Xu Zhang

Center for Multidimensional Carbon Materials (CMCM), Institute for Basic Science (IBS), Ulsan National Institute of Science & Technology (UNIST), Ulsan, Korea|| Phone: +82 10 33065320|| Email: zhangxu.chem@gmail.com

EDUCATION

- Ph. D. (Physical Chemistry) || Institute of Chemistry, Chinese Academy of Sciences (ICCAS) || Sept. 2006- June 2011 || Supervisor: Prof. Li-Jun Wan
- B. S. (Materials Physics) || University of Science and Technology of China (USTC) ||Sept.2002- June 2006

RESEARCH EXPERIENCE

- Postdoc, Research Scientist || Center for Multidimensional Carbon Materials (CMCM), Institute for Basic Science (IBS) || Dec. 2013- Present || Worked with Prof. Rodney S Ruoff
- Postdoc, UNIST Research Scientist || Ulsan National Institute of Science & Technology (UNIST) || Aug. 2013- Nov. 2013 || Worked with Prof. Rodney S Ruoff
- Postdoc, Research Associate || WPI Advanced Institute for Materials Research (WPI-AIMR) || July 2011- June 2013 || Worked with Prof. Yoshinori Yamamoto

RESEARCH INTERESTS

- Chemistry and application of carbon nanomaterials
- Organic semiconductors and devices
- Interface nanochemistry/nanophysics and scanning probe microscopy (SPM)

HONORS&AWARDS

- **Award of the President of CAS (2011)**
  Awarded for Ph.D graduates with distinguished academic records in CAS
- **Bruker Nano Fellowship for Young Scientist (2011)**
- **Excellent Student Leader of CAS (2010)**
  Awarded for student leaders with outstanding contribution in CAS
- **Excellent Student Award of CAS (2010)**
  Awarded for student with outstanding performance in CAS
- **Scholarship of the Director of ICCAS (2010, 2009, 2007)**
  Awarded for student with very good academic records in ICCAS
- **Chang-Xing-Hua-Gong (Eternal Chemical Co.) Student Scholarship (2009)**
- **Excellent Graduate Students of Anhui Province (2006)**
- **Excellent Students of Anhui Province (2005)**
- **Excellent Student Scholarship of USTC(2005, 2004, 2002)**
- **Guang-Hua Student Scholarship (2003)**

EXPERIMENTAL SKILLS

- **Organic synthesis:** Expertise in general organic synthesis, photochemical synthesis, column chromatography, recrystallization, NMR, GC-MS, HPLC, melting point analysis.
- **Organic semiconductor materials:** Expertise in physical vapor transport, vacuum evaporator, cyclic voltammetry, UV-Vis absorption spectrometry, XRD.
- **Self-assembly at surfaces:** Expertise in STM, EC-STM, AFM.

RESEARCH HIGHLIGHTS

1. **Cyclopenta-fused polycyclic aromatic hydrocarbons as highly balanced ambipolar semiconductors in thin film organic field effect transistors**
   - A series of cyclopenta-fused polycyclic aromatic hydrocarbons (CP-PAHs) were synthesized, which exhibited low LUMO energy levels due to the cyclopenta-fusion.
   - The thin film organic field effect transistors (OFETs) based on those materials as an active layer showed good ambipolar characteristics with an excellent balance of hole and electron mobilities.
2. **Solvents induce structural diversity of a monodendron (BIC) self-assembly on HOPG**
   - With the decrease of BIC concentration, 1-octanol serves as a counterpart, interacts and co-assembly with BIC, which induces BIC forms lamellar to quadrangular, and to hexagonal.
   - Different solvents including 1-phenyloctane, 1, 2, 4-trichiorobenzene, and 1-octanoic acid play a crucial role (as dispersant or counterpart) in the assembly of BIC, which controls the formation of a variety of BIC structures on HOPG.
3. **Fabrication linear molecular nanostructures by a hydrogen-bond-mediated modular and flexible host-guest assembly**
   - Steered by the O-H⋯N hydrogen bonds between BIC and pyridylethynyl derivatives, a linear BIC template can be constructed on HOPG.
   - The linear BIC template is flexible to accommodate guest pyridylethynyl molecules into linear nanostructures with different sizes, shapes, and aggregation numbers.
4. **The re-organization of hydrogen bond partners in the co-assembly of BIC and pyridylethynyl derivatives**
   - After the addition of pyridylethynyl derivatives in the BIC adlayers, O-H⋯N hydrogen bonds are able to replace the original formed hydrogen bonds, and drive the molecules to co-assembly on surface.
5. **Effect of C-H⋯F and O-H⋯O hydrogen bonds in forming self-assembled monolayers of BF_2-Substituted *β*-Dicarbonyl Derivatives**
   - C-H⋯F hydrogen bonds help the target molecules to form lamellar structures, while O-H⋯O hydrogen bonds steer the formation of lamella with double molecular rows.
6. **2D self-assembly and 3D aggregates of Melamine (M) and melamine/cyanuric acid (CA-M)**
   - Based on STM and AFM investigations, 2D and 3D structures of CA-M are much more stable than that of M owing to different hydrogen bonds. The formation of CA-M clusters is highly dependent on the sample concentration.
7. **Photo-induced structural transformation of a diarylethene derivative on Au(111) investigated with EC-STM**
   - A structural transformation of a diarylethene derivative from ordered structures to disordered adlayers can be induced by UV irradiation, which is directed by the photo-induced conformational transformation and the molecule-substrate interaction change.

PUBLICATIONS

(Research ID: K-6350-2012, URL: http://www.researcherid.com/rid/K-6350-2012)

1. **Zhang X.**; Kanagasekaran T.; Oniwa K.; Jin T. N.; Shimotani H.; Asao N.; Tanigaki K.; Wan L. J.; Yamamoto Y. Ambipolar organic semiconductors from cyclopenta-fused polycyclic aromatic hydrocarbons: The effect of pentagon annelation. In preparation.

2. **Zhang X.**; Kanagasekaran T.; Oniwa K.; Jin T. N.; Shimotani H.; Asao N.; Tanigaki K.; Wan L. J.; Yamamoto Y. Cyclopenta-fused polycyclic aromatic hydrocarbons as highly balanced ambipolar semiconductors in thin film organic field effect transistors. To be submmitted.
3. Yang, L.; Guan, C.Z.; Yue, W. Z.; Wu, J. Y.; Yan, H. J.; **Zhang, X**.; Wang, Z. H.; Zhan, X. W.; Li, Y. L.; Wang, D.; Wan, L. J. Hybrid molecular nanostructures with donor-acceptor chains. ***Sci. China Chem***.**2013,** *56*, 124-130.
4. **Zhang X.**; Li S. S.; Chen T.; Wang D.; Wan L. J. Molecular Templates for Controlling and Ordering Organic Molecules on Solid Surfaces. ***Nano***. **2012**, *7*, 1230001.
5. **Zhang X.**; Li S. S.; Lin H.; Wang D.; Xu W.; Wan L. J.; Zhu D. B. Molecular adlayer and photo-induced structural transformation of a diarylethene derivative on Au(111) investigated with scanning tunneling microscopy. ***J. Electroanal. Chem.*** **2011**, *656*, 304-311.
6. **Zhang X.**; Chen T.; Yan H. J.; Wang D.; Fan Q. H.; Wan L. J.; Ghosh K.; Yang H. B.; Stang P. J. Hydrogen Bond Partner Reorganization in the Coadsorption of a Monodendron and Pyridylethynyl Derivatives. ***Langmuir***. **2011**, *27*, 1292-1297.
7. Liu J.; **Zhang X.**; Wang D.; Wang J. Y.; Pei J.; Stang P. J.; Wan L. J. Shape-Persistent Two-Component 2D Networks with Atomic-Size Tunability. ***Chem. Asia. J.*** **2011**, *6*, 2426-2430.
8. Chen T.; Yan H. J.; **Zhang X.**; Wang D.; Wan L. J. 2D Hexagonal Tilings Based on Triangular and Hexagonal Structural Units in the Self-Assembly of Thiacalix[4]arene Tetrasulfonate on an Au(111) Surface. ***Chem. Asia. J.*** **2011**, *6*, 1811-1816.
9. **Zhang X.**; Chen T.; Yan H. J.; Wang D.; Fan Q. H.; Wan L. J.; Ghosh K.; Yang H. B.; Stang P. J. Engineering of Linear Molecular Nanostructures by a Hydrogen-Bond-Mediated Modular and Flexible Host-Guest Assembly. ***Acs Nano***. **2010**, *4*, 5685-5692.
10. Liu J.; **Zhang X.**; Yan H. J.; Wang D.; Wang J. Y.; Pei J.; Wan L. J. Solvent-Controlled 2D Host-Guest (2,7,12-Trihexyloxytruxene/Coronene) Molecular Nanostructures at Organic Liquid/Solid Interface Investigated by Scanning Tunneling Microscopy. ***Langmuir***. **2010**, *26*, 8195-8200.
11. Chen T.; Wang D.; **Zhang X.**; Zhou Q. L.; Zhang R. B.; Wan L. J. In Situ Scanning Tunneling Microscopy of Solvent-Dependent Chiral Patterns of 1,4-Di[4-N-(trihydroxymethyl)methyl carbamoylphenyl]-2,5-didodecyloxybenzene Molecular Assembly at a Liquid/Highly Oriented Pyrolytic Graphite Interface. ***J. Phys. Chem. C***. **2010**, *114*, 533-538.
12. Chen T.; Chen Q.; **Zhang X.**; Wang D.; Wan L. J. Chiral Kagome Network from Thiacalix[4]arene Tetrasulfonate at the Interface of Aqueous Solution/Au(111) Surface: An in Situ Electrochemical Scanning Tunneling Microscopy Study. ***J. Am. Chem. Soc.*** **2010**, *132*, 5598-5599.
13. Chen Q.; **Zhang X.**; Chen T.; Wang D.; Qian H. L.; Wang Z. H.; Wan L. J. Substitution effect on the adlayer formation of tetrachloroperylene bisimides on HOPG surface. ***Surf. Sci.*** **2010**, *604*, 2078-2083.
14. **Zhang X.**; Feng Y.; Fan Q. H.; Wan L. J. Self-assembled Structures and Structural Transition of Dimethyl Isophthalate-Functionalized Janus Dendrimers on HOPG Investigated with STM. ***Chem. J. Chinese. U.*** **2009**, *30*, 2424-2428.
15. **Zhang X.**; Chen T.; Chen Q.; Wang L.; Wan L. J. Self-assembly and aggregation of melamine and melamine-uric/cyanuric acid investigated by STM and AFM on solid surfaces. ***Phys. Chem. Chem. Phys.*** **2009**, *11*, 7708-7712.
16. **Zhang X.**; Chen T.; Chen Q.; Deng G. J.; Fan Q. H.; Wan L. J. One Solvent Induces a Series of Structural Transitions in Monodendron Molecular Self-Assembly from Lamellar to Quadrangular to Hexagonal. ***Chem. Eur. J.*** **2009**, *15*, 9669-9673.

17. **Zhang X.**; Chen Q.; Deng G. J.; Fan Q. H.; Wan L. J. Structural Diversity of a Monodendron Molecule Self-Assembly in Different Solvents Investigated by Scanning Tunneling Microscopy: From Dispersant to Counterpart. ***J. Phys. Chem. C***. **2009**, *113*, 16193-16198.
18. Chen Q.; Chen T.; **Zhang X.**; Wan L. J.; Liu H. B.; Li Y. L.; Stang P. Two-dimensional OPV4 self-assembly and its coadsorption with alkyl bromide: from helix to lamellar. ***Chem. Commun.*** **2009**, 3765-3767.
19. **Zhang X.**; Wan L. J. Tuning Self-assembled Structures on Solid Surfaces by Exerting External Stimuli Investigated with STM and Progress. ***Chem. J. Chinese. U.*** **2008**, *29*, 2582-2590.
20. **Zhang X.**; Yan C. J.; Pan G. B.; Zhang R. Q.; Wan L. J. Effect of C-H...F and O-H...O hydrogen bonding in forming self-assembled monolayers of BF_2-substituted beta-dicarbonyl derivatives on HOPG: STM investigation. ***J. Phys. Chem. C***. **2007**, *111*, 13851-13854.

REFERENCES

Prof. Li-Jun WAN
Email: wanlijun@iccas.ac.cn

Institute of Chemistry, Chinese Academy of Sciences (ICCAS), Beijing, 100190, China.

Prof. Yoshinori YAMAMOTO
Email: yoshi@m.tohoku.ac.jp
WPI-Advanced Institute for Materials Research (WPI-AIMR), Tohoku University, Sendai 980-8577, Japan.

Prof. Rodney S. RUOFF
Email: r.ruoff@mail.utexas.edu
Department of Mechanical Engineering, University of Texas at Austin, 78712 Austin, U.S.