, B. Zhang, J. Li, J.-N. Weng, R.-B. Song, X. Huang, H. Zhang, H. Li, Y. Liu, Z. J. Xu, W. Huang,* Q. Zhang,* Nano Energy, 2017, 41C, 117-127

[2] J. Xie, P. Gu, Q. Zhang*, ACS Energy Letter, 2017, 2, 1985–1996.

[3] J. Xie, W. Chen, Z. Wang, K. C. W. Jie, M. Liu,* Q. Zhang*, Chem Asian J. 2017, 12, 868-876.

[4] J. Xie and Q. Zhang*, J. Mater. Chem. A. 2016, 4, 7091 – 7106.

[5] P.-Y. Gu, Y. Zhao, J. Xie, N. Binte Ali, L. Nie, Z. J. Xu,* Q. Zhang* ACS Appl. Mater. Interfaces, 2016, 8,7464-7470.

[6] J. Wu, X. Rui, C. Wang, W.-B. Pei, R. Lau, Q. Yan*, Q. Zhang* Adv. Energy Mater., 2015, 5, 1402189

[7] J. Wu, X. Rui, G. Long, W. Chen, Q. Yan*, Q. Zhang*, Angew. Chem Int. Ed. 2015, 54, 7354-7358

Biography

Dr. Qichun Zhang obtained his B.S. (1992) at Nanjing University (China), MS (1998) in physical chemistry at Institute of Chemistry, Chinese Academy of Sciences, MS (2003) in organic chemistry at University of California, Los Angeles (USA), and Ph.D. (2007,) in inorganic chemistry at University of California Riverside (USA). Then, he joined Prof. Kanatzidis' group at Northwestern University as a Postdoctoral Fellow (Oct. 2007 –Dec. 2008). In 2009, he started his career as an Assistant Professor in School of Materials Science and Engineering at Nanyang Technological University (NTU, Singapore). In 2014, he was promoted to associate professor and became an adjunct associate professor at Division of Chemistry and Biological Chemistry, School of Physical and Mathematical Sciences (NTU). He received TCT fellowship in 2013 and lectureship from National Taiwan University in 2014. Currently, he is an associate editor of J. Solid State Chemistry, the Advisory board member of Journal of Materials Chemistry C, the Advisory board member of Materials Chemistry Frontiers, and the Advisory board member of Inorganic Chemistry Frontiers. Also, he is Guest Editor of Inorganic Chemistry Frontiers (2016-2017), Guest Editor of Journal of Materials Chemistry C (2017-2018), and Guest Editor of Inorganic Chemistry Frontiers (2017-2018). Currently, he is a fellow of the Royal Society of Chemistry. He has published > 255 papers and 4 patents (H-index: 54).

Recent Progress of Low-Cost Metal Anodes for High-Performance Rechargeable Batteries

Xiaolong Zhang, Bifa Ji, Fan Zhang, Meng Wang, Chunlei Jiang, Panpan Qing, Yongbing Tang*

Functional Thin Films Research Center, Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen 518055, China

**Corresponding Author's E-mail: tangyb@siat.ac.cn*

With unique potentials to achieve high energy density and low cost, rechargeable batteries based on metal anodes are capable to store more energy via an alloying/de-alloying process, in comparison to traditional graphite anode via an intercalation/de-intercalation process. Herein, we report a novel aluminum-graphite dual-ion battery (AGDIB) in an conventional electrolyte with high reversibility and high energy density.[1] It is the first report on using an aluminum anode in dual-ion battery. The battery shows good reversibility, delivering a capacity of ~100 mAh/g and capacity retention of 88% after 200 charge-discharge cycles at 2 C. A packaged aluminum-graphite battery is estimated to deliver an energy density of ~150 Wh/kg at a power density of ~1200 W/kg, which is ~50% higher than most commercial lithium ion batteries. In this talk, we will present recent progress of some rechargeable batteries based on non-precious metal anodes.[2-10]

References

[1].X.L.Zhang, Y.B. Tang,* et al., A Novel Aluminum-Graphite Dual-Ion Battery, Advanced Energy Materials, 2016, 6, 1502588.

[2].X.F. Tong, F. Zhang, Y.B. Tang*, et al., Carbon-Coated Porous Aluminum Foil Anode for High-Rate, Long-Term Cycling Stability and High Energy Density Dual-Ion Batteries, Advanced Materials, 2016, 28, 9979.

[3].B.F. Ji, Y.B. Tang*, et al., A Novel and Generalized Lithium-Ion Battery Configuration Utilizing Al Foil as Both Anode and Current Collector for Enhanced Energy Density, Advanced Materials, 2016, 28,1604219

[4].M.H. Sheng, Y.B. Tang*, et al., A Novel Tin-Graphite Dual-Ion Battery Based on Sodium-Ion Electrolyte with High Energy Density, Advanced Energy Materials, 2017, 7, 1601963

[5].P.P. Qin, M. Wang, Y.B. Tang*, et al., Bubble-Sheet-Like Interface Design with an Ultra-Stable Solid Electrolyte Layer for High-Performance Dual-Ion Batteries, Advanced Materials, 2017, 29,1606805

[6].M. Wang, F. Zhang, Y.B. Tang*, et al., Low-Cost Metallic Anode Materials for High Performance Rechargeable Batteries Advanced Energy Materials, 2017, 7, 1700536

[7].B.F. Ji, F. Zhang, Y.B. Tang*, et al., A Novel Potassium-Ion-Based Dual-Ion Battery, Advanced Materials, 2017, 7, 1700519

[8].C.L. Jiang, Y. Fang, Y.B. Tang*, et al., Integrated Configuration Design for Ultrafast Rechargeable Dual-Ion Battery, Advanced Energy Materials, 2017, 7, 1700913

[9].B.F. Ji, F. Zhang, Y.B. Tang*, et al., A Dual-Carbon Battery Based on Potassium-Ion

Electrolyte, Advanced Energy Materials, 2017, 7, 1700920
[10].S.Q. Zhang, M. Wang, Y.B. Tang*, et al., Multifunctional Electrode Design Consisting of 3D Porous Sepatator Modulated with Patterned Anode for High-Performance Dual-Ion Batteries, Advanced Functional Materials, 2017, 27, 1703035

Biography

Prof. Yongbing Tang recevied his Ph.D degree from the Institute of Metal Research (IMR), Chinese Academy of Sciences (CAS) in 2007. He worked as research fellow at the City University Hong Kong from 2007 to 2013. Now, he is a professor in Shenzhen Institutes of Advanced Technology (SIAT), CAS. He is interested in controllable synthesis of nanomaterials and functional thin films for various applications, such as energy and device applications.

Main Group Inorganic Materials for Small Molecule Activation

Yang Peng

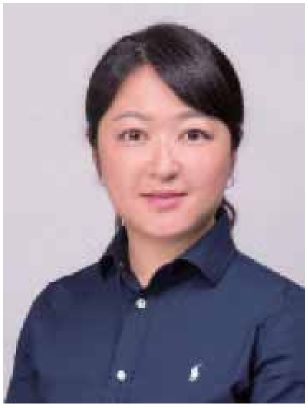
Soochow Institute for Energy and Materials Innovations, College of Physics, Optoelectronics and Energy, Soochow University, Suzhou 215006, China

Provincial Key Laboratory for Advanced Carbon Materials and Wearable Energy Technologies, Soochow University, Suzhou 215006, China

Email: ypeng@suda.edu.cn

One of the greatest challenges that mankind is facing is the heavy dependence on fossil fuels, causing not only environmental pollution, but also global warming resulted from excess CO2 emission. In order to address this challenge, tremendous efforts have been put into renewable/clean energy exploration, as well as CO2 re-utilization. Specifically, carbon capture, small molecule activation and photocatalytic production of high-value chemicals from CO2 have been extensively studied and will be an ongoing hot topic. In this talk, chemical activation and physical adsorption of energy related small molecules such as H2, C2H4, NH3, CO2 by unsaturated main-group inorganic materials and 3-D metal organic frameworks (MOFs) will be discussed. In addition, visible-light-driven photocatalytic CO2 reduction by 2D conductive MOFs assisted with photo-sensitizer for highly selective CO production will be demonstrated. These works provide important insights and references into the design of suitable new energy materials for small molecule utilization.

Biography



Dr. Yang Peng, is currently a Professor (2016 -) in Soochow Institute for Energy and Materials Innovations (SIEMIS), College of Physics, Optoelectronics and Energy of Soochow University. She received the bachelor and master degree in chemistry from Nanjing University, and her Ph.D. degree in inorganic chemistry from University of California Davis. 2010-2013, she was working as a research associate at University of Pennsylvania and National Institute of Science and Technology (NIST). Before joining Soochow University, she has three-year working experience in oil & gas industry in the U.S. Her current research interests focus on the discovery of novel organic-inorganic hybrid materials for renewable energy storage and conversion.

2D Materials for Synergistic Catalysis

Chenliang Su [1,2,*]

[1]SZU-NUS Collaborative Center and International Collaborative Laboratory of 2D Materials for Optoelectronic Science& Technology of Ministry of Education, College of Optoelectronic Engineering, Shenzhen University, Shenzhen 518060, China

** Email: chmsuc@szu.edu.cn*

Two dimensional materials with atomic thickness possess great advantages over their bulk counterparts. Several unique features define these types of materials in terms of the catalytic reactivity on their own. 2D materials are also ideal playgrounds for chemical design to introduce a second active site and/or catalyst for synergistic catalysis. We previous demonstrated that GO[1] shows remarkable catalytic properties on its own for the one-pot multicomponent Strecker reaction[2] and the oxidative coupling of amines to imines.[3] In this talk, I will summarize and discuss our recent work on using 2D materials for Synergistic Catalysis: 1) GO could also function as Janus catalytic materials when hybridized with a second material. Loading metal nanoparticles on porous GO allows this hybrid material to be a bifunctional catalyst for tandem oxygen and hydrogen activation with remarkable catalytic activity;[4] 2) The synergistic catalysis of graphene oxide with acids show great promising for oxidative C-C bond formation reaction of benzylic C-H bonds with various C-nucleophiles, mechanistic studies suggest that Zig-zag edges and quinones-type functionalities at the defective sites are able to promote this CH−CH-type cross coupling; 3) Two-dimensional porous CdSe nanosheets are designed as a bifunctional catalyst for heavy water-splitting under visible light followed by deuteration of C-I, C-Br, C-Cl, and C-F bonds using D2O as D donor, which proposes a novel and cost effective route to deuterated compounds including deuterated reagents, deuterated building blocks, deuterated drugs etc.; 4) Using 2D crystalline polymeric carbon nitride (C-PCN)/Pd composites as the bifunctional catalyst, the in-situ generated Had from water splitting is sequentially designed and used for artificial photocatalytic hydrogenation instead of energy/H2 storage.

References

[1] Su, C. L.; Loh, K. P. Acc.Chem.Res. 2013, 46, 2275.

[2] Ananya, S.; Su, C. L.; Loh, K. P.* ChemCatChem 2014, 2507-2511.

[3] Su, C. L.; Acik, M.; Takai, K.; Lu, J.; Hao, S. J.; Zheng, Y.; Wu, P.P.; Bao, Q.L.; Enoki, T.; Chabal, Y. J.; Loh, K. P. Nat. Commun. 2012, 3, 1298.

[4] Su, C. L.; Tandiana, R.; Balapanuru, J.; Tang, W.; Pareek, K.; Nai, C. T.; Hayashi, T.; Loh, K. P.* Tandem Catalysis of Amines Using Porous Graphene Oxide J. Am. Chem. Soc. 2015, 137, 685.

[5] Su, C. L. etc. Controllable Deuteration of Halogenated Compounds by 1 Photocatalytic D2O Splitting, Nat. Commun. 2017, Minor Revision.

Biography

Dr. Chenliang Su is currently a Full Professor (2015 -) of International Collaborative Laboratory of 2D Materials for Optoelectronics Science and Technology (ICL-2D MOST) in at Shenzhen University (SZU). He received his BS degree (2005) and Ph.D. degree (2010) in the Department of Chemistry from Zhejiang University of China (2010). After that he worked as a research fellow in Advanced 2D Materials and Graphene Research Centre in the National University of Singapore under the supervision of Prof Loh Kian Ping (2010-2015). His current interests focus on the chemical design of two dimensional materials/nano materials for catalysis, energy related applications.

PerovLight: Photonics and Nanophotonics of Perovskite Materials

Qihua Xiong, Ph.D.

[1]*Division of Physics and Applied Physics, SPMS, Nanyang Technological University, Singapore*

** Email: qihua@ntu.edu.sg*

Perovskite materials have recently attracted considerable interest in photovoltaics and light-emtting diodes. In general, a number of hybrid and all-inorganic perovskite materials are excellent optical gain materials, due to strong optical absorption, large exciton binding energy and oscillator strength. In this talk, I will first discuss our effort in vapor phase synthesis of high quality inorganic-organic or all-inorganic perovskite crystals, with controllable emission band from ultraviolet to near-infrared. Steady-state and transient spectroscopy approaches can elaborate the exciton binding energy and excitonic emission nature at room temperature. Then I will discuss the optically pumped photonic lasing based on the intrinsic whispering gallery mode cavity will then be presented, while the lasing quality factor can be as high as 5000 in all-inorganic perovskite crystals. Lastly, I will introduce our latest work on room temperature exciton-polariton lasing in all-inorganic perovskite $CsPbCl_3$ crystals embedded in optical microcavities. Those crystals have exceptionally large exciton binding energy, strong oscillator strength and can be grown by facile epitaxy-free techniques. Polariton lasing is unambiguously evidenced by a superlinear power dependence, macroscopic ground state occupation, blueshift of ground state emission, and the build-up of long-range spatial coherence. Our work suggests considerable promise of lead halide perovskites towards large-area, low-cost, high performance room temperature polariton devices and coherent light sources extending from the ultraviolet to near infrared range.

References

1. Q. Zhang*, R. Su, W.N. Du, X.F. Liu, L.Y. Zhao, S.T. Ha and Q.H. Xiong*, “Lead halide perovskite nanostructures for small lasers”, Small Methods 1, 1700163 (2017)
2. R. Su et al., “Room temperature polariton lasing in all-inorganic perovskite”, Nano Lett. 17, 3982-3988 (2017)
3. S.T. Ha, et al., “Laser Cooling of Organic-inorganic Lead Halide Perovskites”, Nature Photonics 10, 115–121 (2016)
4. Q. Zhang, et al., “High quality whispering-gallery-mode lasing from cesium lead halide perovskite nanoplatelets”, Adv. Funct. Mater. 26, 6238-6245 (2016)
5. Q. Zhang, et al., “Room-temperature near-infrared high-Q perovskite whispering-gallery planar nanolasers”, Nano Lett. 14, 5995-6001 (2014)

（6）S.T. Ha, et al., “Synthesis of organic-inorganic lead halide perovskite nanoplatelets: Towards high performance perovskite solar cells and opto-electronic devices”, Adv. Optical Mater. 2, 838-844 (2014) (highlighted as Best of Advanced Optical Materials – 2014 edition)

Biography

Qihua Xiong received his B.S. degree in physics from Wuhan University in 1997, and then finished three years graduate studies at the Shanghai Institute of Applied Physics, Chinese Academy of Sciences. He went to the United States in 2000 and received Ph.D. degree under the supervision of Prof. Peter C. Eklund from The Pennsylvania State University in 2006. After three years postdoctoral experience in Prof. Charles M. Lieber's group at Harvard University, he joined Nanyang Technological University as an assistant professor in 2009 and promoted to Nanyang Associate Professor in 2014. He was promoted to full Professor in 2016 recently. He is a Fellow of Singapore National Research Foundation awarded in 2009 and the inaugural NRF Investigatorship Award by Singapore National Research Foundation in 2014. He is the recipient of IPS Nanotechnology Physics Award (2015) and Nanyang Award for Research Excellence of NTU (2014). Prof. Xiong's research focuses on light-matter interactions of emergent quantum matter by optical spectroscopy approaches. He recently ventured into the field of 2D layered materials and laser cooling of solids.

Probing Intrinsic and Extrinsic Light Emission in Two-Dimensional Transition Metal Dichalcogenides

Ting YU[1*]

[1] *Division of Physics and Applied Physics, School of Physical and Mathematical Sciences, Nanyang Technological University, 637371, Singapore*

** Email: yuting@ntu.edu.sg*

Two-dimensional (2D) semiconductors, such as transitional-metal-dichalcogenide (TMD) monolayers, have aroused great attention. Even though considerable progress has been achieved recently, intrinsic and extrinsic excitonic states of TMD monolayers are still under discussion and require direct experimental exploration. Here, we report observations of unconventional excitonic emission states of monolayer TMDs under electrical doping and photoexcitation at low temperature. Particularly, the superlinear emission and the unusual linear polarization behaviour of its photon energy opposite to that of exciton emission have been clearly observed, which is assigned to the presence of biexciton states, evidencing the strong Coulomb interactions in such 2D semiconductors. Extrinsic emission bands in monolayer TMDs have also been revealed and attributed to specific localized states resulting from impurities and structural defects, where the exact origin of such states has been discussed. In view of applications, we have developed a highly practical strategy to electrically manipulate the diverse excitonic emission in atomically thin semiconductors, which opens up many possibilities for design and improvement of 2D TMD-based optoelectronic devices.

Biography

Dr. Ting YU received his PhD in Department of Physics, National University of Singapore in 2003 and is currently a Professor in Division of Physics and Applied Physics, Nanyang Technological University, Singapore. Dr. YU has received many prestigious awards including Nanyang Excellence Award for Research and Innovation (2008), National Young Scientist Award, National Research Foundation Fellowship Award (2009), Outstanding Young Scientist for the 3rd Inter Academy Panel/World Economic Forum (Summer Davos Forum) ((IAP/WEF, Representative of Singapore, 2010) and Institute of Physics Singapore, Nanotechnology award (2011). His research interests cover fabrication of low dimensional, especially 2D materials and investigation of their optical, optoelectrical and eletrochemical properties for developing novel electronics, optoelectronics and energy conversion/storage. Dr Yu has published more than 230 SCI papers and received over 15,000 nonself-citations. His H-index is 67.

二维材料的电子输运与器件应用研究

缪峰
南京大学物理学院，固体微结构国家重点实验室

* Email: miao@nju.edu.cn

二维材料体系有可能成为后摩尔时代重要的基础电子材料，二维材料研究的核心内容包括对其电子性质的量子调控和电子器件的应用基础研究。过去几年间，我们围绕二维材料中的新型半金属和半导体材料的电子输运与器件应用方向系统深入地开展了多项工作。

在新型半金属方向，我们研究了第一个被预言的第二类外尔半金属材料二碲化钨（WTe2），在高质量的薄膜样品中观测到各向异性的手征输运特性，并首次实现了费米能在外尔点附近的原位调控，为验证 WTe2 为第二类外尔半金属提供了有力的电子输运实验验证。该工作不仅在凝聚态物理中为原位研究第二类外尔费米子提供了可通用的实验手段，也为拓扑及手征电子的应用研究提供了实验基础 [1]。

在新型半导体方向，我们系统研究了材料晶格对称性对其基本物性和器件性能的影响，包括两种低晶格对称性的代表材料二硫化铼（ReS2）和黑砷磷。我们研究了单层及薄层 ReS2 的场效应电子输运性质，观察到其机械性能及电子输运性质的各向异性，得到了二维材料中最高的迁移率各向异性比值；并进一步利用晶格方向作为新的器件设计参数，成功制备出高性能逻辑反向器 [2]。黑砷磷是一类刚刚兴起的新型窄带隙二维材料，我们发现沿着相互垂直的两个晶向，其电子输运和光电性质都显示了很强的各向异性；基于带隙被调至 ~0.15 eV 的 b-As0.83P0.17 样品，我们制备了光电响应波段长达 8.3 μm 的红外探测器件，并对其工作机制做了系统的研究 [3]。

最后，由于不同种类的二维材料可以进行可控转移和堆垛，实现具有原子级平整界面的异质结构，我们还设计和制备了多种高质量的二维异质结构，围绕其电子输运的基本性质，探索了这些结构在光电探测、信息存储等方向的器件应用 [3-6]

参考文献

[1] Wang, et al. “Gate-Tunable Negative Longitudinal Magnetoresistance in the Predicted Type-II Weyl Semimetal WTe2”, Nat. Comm. 7, 13142 (2016).

[2] Liu, et al. “Integrated Digital Inverters Based on Two-dimensional Anisotropic ReS2 Field-effect Transistors”, Nat. Comm. 6, 6991 (2015).

[3] Long, et al. “Room-temperature high detectivity mid-infrared photodetectors based on black arsenic phosphorus”, Science Adv. 3, e1700589 (2017).

[4] Long, et al. “Broadband photovoltaic detectors based on an atomically thin heterostructure”, Nano Lett. 16, 2254 (2016).

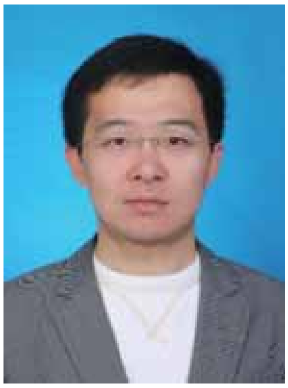
[5] Liu, et al. “Ultra-high responsivity phototransistors based on few-layer ReS2 for weak signal detection”, Adv. Func. Mater. 26, 1938 (2016).

[6] Wang, et al. “Ultra-robust memristors based on fully layered materials”, (2017) (submitted).

Biography

缪峰， 南京大学物理学院和南京微结构国家实验室教授、博士生导师，国家杰出青年科学基金获得者，科技部国家重大科学研究计划青年项目首席科学家，国家青年千人计划入选者。2004 年本科毕业于南京大学物理系，2009 年获美国加州大学河滨分校物理学博士学位，同年获得最佳博士毕业生奖和国家优

秀自费留学生奖，2009-2012 年在美国惠普实验室（硅谷总部）任助理研究员，2012 年入选国家青年千人计划后全职回南京大学工作。主要从事二维材料的电子输运研究，以及它们在信息器件领域的应用研究。在过渡金属硫族化合物电子输运、场效应晶体管及逻辑器件、忆阻器器件物理等研究上取得了一系列创新成果。作为第一作者或通讯作者在 Science、Nature 子刊、Science 子刊、Phys. Rev. Lett. 等国际权威学术期刊上发表论文，共发表 SCI 论文 60 余篇，总引用 10500 余次；已获授权美国专利 8 项和中国专利 3 项。目前担任 Scientific Reports 和 npj 2D Materials and Applications 的编委和 Nature Nano.、Nature Comm.、Adv. Mater.、Nano Lett. 等学术期刊的特约审稿人



Phase-Controlled Growth and ambipolar transistors of MoTe2

Xueao Zhang,*

College of Science, National University of Defense Technology, Changsha 410073, P. R.China

** Email: xazhang@nudt.edu.cn*

The phase-controlled growth of 1D Mo6Te6 - 2D MoTe2 hybrid structures is demonstrated via molecular beam epitaxy. In-situ scanning tunneling microscopy study shows a novel morphological phase transition from 2D ultrathin films to 1D nanowires as growth temperature increasing. X-ray photoelectron spectroscopy confirm 1D nanowires with good stoichiometry of Mo6Te6. In-situ scanning tunneling spectroscopy further reveals the metallic property of grown Mo6Te6 nanowires, which is consistent with density functional theory calculations. Furthermore, we demonstrate carrier modulation of ambipolar few-layer MoTe2 transistors utilizing magnesium oxide (MgO) surface charge transfer doping (SCTD). By carefully adjusting the thickness of MgO film and the number of MoTe2 layers, we can reversely control the carrier polarity of MoTe2 transistors from p-type to n-type. The effective carrier modulation enables us to achieve high-performance complementary inverters with high DC gain of > 25 and photodetectors based on few-layer MoTe2 flakes.

References

(1)“Molecular beam epitaxy growth of atomically ultrathin MoTe2 lateral heterophase homojunctions on graphene substrates” Yayun Yu, Guang Wang, Shiqiao Qin, Nannan Wu, Zhenyu Wang, Ke He, Xueao Zhang*, Carbon 115, 526 (2017)

(2)“Phase-Controlled Growth of 1D Mo6Te6 Nanowires and 2D MoTe2 Ultrathin Films Hybrid Structure" Yayun Yu, Guang Wang, Yuan Tan, Nannan Wu, Xueao Zhang*, Shiqiao Qin, Nano Letter, Under Review

(3)“Carrier modulation of ambipolar few-layer MoTe2 transistors by MgO surface charge transfer doping” Wei Luo, Mengjian Zhu, Gang Peng, Xiaoming Zheng, Feng Miao, Shuxin Bai, Xue-Ao Zhang *, and Shiqiao Qin, Adv Fun Mater, Under Review

Biography

Dr. Zhang Xue-Ao is currently an Associate Professor (2010 -) in both College of Science and State Key Laboratory of high Performance Computing at National University of Defense Technology (NUDT). He received his Bachelor’s degree in Chemistry from Qingdao University of Science and Technology (China) in 2001, Master's and Ph.D. degrees from College of Aerospace and Materials Engineering at NUDT in 2003 and 2007, respectively. His current research interests include Growth and Physical Properties of 2D Materials, Graphene and Carbon Nanotube Electronics, and Carbon Nanotubes Thermal Interface Materials Research. He has published more than 60 papers on peer-reviewed journals in these topics, and receiving over 1000 citations. Zhang is a recipient of the Outstanding Doctoral Dissertation of the PLA.

Brave New World : When electron devices meet two dimensional materials

Peng Zhou *

State Key Laboratory of ASIC and System, School of Microelectronics, Fudan University, Shanghai 200433, China

** Email: pengzhou@fudan.edu.cn*

Field-effect transistors (FETs) in today's integrated circuits are facing the problem of lowering power dissipation when scaling down the supply voltage further. Tunneling FETs (TFETs) are one of the solutions as quantum-mechanical band-to-band tunneling avoids the thermal injection limit. The booming two dimensional materials can maintain excellent device electrostatics, rich in species and have atomic thickness without dangling bonds, high mobility and high ON currents. Combination of two dimensional (2D) materials and TFETs technology can be a new revolution for high performance. In this talk, I will discuss the principle of TFETs, the feasibility of TFETs using layered 2D materials and the current status in this research field.

Meanwhile, facing the growing data storage and computing demands, a high accessing speed memory with low power and non-volatile character is urgent needs. The energy per bit is still too high to compete against static random access memory and dynamic random access memory. The sneak leakage path and metal film sheet resistance issues hinder the further scaling down. The variation of resistance between different devices and even various cycles in the same device, hold resistive access random memory back from commercialization. The emerging of atomic crystals, possessing fine interface without dangling bonds in low dimension, can provide atomic level solutions for the obsessional issues. Moreover, the unique properties of atomic crystals also enable new type resistive switching memories, which provide a brand-new direction for the resistive access random memory.

Biography

Peng Zhou received his bachelor and Ph.D. degree in physics from Fudan University in 2000 and 2005, respectively. He is currently a full professor on novel electronic devices and process in school of microelectronics, Fudan University. He has authored or co-authored more than 100 journal papers on Nano Letter, Advanced Functional Materials, ACS Nano,Small, Applied Physics Letters, and IEEE Electron Device Letters. He also has more than 30 international conference presentations till now.

Interactions between lasers and 2D nanomaterials

Junpeng Lu（吕俊鹏）

School of Physics, Southeast University, Nanjing, China

** phyljp@seu.edu.cn*

Two-dimensional (2D) nanomaterials have generated considerable interest amongst researchers because of their potential as fundamental building block in future nano- and micro-electronic devices. In this talk, we present a review of a focused laser beam system as a versatile tool for the manipulation, structural transformation, micropatterning and chemical modification of 2D nanomaterials.[1,2,6] This tool was found to be effective in patterning and modifying various physical and chemical properties of the pristine 2D nanomaterials. It also aids in the fabrication process of heterostructures and 2D nanomaterial based devices.[3] Finally, we present the implementation of the focused laser beam setup as a valuable tool in the study of the origins and photoresponse mechanism of the 2D nanomaterial devices.[4,5]

References

(1)Lu Junpeng, Lu Jia Hui, Liu Hongwei, Liu Bo, Lin Jiadan, Chen Wei, Loh Kian Ping and Sow Chorng Haur, ACS Nano, Vol 8, page 6334-6343, 2014.

(2)Lu Junpeng, Wu Jing, Carvalho Alexandra, Ziletti Angelo, Liu Hongwei, Tan Junyou, Chen Yifan, Neto A.H. Castro, Ozyilmaz Barbaros, Sow Chorng Haur, ACS Nano, Vol 9, page 10411-10421, 2015.

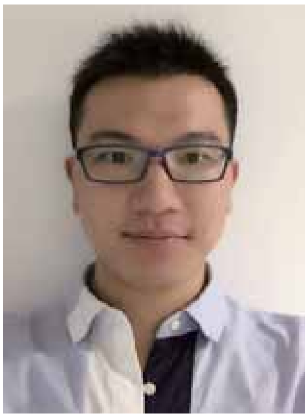
(3)Lu Junpeng, Lu Jia Hui, Liu Hongwei, Liu Bo, Gong Lili, Tok Eng Soon, Loh Kian Ping, Sow Chorng Haur, Small, Vol 11, page 1792-1800, 2015.

(4)Lu Junpeng, Carvalho Alexandra, Chan Kim Xinhui, Liu Hongwei, Liu Bo, Tok Eng Soon, Loh Kian Ping, Neto A.H. Castro, Sow Chorng Haur, Nano Letters, Vol 15, page 3524-3532, 2015.

(5)Lu Junpeng, Carvalho Alexandra, Wu Jing, Liu Hongwei, Tok Eng Soon, A. H. Castro Neto, Özyilmaz Barbaros, Sow Chorng Haur, Enhanced Photoresponse from Phosphorene-Phosphorene-Suboxide Junction Fashioned by Focused Laser Micromachining, Advanced Materials, DOI: 10.1002/adma.201506201, 2016.

（6）Lu Junpeng, Liu Hongwei, Tok Eng Soon, Sow Chorng Haur, Interactions between lasers and two-dimensional transition metal dichalcogenides, Chemical Society Reviews, DOI:10.1039/c5cs00553a, 2016.

Biography



Dr. Lu Junpeng, Professor of School of Physics, Southeast University. He received his Bachelor’s degree from Department of Optical Information Science and Technology of Shandong University in 2009 and received his Ph.D. degree from Department of Physics, National University of Singapore (NUS) in 2013. Then he engaged his research work as a Research Fellow in NUS from 2013 to 2017. After that, he joined School of Physics, Southeast University in 2017. His current research interests include: Laser micro/nano manufacturing/modification of low-dimensional materials; Micro/nano optoelectronics; Ultrafast Spectroscopy: Transient absorption spectroscopy & Time-resolved PL spectroscopy; THz time domain spectroscopy; THz metamaterials.

报告题目：基于分子取向调控的室温单分子器件研究

摘要：分子器件是指构建在单个分子或有限个分子上的具有特定功能的器件。我们研究组基于扫描隧道显微技术探索室温下操控单个分子吸附结构的途径，并利用有机分子的吸附取向作为信号载体，构筑室温单分子原型器件。在富勒烯/硅体系上，我们首先明确了室温下富勒烯分子在硅(111)表面上的五种吸附位点的吸附几何结构，并提出了针尖发射电子调控分子取向的机制，实现了对富勒烯分子取向的可控操纵，并构建了基于单个富勒烯的分子开关器件。我们也建立了操纵单个富勒烯分子位置的技术路线，即可实现富勒烯分子的在硅单胞内的准确定位，也可实现跨越微米尺度的长距离转移；在酞菁/铜体系上，我们建立了操控单个酞菁分子取向和定向运动的高效技术路线，实现了有序分子阵列的人工排布和阵列内分子的取向调控，构筑了室温下分子存储原型器件，在此基础上，提出了利用分子间相互作用所形成的定向势阱调控分子取向的新思路，从实验上证实了分子间耦合作用对分子取向的调控，并利用该效应构建了分子摩托、分子多米诺骨牌、分子逻辑运算等原型器件。

王立，博士，教授，博士生导师，国防科技大学客座教授，入选教育部新世纪优秀人才支持计划、江西省“赣鄱英才555工程”领军人才计划、江西省科技创新人才，江西省新世纪百千万人才工程、江西省高等学校中青年学科带头人，获国家级教学成果奖二等奖、中组部“西部之光”优秀访问学者、江西省青年五四奖章、江西省高校科技成果奖一等奖和江西省优秀硕士论文指导教师，现任南昌大学理学院院长、中国物理学会理事、江西省物理学会理事长、江西省理科学科评议组专家。主要从事分子量子结构、二维材料及器件和高灵敏可穿戴探测器件的基础和应用研究，主持国家自然科学基金项目5项和省部级项目5项，参与国家重大研究计划2项。在Nature Nanotechnology、ACS Nano、Journal of the American Chemical Society、Surface Science Reports等国际知名期刊发表SCI论文80余篇，引用1200余次，H因子17。获国家发明专利2项和实用新型专利1项。担任Journal of the American Chemical Society、ACS Nano、Applied Physics Letters、Journal of Physical Chemistry letters等国际知名期刊审稿人。

Applications of synchrotron radiation soft X-ray spectroscopies in the studies of functional materials

Junfa Zhu

National Synchrotron Radiation Laboratory, University of Science and Technology of China, Hefei 230029, China

Fundamental understanding the electronic properties of functional materials as well as their evolution after application is essential to the development of more efficient materials. Synchrotron radiation soft-X ray spectroscopies, including photoemission spectroscopy (SRPES), near-edge X-ray absorption fine structure (NEXAFS) and X-ray emission spectroscopy (XES), are powerful techniques in the studies of the electronic properties of functional materials. In this presentation, I will briefly introduce several examples of our recent studies on the surface and interface electronic structures of functional materials using soft-X ray spectroscopies. These functional materials include graphene and its derivatives used for Li/S battery [1-3], conjugated polymer used for polymer-based organic electronic devices [4,5], and oxide-supported metal particles used for catalysts [6-7]. At the end, I may give a short introduction the functions and recent research progresses of the two beamlines and endstations in Hefei Light Source (HLS) which I am in charge. I hope through this presentation more and more scientists in this field find their interests in the applications of synchrotron-based soft X-ray spectroscopies, especially those in HLS.

References

[1] Electronic Structure and Chemical Bonding of Graphene Oxide-Sulfur Nanocomposite for Use in Superior Performance Lithium/Sulfur cells, Zhang, L., Ji, L., Glans, P.-A., Zhang, Y., Zhu, J.F.*, Guo, J.*, Phys. Chem. Chem. Phys. 2012,14, 13670.

[2] Understanding the degradation mechanism of rechargeable lithium/sulfur cells: a comprehensive study of the sulfur-graphene oxide cathode after discharge/charge cycling, Feng, X.F.; Song, M.-K.; Stolte, W.C.; Gardenghi, D.; Zhang, D.; Sun, X.; Zhu, J.F.*; Cairns, E.J.*, Guo, J.H.*, Phys. Chem. Chem. Phys. 2014, 16, 16931.

[3] X-ray Absorption Spectroscopic Characterization of the Synthesis Process: Revealing the Interactions in Cetyltrimethylammonium Bromide-Modified Sulfur–Graphene Oxide Nanocomposites. Ye, Y.F.; Kawase A.; Song, M.-K.; Feng, B.; Liu, Y.-S.; Marcus, M.A.; Feng, J.; Fang, H.; Cairns, E.J.; Zhu, J.F.*; Guo, J.* J. Phys. Chem. C, 2016, 120(19), 10111.

[4] Interplay between Interfacial Structures and Device Performance in Organic Solar Cells: A Case Study with the Low Work Function Metal, Calcium., Ju, H.X.; Knesting, K.M.; Zhang, W.; Pan, X.; Wang, C.-H.; Yang, Y.-W.; Ginger, D.S.*, Zhu, J.F.*, ACS Appl. Mater. Interfaces 2016, 8, 2125.

[5] Interface properties between a low band gap conjugated polymer and a calcium metal electrode., Zhang, W.; Pan, X.; Feng, X.F.; Wang, C.-H.; Yang, Y.-W.; Ju, H.X.; Zhu, J.F.*, Phys. Chem. Chem. Phys., 2016, 18, 9446.

[6] Growth, Structure, and Stability of Ag on CeO2(111): Synchrotron Radiation Photoemission Studies. Kong, D. D.; Wang, G. D.; Pan, Y. H.; Hu, S. W.; Hou, J. B.; Pan, H. B.; Campbell, C. T.; Zhu, J. F.*. J. Phys. Chem. C 2011, 115, 6715.

[7] Ag Nanoparticles on Reducible CeO2(111) Thin Films: Effect of Thickness and Stoichiometry of Ceria., Hu, S.W.; Wang, Y.; Wang, W.J.; Han, Y.; Fan, Q.T.; Feng, X.F.; Xu, Q.; Zhu, J.F.*, J. Phys. Chem. C, 2015, 119, 3579.

Biography

Dr. Junfa Zhu is currently a professor in National Synchrotron Radiation Laboratory, University of Science and Technology of China (USTC). He received his Ph.D. in Physical Chemistry from USTC in 1999. After several years working in the Institute of Experimental Physics, Johannes-Kepler-Universität Linz, Austria, Lehrstuhl für Physikalische Chemie II, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany and Department of Chemistry, University of Washington, WA, USA, he returned to USTC in December, 2006, and become a professor at National Synchrotron Radiation Laboratory, USTC under the support of "Hundred Talent Program" of Chinese Academy of Sciences. His research interests mainly focus on in-situ studies of surface and interface structures and properties of functional materials using advanced surface science techniques including synchrotron radiation techniques.

Pressure-Induced Structural and Optical Properties of halide perovskites

Bo Zou*

State Key Laboratory of Superhard Materials, Jilin University, Changchun, 130012, China

** Email: zoubo@jlu.edu.cn*

Halide perovskites have come into considerable attention for their applications in solar cells with higher power conversion efficiency. Herein, further development of these devices requires a deep understanding of their fundamental structure−property relationships. The effect of pressure on the structural evolution and band gap shifts of halide perovskites was investigated systematically by combining in situ X-ray diffraction, Raman, optical absorption, photoluminescence measurements, and first-principles calculations. The studies of the structural evolution and optical properties of halide perovskites provide important clues in optimizing photovoltaic performance and help to design novel halide perovskites with higher stimuli-resistant ability.

References

[1] (1)"Pressure Effects on Structure and Optical Properties in Cesium Lead Bromide Perovskite Nanocrystals" Xiao G, Cao Y, Qi G, Wang L, Liu C, Ma Z, Yang X, Sui Y, Zheng W, Bo Zou*, Journal of The American Chemistry Society 139, 10087-10094 (2017)

(2)"High Pressure Study of perovskite-like Organometal Halide: Band Gap Narrowing and Structural Evolution of [NH3-(CH2)4-NH3]CuCl4" Li Q, Li S, Wang K, Quan Z, Meng Y, Bo Zou*, The Journal of Physical Chemistry Letters 8, 500-506 (2017)

(3)"Pressure-Induced Structural and Optical Properties of Organometal Halide Perovskite Based Formamidinium Lead Bromide" Wang L, Wang K, Bo Zou*, The Journal of Physical Chemistry Letters 7, 2556-2562 (2016)

（4）"Pressure Induced Band Gap Shifts and Structural Evolution of Organometal Halide Perovskite-Based Methylammonium Lead Chloride" Wang L, Wang K, Xiao G, Zeng Q, Bo Zou*, The Journal of Physical Chemistry Letters 7, 5273-5279 (2016)

Biography

Dr. ZOU Bo is currently a Professor (2013 -) in State Key Laboratory of Superhard Materials at Jilin University. He received his Bachelor's degree in Chemistry from Jilin University (China) in 1996, Ph.D. degree from Chemistry Department at Jilin University in 2002 under the supervision of Prof Xi Zhang. His current research interests include High Pressure Chemistry and High Pressure Physics.

Multi-Axial Molecular Ferroelectrics

YuMeng You[1,2]

[1] Ordered Matter Science Research Center, Southeast University, Nanjing 211189, P. R. China.

[2] Jiangsu Key Laboratory for Science and Applications of Molecular Ferroelectrics, Southeast University, Nanjing 211189, P. R. China.

Corresponding Author: youyumeng@seu.edu.cn

Besides single crystals, ferroelectric materials are widely used in the forms of polycrystals like ceramics. In such polycrystalline application, multiple-polar-axes is a key feature in order to possess decent ferroelectric polarization in random direction. Most inorganic ferroelectric ceramicsare multiaxial ferroelectrics, such as BaTiO3. On the other hand, in the category of molecular ferroelectrics, there are few reports on the multiple polar axes. Although molecular ferroelectrics have various advantages flexible electronics, wearable devices, etc., mono-axial characteristic have greatly limited their applications. In this report, in order to improve the application potential of molecular ferroelectrics, we have designed and synthesized several new molecular ferroelectrics with multiple polar axes, and characterized their ferroelectric/ piezoelectric properties.

References

(1) You, Y. M.; Tang, Y. Y.; Li, P. F.; Zhang, H. Y.; Zhang, W. Y.; Zhang, Y.; Ye, H. Y.; Nakamura, T.; Xiong, R. G. Nature Communications 2017, 8, 14934.

(2) Ye, H. Y.; Liao, W. Q.; Zhou, Q. H.; Zhang, Y.; Wang, J. L.; You, Y. M.; Wang, J. Y.; Chen, Z. N.; Li, P. F.; Fu, D. W.; Huang, S. P. D.; Xiong, R. G. Nature Communications 2017, 8, 14551.

(3) Pan, Q.; Liu, Z.-B.; Zhang, H.-Y.; Zhang, W.-Y.; Tang, Y.-Y.; You, Y.-M.; Li, P.-F.; Liao, W.-Q.; Shi, P.-P.; Ma, R.-W.; Wei, R.-Y.; Xiong, R.-G. Advanced Materials 2017 (published online).

(4) Pan, Q.; Liu, Z. B.; Tang, Y. Y.; Li, P. F.; Ma, R. W.; Wei, R. Y.; Zhang, Y.; You, Y. M.; Ye, H. Y.; Xiong, R. G. Journal of the American Chemical Society 2017, 139, 3954.

(5) Ye, H. Y.; Liao, W. Q.; Hu, C. L.; Zhang, Y.; You, Y. M.; Mao, J. G.; Li, P. F.; Xiong, R. G. Advanced Materials 2016, 28, 2579.

(6) Ye, H. Y.; Ge, J. Z.; Tang, Y. Y.; Li, P. F.; Zhang, Y.; You, Y. M.; Xiong, R. G. Journal of the American Chemical Society 2016, 138, 13175.

(7) Tang, Y. Y.; Zhang, W. Y.; Li, P. F.; Ye, H. Y.; You, Y. M.; Xiong, R. G. Journal of the American Chemical Society 2016, 138, 15784.

(8) Ye, H. Y.; Zhou, Q. H.; Niu, X. H.; Liao, W. Q.; Fu, D. W.; Zhang, Y.; You, Y. M.; Wang, J. L.; Chen, Z. N.; Xiong, R. G. Journal of the American Chemical Society 2015, 137, 13148.

Light Manipulation in Organic Optoelectronic Devices

Jianxin Tang*

Institute of Functional Nano and Soft Materials Laboratory (FUNSOM), Soochow University, Suzhou 215123, P. R. China

** Email: jxtang@suda.edu.cn*

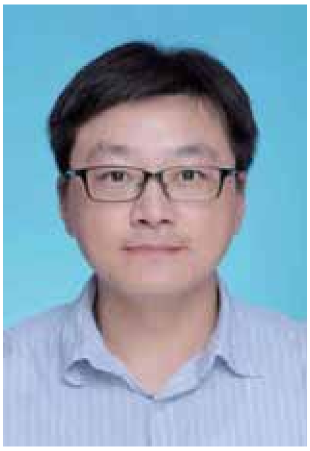
Organic optoelectronic devices, including organic light-emitting devices (OLEDs) and organic solar cells (OSCs) have been attracting considerable interest as next-generation lighting source and renewable energy applications. However, further improvement in efficiency remains a daunting challenge due to limited light extraction or absorption in conventional device architectures. Here we report a universal method of optical manipulation of light by integrating a dual-side bio-inspired moth's eye nanostructure (MEN) with broadband anti-reflective and quasi-omnidirectional properties for use in the performance improvement of organic optoelectronic devices of various material systems. Light out-coupling efficiency of white OLEDs is over 2 times that of a conventional device, resulting in drastic increase in external quantum efficiency and power efficiency exceeding 70% and 160 lm/W without introducing spectral distortion and directionality. Besides a substantial increase in efficiency, this device structure offers superior angular color stability over the visible range. Similarly, the light in-coupling efficiency of OSCs is increased 20%, yielding a certificated power conversion efficiency over 13%. Note also that the method developed here brings about an invaluable advantage, which enables the processing compatibility with the high-throughput large-area roll-to-flat and roll-to-roll manufacturing techniques in future mass production of low-cost organic optoelectronic devices.

References

[1] (1)"Toward Scalable Flexible Nano-Manufacturing for Photonic Structures and Devices", Wen Qiao, Wenbin Huang, Yanhua Liu, Xiangmin Li, Lin-Sen Chen*, and Jian-Xin Tang*, Adv. Mater. 2016, 28, 10353-10380.

(2)"Microcavity-Free Broadband Light Outcoupling Enhancement in Flexible Organic Light-Emitting Diodes with Nanostructured Transparent Metal-Dielectric Composite Electrodes", Lu-Hai Xu, Qing-Dong Ou, Yan-Qing Li*, Yi-Bo Zhang, Xin-Dong Zhao, Heng-Yang Xiang, Jing-De Chen, Lei Zhou, Shuit-Tong Lee, Jian-Xin Tang*, ACS Nano 2016, 10(1), 1625-1632.

（3）"Single-junction polymer solar cells exceeding 10% power conversion efficiency", Jing-De Chen, Chaohua Cui, Yan-Qing Li*, Lei Zhou, Qing-Dong Ou, Chi Li, Yongfang Li*, Jian-Xin Tang*, Adv. Mater. 2015, 27, 1035-1041.



Biography

Jianxin Tang received his B.Sc. degree in physics from Zhejiang University in 2002, and Ph.D. degree in Physics and Materials Science from City University of Hong Kong in 2006. In 2008, he was appointed professor at the Institute of Nano Functional & Soft Materials (FUNSOM), Soochow University. His current research areas/interests span device physics and surface science on organic and quantum-dot light-emitting diodes technology for flat panel display and solid-state lighting, and organic/perovskite photovoltaic cells for renewable energy, including localized electronic state and charge barrier formation at organic interfaces, and novel device architectures to improve device performance with interface modification for carrier transport and light manipulation.

Carboxylate cellulose nanocrystals: Chemistry and ApplicationsJin

Huang*[1,2], Yanjie Zhang[2], Xiaozhou Ma[1], Lin Gan[1]

[1] School of Chemistry and Chemical Engineering, Joint International Research Laboratory of Bio-mass-Based Macromolecular Chemistry and Materials, Southwest University, Chongqing, 400715, China

[2] School of Chemistry, Chemical Engineering and Life Sciences, Wuhan University of Technology, Wuhan, 430070, China

** Email: huangjin2015@swu.edu.cn*

Solid fluorescent materials can be broadly applied in anti-counterfeiting materials or special paints. However, the self-quenching behavior of traditional fluorescent molecules makes this kind of material hard to be applied in making solid fluorescent materials. In this talk, with a new strategy to make carboxylate cellulose nanocrystals (CNCs), I will show the CNC assistant effect in making fluorescent solid material by traditional fluorescent molecules. After being modified on CNC surface, we found that fluorescent molecules can exhibit fluorescent signal in solid state. By adjusting the degree of substitute by our new carboxylation strategy, we also proved that the strength of fluorescent signal is only related to the DS value of fluorescent molecules. Such result provides a simple way to produce low cost solid fluorescent material and further expands the scope of CNC application.

References

[1] (1)"Reinforcement and nucleation of acetylated cellulose nanocrystals in foamed polyester composites" Hu, F.; Lin, N.; Chang, P. R.; Huang, Jin*. Carbohydrate Polymers 129, 208 (2015).

[2]"Hydrophobic modification of cellulose nanocrystal via covalently grafting of castor oil" Shang, W.; Huang, J.*; Luo, H.; Chang, P. R.; Feng, J.; Xie, G., Cellulose 20 (1), 179 (2013).

[3]"Structure and mechanical properties of new biomass-based nanocomposite: Castor oil-based polyurethane reinforced with acetylated cellulose nanocrystal" Lin, S.; Huang, J.*; Chang, P. R.; Wei, S.; Xu, Y.; Zhang, Q., Carbohydrate Polymers 95 (1), 91 (2013)

Biography

Prof. Dr. Jin Huang (黄　进) is affiliated with School of Chemistry and Chemical Engineering, Southwest University, China. He received the PhD from Wuhan University, and completed postdoctoral research in Institute of Chemistry, Chinese Academy of Sciences. He has worked in Wuhan University of Technology from 2005 to 2015, and carried out some research in Grenoble Institute of Technology in this period. His research interests focuses on "Soft Matter and Nanomaterials".

Tubular micro/nanoengines towards the smallest man-made rockets

Yongfeng Mei

Department of Materials Science, State Key Laboratory of ASIC and Systems, Fudan University, Shanghai 200433, China

** E-mail: yfm@fudan.edu.cn*

In this talk, we introduced the concept, design, fabrication and application of self-propelled tubular micro/nanoengines, which can be manipulated by external force, such as magnetic or light-induced driving force [1]. Such tubular micro and nanoengines is mimetic to rockets and could offer more possibility for future applications, especially for the motion with large propelling force [2,3]. Advanced functionalization and creative design with fine structures might enable such rocket-like micro/nanoengines as next generation small motors or robots with fast speed, precise control and complex function.

References

[1] (1)Borui Xu and Yongfeng Mei,Tubular micro/nanoengines: Boost motility in a tiny world, Science Bulletin, 2017.

(2)Jinxing Li, Wenjuan Liu, Jiyuan Wang, Isaac Rozen, Sha He, Chuanrui Chen, Hyun Gu Kim, Ha-Jin Lee, Han-Bo-Ram Lee, Se-Hun Kwon, Tianlong Li, Longqiu Li, Joseph Wang, Yongfeng Mei, Nanoconfined Atomic Layer Deposition of TiO2/Pt Nanotubes: Towards Ultra-Small Highly Efficient Catalytic Nanorockets, Adv. Func. Mater. 2017 .

（3）Jinxing Li, Jing Zhang, Wei Gao, Gaoshan Huang, Zengfeng Di, Ran Liu, Joseph Wang, Yongfeng Mei, Dry-released nanotubes and nanoengines by particle-assisted rolling, Adv. Mater. 2013, 25(27), 3715-3721

Biography

Yongfeng Mei received his BS and MS in physics from Nanjing University and PhD in physics and materials science from City University of Hong Kong. He is a full professor in materials chemistry and physics in the Department of Materials Science at Fudan University. Before that, he worked as a post-doctoral researcher in the Max Planck Institute for Solid State Research and then led a research group in the Leibniz Institute for Solid State and Materials Research Dresden as a staff scientist. His research interest focuses on the development of novel inorganic nanomembranes and their properties in optics, optoelectronics, flexible electronics and micro-/nanoscale mechanics. He has published more than 160 peer-reviewed journal papers including Advanced Materials, NPG Asia Materials, Nano Letters, Laser and Photonics Review, Physical Review Letters, Chemical Society Review, Science Advance, Applied Physics Letters, and Optics Letters. He also serves as guest editors for e.g. Nanotechnology and MRS Advance, and has chaired several international conferences (e.g. AVS topical conference and MRS symposium).

Interfacial amplification for graphene based position sensitive detectors

Zhenhua Ni（倪振华）

School of Physics, Southeast University, Nanjing, China 211189

**Email: zhni@seu.edu.cn*

Position-sensitive-detectors (PSDs) based on lateral photoeffect have been widely used in diverse applications, including optical engineering, aerospace and military fields. With increasing demand in long distance, low energy consumption, and weak signal sensing systems, the poor responsivity of conventional PSDs has become a bottleneck limiting their applications. In this talk, we will introduce a high performance graphene-based PSDs with interfacial amplification mechanism. Signal amplification in the order of ~ 104 has been demonstrated by utilizing the ultrahigh mobility of graphene and long lifetime of photo-induced carriers at the interface of SiO2/Si. This would improve the detection limit of Si-based PSDs from μW to nW level, without sacrificing the spatial resolution and response speed. Such interfacial amplification mechanism is compatible with current Si technology and can be easily extended to other sensing systems.

References

[1] Wang WH, Ni ZH* et al. Distinct photoresponse in graphene induced by laser irradiation Applied Physics Letters 106,021121 (2015)

(2)Guo XT, Ni ZH* et al. High-performance graphene photodetector using interfacial gating Optica 3, 1066-1070 (2016)

(3)Wang WH, Ni ZH* et al. High-Performance Graphene-Based Electrostatic Field Sensor IEEE Electron Device Letters 38, 1136-1138 (2017)

(4)Wang WH, Ni ZH* et al. Interfacial amplification for graphene based position-sensitive-detectors Light: Science & Applications 6, e17113 (2017)

Biography

Dr. NI Zhenhua is a Professor in School of Physics at Southeast University. He received his Bachelor's degree in Physics and a second Bachelor's degree in Applied Electrical Techniques from Shanghai Jiaotong University in 2003, Ph.D. degree in Physics from National University of Singapore (NUS) in 2007, and did his postdoctoral research in Department of Physics and Applied Physics at Nanyang Technological University (NTU) from 2007-2010. In 2009, he received the British Council "Researcher exchange programme Award" and worked as an academic visitor in Andre Geim's research group in the University of Manchester. His current research interests include the spectroscopic investigation and optoelectronic applications of graphene and other two dimensional materials.

Freestanding Electrodes for Current Collector-free Lithium Batteries

Zhao Deng

Soochow Institute for Energy and Materials Innovations, College of Physics, Optoelectronics and Energy, Soochow University, Suzhou 215006,

Email: zdeng@suda.edu.cn

Keywords: Lithium Ion Batteries • Lithium Sulfur Batteries • Wearable Technologies • Freestanding electrodes • Flexible Energy Storage Devices

Abstract:

The emerging market of wearable smart electronics calls for flexible energy storage solutions with high performance but low cost. The inclusion of rigid current collectors in the conventional design of energy storage devices has been one of the major hurdles in realizing their flexibility, due to not only the inelastic deformation, but also the extra componentry interfaces. In this talk, two examples of fabricating current collector-free electrodes are given, respectively for applications in lithium ion batteries and lithium sulfur batteries. In the first example, a high pressure and high temperature filtration method, inspired from the Oil & Gas industry, has been developed to fabricate both flexible and freestanding thin-film cathodes and anodes for the assembly of full-cell lithium ion batteries. The elastic binder used in the electrodes not only enables good mechanical flexibility and strength, but also facilitates alleviating the internal stress caused by cyclic volume expansion of active materials. Moreover, through the elimination of current collectors the interfacial stress caused by repeated device deformation can be effectively mitigated. Electrochemical characterizations on a pair of proof-of-concept anode (graphite) and cathode (lithium iron phosphate) reveal good areal capacity and rate capability, as well as high columbic efficiency. Prototype full cells constructed as such demonstrate excellent deformability, durability and power output. In the second example, carbon nanotubes and element sulfur were incorporated into nonwoven fabrics through electrospinning to fabricate freestanding cathodes for lithium sulfur batteries. The high conductivity endowed by carbon nanotubes and the interconnected web structure of the electrospun fabrics enable the elimination of current collectors, as well as polymeric binder. As a result, lithium sulfur batteries with high specific capacity, rate capability, and cycling stability were achieved. In general, these examples provide alternative paradigmatic solutions towards the fabrication of flexible Lithium batteries at the system level with high performance and low cost.

Zhao Deng received his bachelor and master degree in chemical engineering from Shanghai Jiao Tong University, and his Ph. D in analytical chemistry from University of California, Davis. After that, he worked as a research associate in the Center for Nanoscale Science and Technology (CNST) at National Institute of Science and Technology (NIST). Before joined Soochow University as a professor in 2016, he had worked in the Oil & Gas industry for about 5 years in the United States. Zhao's current research interests include wearable energy solutions, photoelectric catalysis with MOFs derivatives, and in-situ characterization of electrode processes. Zhao is the receiver of the thousand young talent program of the Chinese government.

An Extremely Stable and Highly Active Periodic Mesoporous Lewis Acid Silica for Mukaiyama-Aldol Reaction in Water

Fang Zhang

Department of Chemistry, Shanghai Normal University, Shanghai 200234, China

Homogeneous acid catalysts are mostly common used in the production of industrial chemicals and fine chemicals. However, their inherent drawbacks such as the corrosivity, the environmental hazards as well as the high cost of separating the acids from the reaction system, are very difficult to meet the requirements of environmentally friendly chemical processes. Moreover, some of them must be used under anhydrous conditions, which necessitates massive toxic, flammable organic solvents and specialized reaction vessels. Therefore, the development of solid acid catalyst for chemical synthesis in water attracted a lot of attention in recent years since it could simultaneously reduce the pollution and cost resulting from liquid acids and organic solvents, coupled with the ease of recovery and recycling of homogeneous acid catalysts. Herein we reported for the first synthesis of a series of PMO supported rare earth Lewis acid catalysts ((OTf)2Ln-SO3-Ph-PMO) by coordinating Ln(OTf)3 with benzenesulfonate-ligand (-PhSO3-) resulted from sulfonation of phenyl (Ph) groups embedded in PMO silica walls. The (OTf)2Sc-SO3-Ph-PMO showed the highest catalytic reactivity and selectivity in water-medium Mukaiyama-Aldol reaction. Meanwhile, it exhibited significantly enhanced catalytic reactivity against that of Sc(OTf)3 homogeneous catalyst and higher catalytic efficiencies than the (OTf)2Sc-SO3-Ph-SBA-15 with Sc complex terminally bonded to the pore surface. Moreover, it could be easily recycled and reused at least 10 times without significant loss of its catalytic activity.

Biography

Prof. Fang Zhang received his PhD degree in 2009 from East China Normal University. He studied as joint PhD student at University of California, Los Angeles and worked as post-doc fellow at University of New Mexico. He was promoted to a Full professor at Department of Chemistry in Shanghai Normal University in 2015. He has been the recipient of Shanghai Eastern Scholar Professorship (2016), Shanghai “Rising-Star Program” Scholar (2013), Shanghai Chenguang Talent (2012), and Shanghai Pujiang Talent (2010). His research works mainly focus on the design and development of highly active and selective heterogeneous catalysts for environmentally friendly chemical processes. Zhang has published papers in journals such as J. Am. Chem. Soc., Angew. Chem. Int. Ed., and Chem. Sci., with himself being the first author or the corresponding author. He has published more than 50 peer-reviewed papers and obtained 12 Chinese patents. Prof. Zhang is also the executive director of Joint International laboratory of Resource Chemistry, Ministry of Education, and an Advisory Board Member of Scientific Reports.

Epitaxial Growth of Highly Oriented Metallic MoO2 Nanorods on C-sapphire(0001)

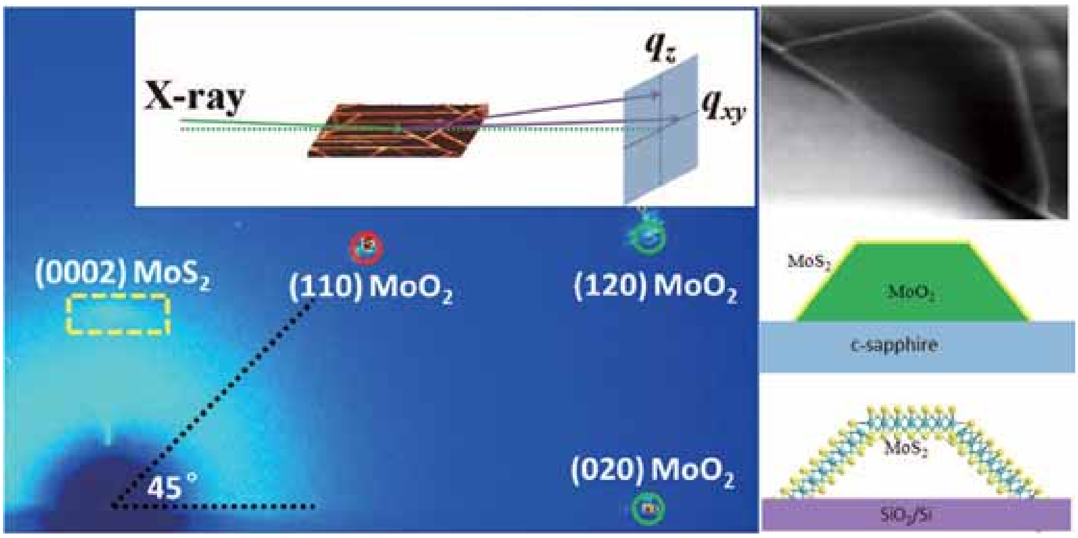
Han Huang[1)] *, Xiaoming Zheng[1)], Di Wu[1)], Xingyu Gao[2)] and Yongli Gao[1)]

[1]Hunan Key Laboratory of Super-microstructure and Ultrafast Process, College of Physics and Electronics, Central South University, Changsha 410083, P. R. China

[2]Shanghai Synchrotron Radiation Facility, Shanghai Institute of Applied Physics, Chinese Academy of Sciences,239 Zhangheng Road,Pudong New Area,Shanghai 201204, P. R. China

**Corresponding author:Email physhh@csu.edu.cn*

Molybdenum oxide nanowires have been found to show promise in a diverse range of applications, ranging from electronics to energy storage and micromechanics.1,2 Here, highly oriented metallic MoO2 nanorods are successfully synthesized on c-sapphire(0001) substrate by CVD method and then characterized by Raman, AFM, SEM, EDS and XRD measurements. MoO2 nanorods exhibit epitaxial growth behaviors on c-sapphire with MoO2(100) || sapphire(0001) and MoO2<001> aligned well with sapphire. Raman and EDS measurements show the chemical composition of MoO2 for the nanorods whose surface is sulfurized. Our finding provides a method to eptaxially grow MoO2 nanorods on c-sapphire(0001) with highly crystalline degree.3 Then, the CVD grown high quality MoO2 nanorods are transferred onto Si wafers for device fabrications. The as-fabricated devices based on individual MoO2 nanorods show a high electrical conductivity of ~6.04×103 S/cm and a low contact resistance of 33 Ω, which shows superior electrical performance than previous reports. The wrapped MoS2 plays a negligible role. The electrical conductivity of MoO2 nanorods are observed declining in air when a high voltage applied, which can be improved in high vacuum or by SiO2 packaging. 4



e: Left: 2D-GIXRD pattern of MoO2 nanorods on c-sapphire (0001). Right: the cross-sectional SEM image of single nanorod and the corresponding proposed model

References:

[1] EunYoung Ahn, et. al. RSC Adv., 6, 60704(2016)

[2] Liqiang Mai, et. al. Materials today, 14, 346-353(2011)

[3] Di Wu, Yingguo Yang, Xiaoming Zheng, Xiaoliu Chen, Qiliang Xie, Jiao Shi, Yingbao Huang, Fei Song, Xingyu Gao, Xue-Ao Zhang, Fang-Ping Ouyang, Yongli Gao, Han Huang.

Epitaxial Growth of Highly Oriented Metallic MoO2 Nanorods on C-sapphire. (under review by JPCC)

[4] Qiliang Xie, Xiaoming Zheng, Di Wu, Xiaoliu Chen, Jiao Shi, Xintong Han, Xue-Ao Zhang, Gang Peng, Yongli Gao, and Han Huang. High electrical conductivity of individual Epitaxially grown MoO2 nanorod. Appl.Phys.Lett. 111, 093505(2017)

Biography

Dr. HUANG Han is currently a professor (2012-) at Central South University in Changsha. He received his Bachelor's degree in applied physics from NUDT (China) in 2002, Ph.D degree from Physics Department at Zhejiang University (China) in 2008 and then became a postdoctoral researcher at the National University of Singapore under Prof. Andrew Wee and Dr. CHEN Wei. His current research interests include molecule–substrate interface problems associated with molecular electronics, as well as fabrication and modification of graphene, graphene nanoribbons and other 2-dimensional materials.

Functional fibrous materials based on silkworm silk

Keqin Zhang

Soochow University, Suzhou, China

Abstract: In this talk, the recent important progress of my research group will be discussed. The functional fibrous materials based on the silks with the novel functions and mechanisms are focused and discussed. Such materials are fabricated through the simple techniques, such as eletrospining, 3Dpriting, and living injection to the silkworm. The following topics will be discussed in this talk. 1) the 3D printing of silk fibroin for the scaffold materials; 2) the organic solar cells based on the flexible and conductive silk thin film; 3) hematopoiesis toxicity of quantum dots in the silkworm: new mechanism of the defense in an invertebrate model organism.Furthermore, the applications of above-mentioned materials in the area of biomaterials, smart textiles, and energy conversion devices are demonstrated. Our work provides new insight into the functional fibers, in particular the natural silk fibers, and their potential applications in many cutting-edge areas.

Dr. Ke-Qin ZHANG (Ph.D. in Physics), now is a professor of polymer science and textile engineering, in National Engineering Laboratory for Modern Silk and College of Textile and Clothing Engineering of Soochow University. He got his B Sc in Physics, M Sc and Ph. D. Degree in Condensed Matter Physics from Nanjing University at 1994, 1997 and 2000 respectively. After the graduation, he conducted his postdoctoral training in Max-Planck Institute for Metal Research sponsored by the Max-Planck Postdoctoral Fellowship and National University of Singapore from 2000-2004. He was awarded by the Lee Kuang Yew outstanding postdoctoral fellowship selected by the Lee Kuang Yew foundation from the global applicants at 2005. He became the research fellow and senior research fellow in National University of Singapore form 2004 to 2009. He returned to Soochow University as a professor at 2009. And he was the awardee of the one-thousand-talent recruiting programme issued by the central government of China at 2010. He has published more than 80 papers in the prestigious journals including the Nature, Physical Review Letters, AngewandteChemie and Biomaterials etc. He also filed more than 30 patents in China and other counties. He is the life member of American Physics Society and Biophysics Section, member of Materials Research Society of America and Singapore and member of a council of Chinese Functional Materials Association. He is the Editorial Board Member of the International Journal of Textile Science and Technology.

Study on the Performance of Visible LED Light-induced Fenton-like Degradation of Organic Pollutants over Bimetal MOF (Fe/Ti)

Qing-Feng Xu*,Yuan-Yuan Li, Feng Zhou, Jian-Mei Lu

College of Chemistry, Chemical Engineering and Materials Science, Soochow University, Suzhou, 215123, China

** Email: xuqingfeng@suda.edu.cn*

Bimetallic MOF(Fe/Ti) for visible light-induced Fenton-like excitation of H2O2 for organic pollution degradation was investigated in this work. The bimetallic MOF(Fe/Ti) (namely MIL-mFe@nTi) was hydrothermally synthesized and characterized by XRD, FT-IR, XPS, TEM, SEM and UV-vis DRS. The photocatalyst has good performance for adsorption of MB and the adsorption capacity increases with the increase of Ti content. The MIL-Fe@Ti showed good photodegradation stability, and there was no obvious leakage of Fe3+ during degradation of MB, and no significant change in catalytic performance after 6 times of recycles. Simultaneously, MIL-Fe@Ti also has a good adsorption degradation performance of RhB and tetracycline. Therefore, the bifunctional MOF(Fe/Ti) material exhibits a promising industrial application prospects.

References

[1] Fan J, Chen D, Li N, et al. Adsorption and biodegradation of dye in wastewater with Fe3O4@ MIL-100 (Fe) core-shell bio-nanocomposites[J]. Chemosphere, 2017, 191:315.

[2] Sheng H, Chen D, Li N, et al. Urchin-Inspired TiO2@MIL-101 Double-Shell Hollow Particles: Adsorption and Highly Efficient Photocatalytic Degradation of Hydrogen Sulfide[J]. Chemistry of Materials, 2017, 29(13).

[3] Qu J, Chen D, Li N, et al. Coral-inspired nanoscale design of porous SnS 2, for photocatalytic reduction and removal of aqueous Cr (VI)[J]. Applied Catalysis B Environmental, 2017, 207:404-411.

Biography

Education: 1989 – 1993 B.S. Dept. of Chemistry, Soochow University, China; 1994 – 1996 M.S. Dept. of Chemistry, Soochow University, China; 2001 – 2004 Ph.D. Dept. of Chemistry, Soochow University, China.

Experience: 1996- Present College of Materials sciences, Soochow University, Lecturer (1999), Associate Professor(2005), Professor(2011); 2009 –2010 Visiting research fellow, National University of Singapore, Singapore

Research Interests: Functional materials and their Electronic Memory Performance; Functional materials and application in wastewater treatment.

Awards: National Award for Technological Invention (2014, second prize, rank second)

Publication: published more than 70 SCI papers including Adv. Mater., Mater. Horiz., Nanoscale, J. Mater. Chem., Polym. Chem., etc. and 10 Chinese invent patents.

Exploring organic semiconductors at two-dimensional limit

Xinran Wang

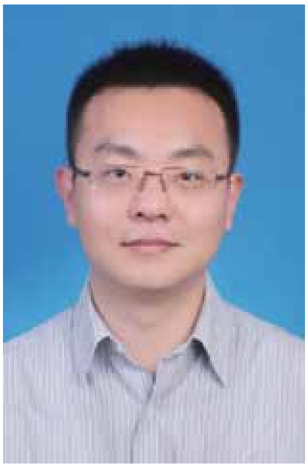
School of Electronic Science and Engineering, Nanjing University, Nanjing, China

** E-mail: xrwang@nju.edu.cn*

From the research on graphene and other 2D materials we learn that the material properties depend significantly on thickness. By thinning the materials down to monolayer, new physics and device applications can emerge. However, most research efforts in the field are focused on atomic crystals, while many molecular crystals also adopt layered form in bulk. In this presentation, I will show that highly crystalline molecular crystals down to monolayer can be obtained by van der Waals epitaxy on graphene and BN. This class of materials can not only make high-performance organic thin-film transistors but also serve as a powerful platform to study intrinsic structure-property relationship. Precise control of epitaxy offers new possibilities in achieving well-defined heterostructures based on organic materials.

References

[1] D. W. He et al., Nat. Commun. 5, 5162 (2014).
[2] D. W. He et al., Appl. Phys. Lett. 107.183103 (2015)
[3] Y. H. Zhang et al., Phys. Rev. Lett. 116,016602 (2016).
[4] X. L. Liu et al., Adv. Mater. 28, 5200 (2016).
[5] B. Wu et al., Nano Lett.16 (6), 3754 (2016).
[6] Y. H. Zhang et al., Nano Res. 10, 1336 (2017).



- 2004 B. S., Physics, Nanjing University, China
- 2010 Ph. D., Physics, Stanford University, USA
- 2010 Postdoctoral Fellow, Stanford University, USA
- 2010-2011 Postdoctoral Fellow, University of Illinois at Urbana-Champaign, USA
- 2011-2014 Professor, School of Electronic Science and Engineering, Nanjing University, China
- 2015- Changjiang distinguished professor, School of Electronic Science and Engineering, Nanjing University, China

Research: Two-dimensional materials, electronic and optoelectronic devices, organic electronics.

Functional TiO2 Thin Films towards Applications in Sensing and Environmental Sciences

Min Lai [1,2]（赖敏）

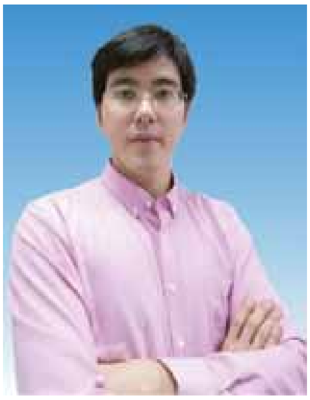
[1]Jiangsu Key Laboratory for Optoelectronic Detection of Atmosphere and Ocean, Nanjing University of Information Science & Technology(南京信息工程大学), 210044, Nanjing

[2]School of Physics and Optoelectronic Engineering, Nanjing University of Information Science & Technology(南京信息工程大学), 210044, Nanjing

* Email: mlai@nuist.edu.cn

Preparation and application of high-performance nanostructured semiconducting materials is an intriguing research area that follows the extensively increasing demands in many areas such as electronics, new energy and environment. Owing to the advantages on photocatalytic activity, chemical stability, production cost and environmental compatibility, semiconducting titanium dioxide has attracted intense scientific interest with potential applications in photocatalysis, environmental processing, sensors and solar cells. We have recently fabricated ultra-smooth titanium dioxide thin film with superhydrophilicity without UV illumination. High wettability may offer great benefits to vacancy generation and light scattering in humid air. We particularly focused on its applications on humidity sensing with a fast response and recovery and removal of gas-phase organic pollutants.

Biography



Dr. Min LAI is currently a professor in school of physics and optoelectronic engineering at Nanjing University of Information Science & Technology (NUIST). He received his Bachelor’s degree in Chemistry from Nanjing University in 2001, Ph.D. degree in physical chemistry at University of Bristol in 2007 under the supervision of Prof Jason Riley. Before joining NUIST, he worked with Prof Nosang Myung and Prof Ashok Mulchandani as a postdoctoral research associate at University of California, Riverside. His current research interests include functional semiconducting materials and devices and their applications in sensing, environmental sciences, etc.

Interface Engineering for 2D Phosphorene Based Optoelectronic Devices

Wei Chen [1,2,3]*

[1]*Department of Physics National University of Singapore, Singapore 117542, Singapore*

[2]*Department of Chemistry, National University of Singapore, 117543, Singapore*

[3]*NUS Research Institute (Suzhou), Suzhou, China*

* Email: phycw@nus.edu.sg

Black phosphorus (BP), as a fast-emerging two-dimensional (2D) material, stands out from other members in 2D family such as graphene and transition metal dichalcogenides (TMDs), and attracts substantial research interests attributed to its remarkably unique fundamental properties and versatile device applications. In this talk, I will summarize and discuss our recent work for interface engineered 2D materials phosphorene based field-effect-transistors (FETs) and photo-transistors, through the combination of in-situ FET device evaluation and photoelectron spectroscopy investigation. We will particularly emphasize on the electron and hole doping effect on the transport properties and optoelectronic response of phosphorene devices.

References

(1) Xiang D, Han C, Wu J, Zhong S, Liu YY, Lin JD, Zhang XA, Hu WP, Özyilmaz B, Castro Neto AH, Wee ATS, **Chen Wei***, ***Nature Communication*** **6**, 6485 (2015)

(2) Zhang JL, Zhao ST, Han C, Wang ZZ, Zhong S, Sun S, Guo R, Zhou X, Gu CD, Yuan KD, Li ZY*, **Chen Wei***, ***Nano Letter*** **16**, 4903-4908 (2016)

(3) Hu ZH, Li Q, Lei B, Zhou QH, Xiang D, Lyu ZY, Hu F, Wang JL, Ren YJ, Guo R, Goki E, Wang L, Han C*, Wang JL*, **Chen Wei*** ***Angew. Chem. Int. Ed.*** **56**, 9131-9137 (2017)

(4) Han C, Hu ZH, C. Gromes L, Bao Y, Carvalho A, Tan SJR, Lei B, Xiang D, Wu J, Wang L, Huo FW, Huang W, Loh KP, **Chen Wei***, ***Nano Letter*** **17**, 4122-4129 (2017)

Biography

Dr. CHEN Wei is currently an **Associate Professor (2013 -)** in both Chemistry Department and Physics Department at National University of Singapore (NUS). He received his Bachelor's degree in Chemistry from Nanjing University (China) in 2001, Ph.D. degree from Chemistry Department at NUS in 2004 under the supervision of Prof Loh Kian Ping and Prof Andrew T. S. Wee. His current research interests include **Molecular-scale Interface Engineering for Molecular, Organic and 2D Materials-based Electronics, and Interface-Controlled Nanocatalysis for Energy and Environmental Research.**

会议的交通说明

由于本次会议人数较多，会务组无法安排参会代表的接送工作，请各位代表自行抵达入住酒，赶往火车站请多预留时间，希望如下指南对您的出行有所帮助。

苏州出租车呼叫号码：0512-67776777

苏州园区火车站—东山宾馆：

路程约：53 公里

时间约：1 个小时 5 分钟

打的费用约：135 元

苏州火车站—东山宾馆：

路程约：43 公里

时间约：50 分钟

打的费用约：118 元

苏州北站—东山宾馆：

路程约：57 公里

时间约：1 个小时 10 分钟

打的费用约：147 元

第四届国际纳米功能材料和应用学术会议

参 会 指 南

尊敬的会议代表：

为了保障本会议顺利召开，我们提醒您在会期间注意以下事项：

一、 出入宾馆酒店、会场及参加会议组织的活动时，请佩戴会议代表证；

二、 请妥善保管会议文件资料及有关证件；

三、 请按照会议日程的安排准时参加会议和有关活动，口头报告者应提前做好准备，如有任何变化，应及时与会务组联系；

四、 开会期间请务必将手机等通讯工具调整至静音或振动状态，不要在会场内拨打手机，拍照时请勿使用闪光灯；

五、 请自觉遵守下榻酒店的规章制度，注意防火安全，妥善保管自己的财物，不要在空房间放置贵重物品；

六、 入住酒店后，注意查看安全通道，认清安全疏散路线；

七、 参会代表若遇身体不适或其他紧急情况，请联系会务组；

八、 特殊要求请与会务组联系，敬请提出宝贵意见。

会务组联系方式：

孔金晶：15051531006

洪正琳：18862231932

尹　菲：18801547430

温 馨 提 示

欢迎您参加本次研讨会，您的支持和配合将有助于我们为您提供更周到的服务！为便于您愉悦参会，会务组特别提醒您留意以下事项：

(1) 本次会议住宿酒店和会场为苏州东山宾馆（地址：苏州东山宾馆一区叠翠楼二楼，苏州市吴中区启园路 46 号）；

(2) 酒店公共区域的 WIFI: dongshan hotel, 无密码。

(3) 11 月 24 日会务组在苏州东山宾馆对各位代表进行接待，时间：13:00-19:00，如您有特殊情况不能按时报到，请提前联系会务组。

(4) 酒店房费（含早餐费），早餐时间为 7:00-9:00 AM

11 月 24 日晚宴安排在酒店 1 楼亿湖轩包厢；

10 月 25-26 日日午餐安排在 1 楼亿湖轩包厢；

10 月 25 日晚宴安排在 1 楼郁金香；

10 月 26 日晚宴安排在 1 楼鸿运厅；

注：如您不能参加晚宴，请提前联系会务组

会务联系：

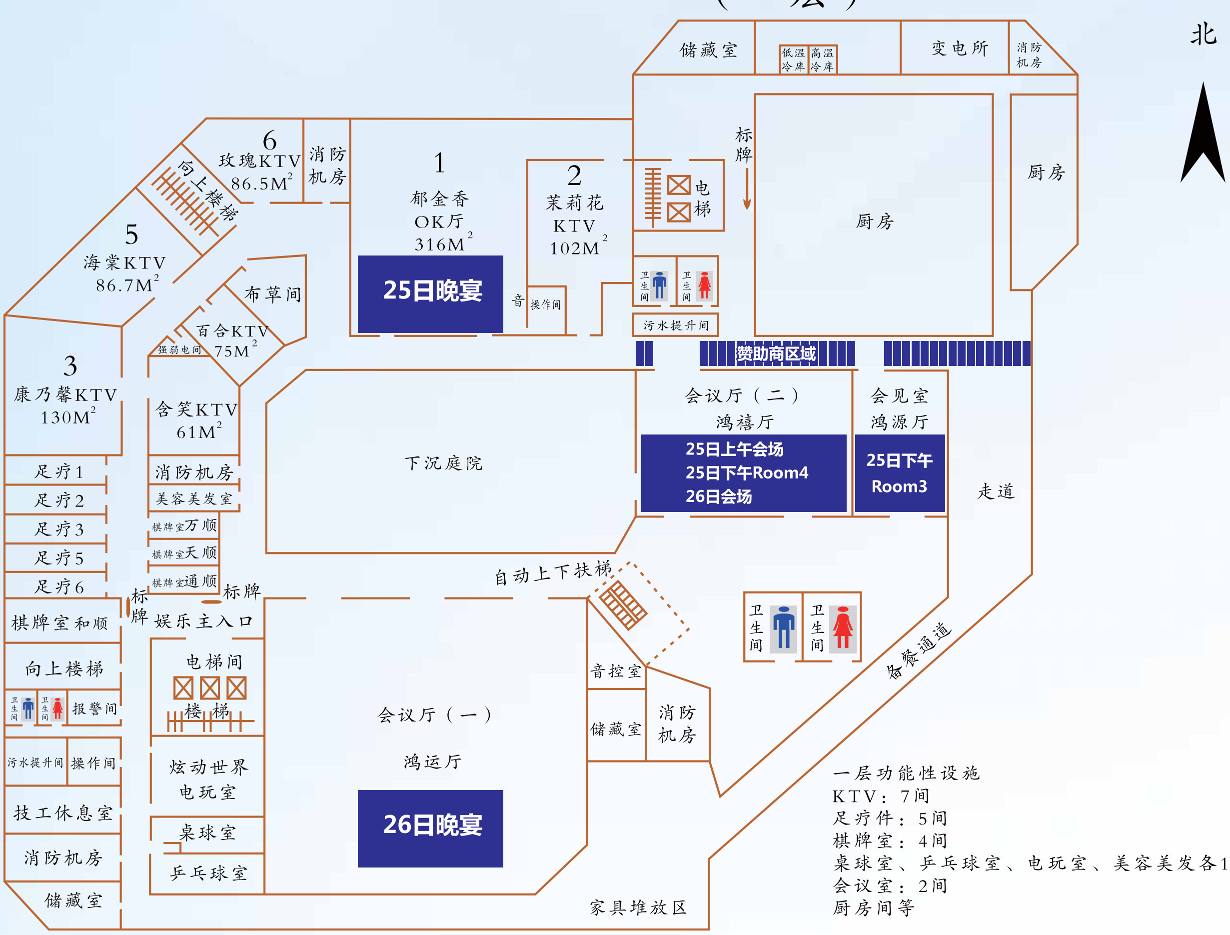
孔金晶：15051531006

洪正琳：18862231932

尹　菲：18801547430

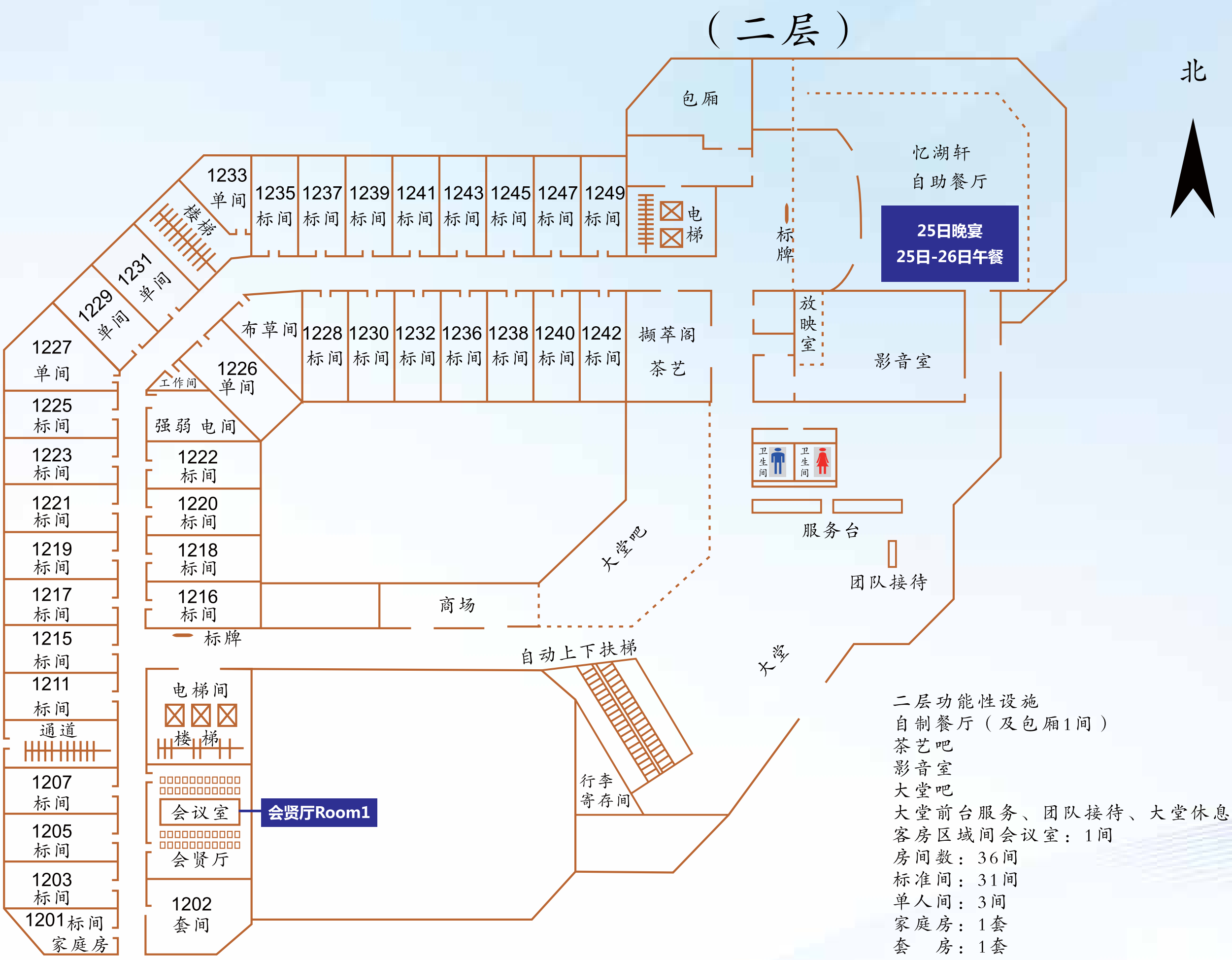
酒店平面示意图——叠翠楼（1号楼）

（一层）



一层功能性设施
KTV：7间
足疗件：5间
棋牌室：4间
桌球室、乒乓球室、电玩室、美容美发各1间
会议室：2间
厨房间等

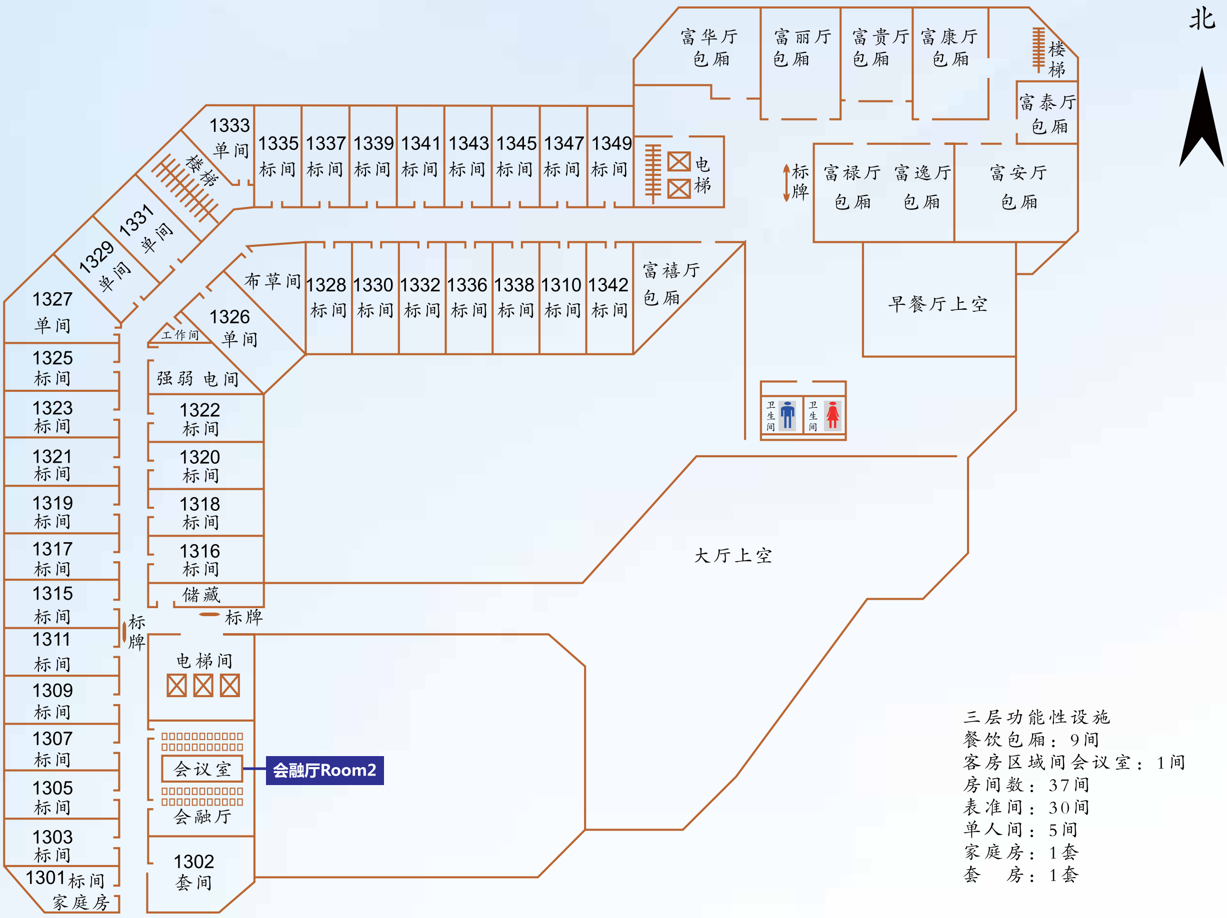
酒店平面示意图——叠翠楼（1号楼）



二层功能性设施
自制餐厅（及包厢1间）
茶艺吧
影音室
大堂吧
大堂前台服务、团队接待、大堂休息区
客房区域间会议室：1间
房间数：36间
标准间：31间
单人间：3间
家庭房：1套
套　房：1套

酒店平面示意图——叠翠楼（1号楼）

（三层）



三层功能性设施
餐饮包厢：9间
客房区域间会议室：1间
房间数：37间
表准间：30间
单人间：5间
家庭房：1套
套　房：1套

会议主办单位：苏州大学、苏州纳米科技协同创新中心、新加坡国立大学苏州研究院、

新加坡国立大学、江苏省化学化工学会

会议承办单位：苏州大学、新加坡国立大学苏州研究院、新加坡国立大学

会议协办单位：南京大学、东南大学、南京信息工程大学、江苏先进生物与化学制造协同创新中心、

深圳大学教育部二维材料光电科技国际合作联合实验室

会议赞助单位

深圳市欧弗德光电科技有限公司　　北京理化赛思科技有限公司