A person wearing a suit and tie

Description automatically generated**Kai Xiao, Ph.D.**

Senior R&D Staff Scientist

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**Education:**

Ph.D. (2004) Institute of Chemistry, Chinese Academy of Sciences, Beijing, China

*Physical Chemistry*

M.S. (2001) Institute of Metal Research, Chinese Academy of Sciences, Shenyang, China

*Materials Science*

B.S. (1998) East China Institute of Technology, China

*Chemistry*

**Research Expertise:**

* ~ 20 Years Research Experience in functional nanomaterial synthesis, characterization, and devices.
* Expertise in the synthesis and processing of functional nanomaterials including CVD, PVD, exfoliation, and other approaches.
* Expertise in the in-situ characterization of materials synthesis and processing by x-ray diffraction and optical spectroscopies.
* Expertise in the fabrication of nanoelectronic devices (FET, photodetectors, etc) by e-beam lithography and photolithography and characterization of devices to understand the optoelectronic and quantum properties.
* Expertise in the fabrication and characterization of solution-processing thin film electronic devices (FET, photodetector, photovoltaic) for energy conversion and flexible electronics.
* Functional nanomaterials: 2D Materials, conjugated polymers, halide perovskites.

**Research and Professional Experience:**

2018- *Present* Senior R&D Staff Scientist Oak Ridge National Laboratory

2011- *Present* Joint faculty in EE University of Tennessee Knoxville

2014- *Present* Joint Faculty in Bredesen Center University of Tennessee Knoxville

2013-*2017* R&D Staff Scientist Oak Ridge National Laboratory

2008-2013 R&D Associate  Oak Ridge National Laboratory

2005-2008 Postdoctoral Research AssociateOak Ridge National Laboratory (Mentor: David B Geohegan)

**Patents:**

2015 D. B. Geohegan, M-W. Lin, M. Mahjouri-Samani, A. Puretzky, C. M. Rouleau, K. Wang, K. Xiao, “Patterned Two-Dimensional Heterocrystals”, 201503565, DOE S-138,201

2017 D. B. Geohegan, O. E. Dyck, J. K. Keum, J. D. Poplawsky, K. Xiao, B. Yang, “Hybrid Perovskite Films”, 20170098514.

2003 Y. Q. Liu, K. Xiao, P. A. Hu, G. Yu, L. Fu, D. B. Zhu, “A New Method for the Fabrication of Nanotube-FET Devices Based on N-doped Carbon Nanotubes,” CN ZL 03108244.

2003 Y. Q. Liu, K. Xiao, P. A. Hu, G. Yu, L. Fu, D.B. Zhu, “Process for Preparing a CNx/C Nanotube Diodes and Its Rectifying Properties,” CN ZL 03104280.5.

2004 Y. Q. Liu, Y. Sun, Y. Ma, K. Xiao, G. Yu, D. Zhu, “Fabrication Way and Application of 5,5’-bis-biphenyl-dithieno[3,2-b:2’,3’-d]thiophene Compounds,” CN ZL 200410046350.8.

2004 Y. Q. Liu, K. Xiao, Y. Fu, G. Yu, Y. Luo, J. Zhai, L. Jiang, W. Hu and D. Zhu, “Fabrication Way of Field-Effect Transistors Controlled by Light Intensity,” CN ZL 200410101837.1.

2002 Y.Q. Liu, K. Xiao, P.A. Hu, G. Yu, X. B. Wang, D. B. Zhu, “Fabrication of Thin-Film Transistors Based on Aligned Carbon Nanotubes,” CN ZL 02145889.8.

2002 Y. Q. Liu, P. A. Hu, K. Xiao, X. B. Wang, L. Fu, D. B. Zhu, “Fabrication and Application of CNx/C Nanotube Junctions,” CN ZL 02160815.6.

2002 Y. Q. Liu, X. B. Wang, P. A. Hu, G. Yu, K. Xiao, and D. B. Zhu, “A Synthesis Method of Three-Dimensional Carbon Nanotube Alignments,” CN ZL 02102542.8.

**Funding:**

2018- PresentDOE Office of Science, BES Materials Science and Engineering Division. “Growth Mechanisms and Controlled Synthesis of Nanomaterials”. (David Geohegan) (Xiao, Co-PI)

2018- present DOE Office of Science, BES, Quantum Information Science NSRC “Thin Film Platform for Rapid Prototyping of Novel Materials with Entangled States for QIS.” (Chris Rouleau, PI), (Xiao, Co-PI)

2015-2017 ORNL LDRD: “Synthesis and Characterization of Novel Two-Dimensional Mesoscale Organic Nanomembranes.” (Xiao, PI).

2012-2014 DOE-EERE “Novel photon management for thin-film photovoltaics” (Rajesh Menon, University of Utah PI), (Xiao, Co-PI)

2009-2011 ORNL LDRD “Rational design of deuterated conjugated polymers with controlled spin-polarized electron transport.” (Keum, PI), (Xiao, co-PI).

**Invited Book Chapters:**

1. B. Yang, MJ. Keum, D. B. Geohegan and K. Xiao, ”In Situ X-Ray Studies of Crystallization Kinetics and Ordering in Functional Organic and Hybrid Materials”, Chapter 2 in In-situ Characterization Techniques for Nanomaterials, Spring Series on Nanoscience and Nanotechnology, Vol. 7, 2018, pp 33-60.
2. B. Yang, D. B. Geoghegan, K. Xiao, "Perovskite Materials: Solar Cells and Optoelectronic Applications" in Encyclopedia of Inorganic and Bioinorganic Chemistry, ed R. A. Scott, John Wiely: Chichester. DOI: 10.1002/9781119951438. Published 15 March 2017.
3. B. Yang, M. Shao, J. Keum, D. B. Geohegan and K. Xiao, "Nanophase Engineering of Organic Semiconductor-Based Solar Cells", Chapter 7 in Semiconductor Materials for Solar Photovoltaic Cells, Springer Series in Materials Science, Vol 218, 2015, pp 197-229.
4. David B. Geohegan, Alex A. Puretzky, Mina Yoon, Gyula Eres, Chris Rouleau, Kai Xiao, Jeremy Jackson, Jason Readle, Murari Regmi, Norbert Thonnard, Gerd Duscher, Matt Chisholm and Karren More, "Laser Interactions for the Synthesis and In Situ Diagnostics of Nanomaterials", Chapter 7 in Lasers in Materials Science, Springer Series in Materials Science, Vol 191, 2014, pp 143-173.
5. D. B. Geohegan, A. A. Puretzky, C. M. Rouleau, J. J. Jackson, G. Eres, Z. Liu, D. Styers-Barnett, H. Hu, B. Zhao, K. Xiao, I. Ivanov, and K. More, "Laser Interactions in Nanomaterials Synthesis," Chapter 1 in Laser-Surface Interactions for New Materials Production: Tailoring Structure and Properties, Springer Series in Materials Science, Vol. 130, Miotello, Antonio; Ossi, Paolo M., Eds. ISBN: 978-3-642-03306-3 (2010).
6. X. B. Sun, K. Xiao, D. Q. Zhang, Y. Q. Liu, D. B. Zhu, "Organic Semiconductor Materials," Chapter in Materials Science and Engineering, Eds. C. X. Shi, H. D. Li, and L. Zhou, Chemical Engineering Publishers, Beijing, China (2004).

**Journal Articles Published in Peer Reviewed Journals: [h index as of 08/15/2020: h-53]**

169. H. Cai, Y. Yu, Y.-C. Lin, A. A. Puretzky, D. B. Geohegan, K. Xiao, “Heterogeneities at multiple length scales in 2D layered materials: From localized defects and dopants to mesoscopic heterostructures”, Nano Research, accepted. (2020).

168. W. Luo, A. Oyedel, Y. Gu, T. Li, X. Wang, A. V. Haglund, D. Mandrus, A. A Puretzky, K. Xiao, L. Liang, X. Ling, “Anisotropic Phonon Response of few-Layer PdSe2 under Uniaxial Strain”, Advanced Functional Materials, 2003215 (2020).

167. K. Xiao, Z. Y. Al Balushi, S. Tongay, “Introduction of Focus Section: Heterogeneity in Beyond Graphene 2D Materials”, Journal of Materials Research 35 (11), 1349 (2020).

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156. B. Doughty, M. J Simpson, S. Das, K. Xiao, Y. Ma, “Connecting Femtosecond Transient Absorption Microscopy with Spatially Co-Registered Time Averaged Optical Imaging Modalities,” The Journal of Physical Chemistry A 124, 3915 (2020).

155. X. Li, E. Kahn, G. Chen, X. Sang, J. Lei, D. Passarello, A. D Oyedele, D. Zakhidov, K. Chen, Y. Chen, et al “Surfactant-Mediated Growth and Patterning of Atomically Thin Transition Metal Dichalcogenides,” ACS Nano, 14, 6570 (2020).

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153. N. N Hoffman, Y. Gu, L. Liang, J. D Fowlkes, K. Xiao, P. D Rack, “Exploring the air stability of PdSe2 via electrical transport measurements and defect calculations”, npj 2D Materials and Applications 3, 1-7 (2019).

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151. J. Zhang, X. Li, K. Xiao, B. G Sumpter, A.W Ghosh, L. Liang, “The role of mid-gap phonon modes in thermal transport of transition metal dichalcogenides”, Journal of Physics: Condensed Matter 32 (2), 025306 (2019).

150. Y. Liu, L. Collins, R. Proksch, S. Kim, B. R Watson, B. Doughty, T. R Calhoun, Reply to: On the ferroelectricity of CH3NH3PbI3 perovskites, Nature materials 18 (10), 1051-1053 (2019).

149. Y. Liu, A. V Ievlev, L. Collins, N. Borodinov, A. Belianinov, J. K Keum, M. Wang, M. Ahmadi, S. Jesse, K. Xiao, B. G Sumpter, B. Hu, S. V Kalinin, O. S Ovchinnikova, “Light‐Ferroic Interaction in Hybrid Organic–Inorganic Perovskites”, Advanced Optical Materials, 7, 1901451 (2019).

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145. X. Sang, X. Li, A. A Puretzky, D. B Geohegan, K. Xiao, R. R Unocic, “Atomic Insight into Thermolysis‐Driven Growth of 2D MoS2”, Advanced Functional Materials 29, 1902149 (2019).

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143. Y. Liu, A. Ievlev, L. Collins, A. Belianinov, S. Kim, B. Doughty, S. Jesse, M. Ahmadi, S. T Retterer, K. Xiao, B. G Sumpter, S. Kalinin, B. Hu, O. Ovchinnikova, “Multi-Model Imaging of Local Chemistry and Ferroic Properties of Hybrid Organic-Inorganic Perovskites”, Microscopy and Microanalysis, 25 (S2), 2076-2077 (2019).

142. D. B Brown, W. Shen, X. Li, K. Xiao, D. B Geohegan, S. Kumar, “Spatial Mapping of Thermal Boundary Conductance at Metal–Molybdenum Diselenide Interfaces”, ACS applied materials & interfaces 11 (15), 14418-14426 (2019)

141. M. G Stanford, Y.C. Lin, M. G Sales, A. N Hoffman, C. T Nelson, K. Xiao, S. McDonnell, P. D Rack, “Lithographically patterned metallic conduction in single-layer MoS2 via plasma processing”, npj 2D Materials and Applications 3 (1), 131(2019).

140. M. Zeng, Y. Chen, E. Zhang, J. Li, R. G.Mendes, X. Sang, S. Luo, W. Ming, Y. Fu, M. Du, L. Zhang, D. S. Parker, R. R.Unocic, K. Xiao, C. Wang, T. Zhang, Y. Xiao, M. H. Rümmeli, F. Xiu, L. Fu, “Molecular Scaffold Growth of Two-Dimensional, Strong Interlayer-Bonding-Layered Materials,” CCS Chemistry 1, 117 (2019).

139. A. Maksov, O. Dyck, K. Wang, K. Xiao, D. B Geohegan, B. G Sumpter, R. K Vasudevan, S. Jesse, S. V Kalinin, M. Ziatdinov, “Deep learning analysis of defect and phase evolution during electron beam-induced transformations in WS2”, npj Computational Materials 5 (1), 129 (2019).

138. X. Li, J. Zhang, A. A Puretzky, A. Yoshimura, X. Sang, Q. Cui, Y. Li, L. Liang, A. W Ghosh, H. Zhao, R. R Unocic, V. Meunier, C. M Rouleau, B. G Sumpter, D. B Geohegan, K. Xiao, “Isotope-Engineering the Thermal Conductivity of Two-Dimensional MoS2”, ACS Nano 13, 24812 (2019).

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133. X. Sang, Y. Xie, D. E Yilmaz, R. Lotfi, M. Alhabeb, A. Ostadhossein, B. Anasori, W. Sun, X. Li, K. Xiao, P. RC Kent, A. CT van Duin, Y. Gogotsi, R. R Unocic, “In situ atomistic insight into the growth mechanisms of single layer 2D transition metal carbides”, Nature Comm, 9, 2266 (2018).

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131. A. A Puretzky, A. D Oyedele, K. Xiao, A. V Haglund, B. G Sumpter, D. Mandrus, D. B Geohegan, L. Liang, “Anomalous interlayer vibrations in strongly coupled layered PdSe2”, 2D Materials, 5, 035016 (2018).

130. B. Yang, W. Ming, M.-H. Du, J. K Keum, A. A Puretzky, C. M Rouleau, J. Huang, D. B Geohegan, X. Wang, K. Xiao, “Real-Time Observation of Order-Disorder Transformation of Organic Cations Induced Phase Transition and Anomalous Photoluminescence in Hybrid Perovskites”, Advanced Materials, 30, 1705801 (2018).

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**Note: highlighted as the journal cover and selected as a spotlight article.**

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31. M. A. Schreuder, K. Xiao, I. N. Ivanov, S. M. Weiss, and S. J. Rossenthal, “White Light- Emitting Diodes Based on Ultrasmall CdSe Nanocrystal Electroluminescence,” Nano Letters 10, 573 (2010).

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15. K. Xiao, Y. Liu, T. Qi, W. Zhang, F. Wang, J. Gao, W. Qiu, Y. Ma, G. Cui, S. Chen, X. Zhan, G. Yu, J. Qin, W. Hu, and D. Zhu, “A Highly π-Stacked Organic Semiconductor for Field-Effect Transistors Based on Linearly Condensed Pentathienoacene,” Journal of the American Chemical Society 127, 13281 (2005). (Top 20 papers published in 2004-2007, Thomson Science Watch; Time cited: 190)

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6. X. B. Wang, Y. Q. Liu, P. A. Hu, G. Yu, K. Xiao, and D. B. Zhu, “Controllable Fabrication of Three-Dimensional Carbon Nanotube Alignments,” Advanced Materials 14(21), 557 (2002).

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3. L. C. Lei, K. Xiao, Y. Shen, X. Shi, Y. Gao, Y. L. Du, “Preparation and Characteristics of A Novel Imidazoline Inhibitor Made from Naphthenic Acid and Diethy-lenetriamine,” Corrosion and Protection 22, 420 (2001). In Chinese

2. K. Xiao, Y. G. Yan, L. C. Lei, and Y. L. Du, “Studies of Solid State Electrolyte Hydrogen Sensors,” Corrosion Science and Protection technology 13,165 (2001). In Chinese

1. J. R. Song, Z. X. Gong, M. B. Luo, and K. Xiao, “Study on the Performance of Adsorbing Uranium by Attapulgite Clay,” Journal of East China Geological Institute 21, 265 (1998). In Chinese

**Presentations:**

43. “Defect-Mediated Phase Transformations in Highly Anisotropic 2D Quantum Materials”, CNMS User Meeting, Oak Ridge, Aug 10-12, 2020.

42. “Tailoring Synthesis and Assembly of 2D Materials for Monolayer and Bilayer heterostructures”, MRS Spring meeting, Phoenix, Arizona, April 14, 2020 and also as Session Chair at 2D Materials Symposium. (Postponed).

41. “Tailoring the Heterogeneities in 2D Materials by Controlled Synthesis and Processing”, AVS 66th International Symposium & Exhibition, Columbus, Ohio, October 20-25, 2019.

40. “Toward Synthetic Control over Heterogeneity and Functionality in Two-Dimensional Materials”, 2019 Synthesis and Processing Science Principal Investigators’ Meeting, Gaithersburg Marriott Washingtonian Center, Gaithersburg, MD, July 17-19, 2019.

39. “The shape of things to come for 2D materials: a pentagonal layered PdSe2 for electronics”, 2019 Graphene & Beyond workshop, Penn State University, State College, PA, May 8-10, 2019.

38. “The Effect of Doping, Vacancies and Isotopes on the Thermal Conductivity of 2D Materials”, MRS Spring Meeting, Phoenix, Arizona, April 22-26, 2019.

37. “Defect-Induced Phase Transformation in Low-Symmetry 2D Materials for High Performance Electronics”, MRS Spring Meeting, Phoenix, Arizona, April 22-26, 2019. (contributed talk).

36. “Tailoring the heterogeneities in 2D materials by controlled synthesis and processing”, The TMS 148th Annual Meeting and Exhibition, Mar 10-14, 2019, San Antonio, Texas. (Invited talk).

35. “Strain-Engineered Growth of 2D Materials on Patterned Substrates”, MRS Spring Meeting, Phoenix, Arizona, April 2-6, 2018.

34. “Tailoring the heterogeneity in 2D materials for optoelectronics”, XXVII International Materials Research Congress, Cancun, Mexico, August 19-24, 2018.

33. “Toward Synthetic Control over Heterogeneity and Functionality in Two-Dimensional Materials”, 2017 Synthesis and Processing Science Principal Investigators’ Meeting, Gaithersburg Marriott Washingtonian Center, Gaithersburg, MD November 7-9, 2017.

32. “Heterogeneity in 2D Materials: From Localized Defects, Isoelectronic Doping to Macroscopic Heterostructures”,The 64th AVS International Symposium and Exhibition, Oct 29-Nov 3, 2017, Tampa, Florida. (Invited talk)

31. “Defect engineering in two dimensional materials”, The 7th International Conference on Nanoscience & Nanotechnology, China 2017, August 29-31, Beijing, China. (Invited talk)

30. “2D materials research at ORNL”, Synthesis and Collective Phenomena in 2D and Layered Materials Workshop at 2017 Joint Nanoscience and Neutron Scattering User Meeting, Oak Ridge, TN, July 31, 2017. (Invited talk)

29. “Edge-Controlled Growth and Etching of Two-Dimensional Materials”, 9th International Conference on Materials for Advanced Technologies (ICMAT), Suntec Singapore, June 18-23, 2017. (Invited talk)

28. “Defect Engineering in Monolayer MoSe2 through Controlled Synthesis and Doping”, MRS Spring Meeting, Phoenix, AZ, April 16-21, 2017. (Invited talk)

27. “Understanding the Growth of 2D Materials for Optoelectronic Devices”, Guadalupe workshop on Nucleation and Growth Mechanisms of Atomically-Thin Nanomaterials: From SWCNTs to 2D Crystals”, San Antonio, Texas, April 21-25, 2017.

26. “Epitaxial Growth and Optoelectronic Properties of 2D Materials”, International Graphene Innovation Conference, Qingdao, China, September 22-24, 2016. (Invited talk).

25. “Heterogeneity in 2D systems: From localized defects to macroscopic van der Waals heterostructures”, CNMS User Meeting Workshop: Collective Phenomena in Layered and 2D Materials, Oak Ridge, TN, August 9-10, 2016. (Invited talk)

24. “Controlled synthesis and processing of perovskite films for high-efficiency Organometal Halide Perovskite Photovoltaics”, IUMRS-International Conference on Electronic Materials, Suntec, Singapore, July 4-8, 2016. (Invited talk)

23. “Isoelectronic Doping of MoSe2 Monolayers for 2D Heterostructures”, IUMRS-International Conference on Electronic Materials, Suntec, Singapore, July 4-8, 2016.

22. “Understanding the Effect of Solvent Additive on Nanophase Engineering in Organic Photovoltaics”, The 30th Chinese Chemical Society (CCS) Congress, Dalian, China, July 1-4, 2016. (Invited talk)

21. “Isoelectronic Doping of MoSe2 Monolayers for 2D Heterostructures”, Graphene and Beyond workshop, Penn State University, State College, PA, May 9-10, 2016. (Invited talk)

20. “Ultrasonic Spray Printing for High-Performance Flexible Organic Field-Effect Transistors and Hybrid Perovskite Solar Cells”, The 145th TMS Annual Meeting & Exhibition, Recent Advancement on Stretchable and Wearable Electronics, Nashville, TN, February 14-18, 2016. (Invited talk)

19. “Synthesis, processing, and optoelectronic devices of van der Waals heterostructures”, The 40th International Conference and Exposition on Advanced Ceramics and Composites, Daytona Beach, FL, January 24-29, 2016. (Invited talk)

18. “Van der Waals Epitaxial Growth of Atomically Thin Lattice-misfit GaSe/MoSe2 Heterostructures”, the 2nd International Conference on Two-Dimensional Layered Materials, Hong Kong, January 7-9, 2016. (Invited talk)

17. “Synthesis of Two-Dimensional Metal Chalcogenides by Laser Vaporization and CVD”, 2015 Synthesis and Processing Science Principal Investigators’ Meeting, Washington DC North/Gaithersburg, Gaithersburg, MD, November 2-4, 2015.

16. “Understanding the effect of deuterated conducting polymer and solvent additive on the performance of organic photovoltaics”, SNS/HFIR 2015 User Meeting, Oak Ridge, October 26-27, 2015.

15. “Effect of Isoelectronic Doping on the Optoelectronic Properties of MoSe2 Monolayer Crystals”, The 6th International Conference on Nanoscience & Technology, Beijing, China, Sep. 3-5, 2015. (Invited talk)

14. “Understanding the Effect of Solvent Additive on the Performance of Organic Photovoltaics”, 23rd World Forum on Advanced Materials, Lincoln, Nebraska, May 11-15, 2015. (Invited talk)

13. “Revealing the Origin of High-Efficiency in Layer-by-Layer Processed Organometal Halide Perovskite Photovoltaics”, MRS spring conference, San Francisco, April 7-12, 2015.

12. “The Isotopic Effects of Deuteration on the Charge Transport and Optoelectronic Properties of Conducting Polymers,” XXIII International Materials Research Congress, August 17 – 21, 2014, Cancún, Mexico. (Invited talk)

11. “Synthesis and Properties of Two-Dimensional Layered Metal-Chalcogenides and their Heterostructures,” International Symposium on “Materials Chemistry of Two-Dimensional Crystals, at Peking University, Beijing, China, August 5-6, 2014. (Invited talk)

10. “The isotopic effects deuteration on the optoelectronic properties of conducting polymers,” American Conference on Neutron Scattering, Knoxville, TN, USA, June 1-5, 2014.

9. “Substrate-mediated assembly and growth of organic semiconductor nanostructures,” The 5th International Conference on Nanoscience & Technology, Beijing, China, Sep. 5-7, 2013. (Invited talk)

8. “Understanding the metal-directed growth of semiconducting organic nanocrystals,” Joint NSRC Workshop on Nanoparticle Science, November 5-6, 2012 Argonne National Laboratory.

7. “Isotope Effect of Deuterated P3HT on Charge Transport and Solar Harvesting,” International Conference on Science and Technology of Synthetic Metals, Atlanta, Georgia, July 8-13, 2012.

6. “Self-Assembly of Conjugated Block Copolymers for Organic Field-Effect Transistors and Photovoltaics,” The 10th Int. Symposium on Functional π-Electron Systems, Beijing, China, Oct. 13, 2011.

5. “Self-Assembled Single Crystal Organic Nanowires for High-performance Memory Devices,” Workshop on Self-Assembled Organic Nanomaterials: Structure and Function at The Molecular Foundry, Lawrence Berkeley National Laboratory, San Francisco, CA, Oct. 5-6, 2011.

4. “Block Copolymer Controlled Morphology of P3HT/PCBM Photovoltaics,” 4th Workshop on Sustainable Energy Future: Nanomaterials Enabled Photovoltaics, ORNL, Oak Ridge, TN, Sept. 22-23, 2011.

3. “Tailored Assemblies of PS-b-P3HT Diblock Copolymers: Adaptable Building Blocks for High-Performance Organic Transistors and Solar Cells”, 2011 EBMC-NSRC Contractors’ Meeting, Annapolis, MD, May 31, 2011.

2. “One-Dimensional Electron-Transport in Self-Assembled Organic Nanowires,” 9th International Symposium on Functional π-Electron Systems, Atlanta, GA, Oct. 6, 2010

1. “Synthesis of Organic Semiconductor Nanowires for Solar Cells”, 3th Workshop on Sustainable Energy Future: Nanomaterials Enabled Photovoltaics, ORNL, Oak Ridge, TN, Sept. 22, 2010.

**University Colloquium and Seminar**

8. “Toward Synthetic Control over Heterogeneity and Functionality in 2D Quantum Materials”, CNMS Seminar, Oak Ridge, TN, March 10, 202o.

7. “Tailoring the heterogeneity in 2D materials for optoelectronics and quantum information science” at the University of Tennessee at Knoxville – Department of Materials Science & Engineering – Materials Seminar, Knoxville, TN, October 8, 2019.

6. “Heterogeneity in 2D Materials: From Localized Defects to Macroscopic Heterostructures”, Department of Physics & Astronomy, Vanderbilt University, Jan 18, 2018.

5. “2D materials: synthesis and functionality”, College of Engineering, University of Georgia, October 23, 2017.

4. “Controlled Synthesis and Processing of Organometal Halide Perovskite Thin Film for high-efficiency Photovoltaics”, Department of Physics and Astronomy, University of Georgia, Athens, October 29, 2015.

3. “Heterogeneity in 2D systems: From Doped Monolayers to van der Waals Heterostructures”, Physical Sciences Directorate Chemical and Materials Sciences Seminar, ORNL, Oak Ridge, November 18, 2015.

2. “Twisted Bilayer and Tri-layer Two-Dimensional Metal Chalcogenides: Controlled Synthesis, Characterization, and Optoelectronic Devices”, Department of Mechanical Engineering, University of Houston, February 12, 2015

1. “Two-dimensional Chalcogenide Crystals: Synthesis, Characterization, and Optoelectronics”, Department of Materials Science and Engineering Seminar, University of Tennessee, Knoxville, March 7, 2014.

**Professional Activities: (International Conference and Workshop Organizer)**

2020 The Focus Section: Heterogeneity in Beyond Graphene 2D Materials in JMR, Vol35, issue 11, June 2020. Co-editor with Zakaria Y. Al Balushi and Sefaattin Tongay).

2018 Emerging 2D Non-Graphene Materials in XXVII International Materials Research Congress (IMRC2018). Lead Symposium Organizer. Deji Akinwande (University of Texas at Austin), and Talat Rahman (University of Central Florida) (Co-organizers)

2017 Synthesis and Collective Phenomena in 2D and Layered Materials workshop in 2017 Joint Nanoscience and Neutron Scattering User Meeting, 2017. (Co-organizer with David Mandrus and Travis Williams).

**Editorial and Conference Board, Review and Service:**

2020 International Advisory Committee Member for the Centre for Advanced Electronics at Indian Institute of Technology (IIT) Indore.

2019 A CAREER panel review for EPMD (Electronics, Photonics and Magnetic Devices) program, NSF.

2018 International Advisory Committee of the International Conference on Computational Mathematics in Nanoelectronics and Astrophysics (CMNA 2018), India

2018 The committee member of the ‘2D Materials Focus Topic’ Program Committee for the AVS 65th International Symposium & Exhibition.

2012 Organic Electronics program, Proposal Review Panelist.

2008-present Journal Editorial Board: Scientific Report; AIMS Materials Science.

2008-present Proposal Reviewer: NSF Reviewer Panel on Organic Electronics, Materials Engineering and Processing Program (MEP), DOE-BES, ORNL seeds and LDRD, User proposal reviewer for the Molecular Foundry at Laurence Berkeley National laboratory and Stanford Synchrotron Radiation Lightsource (SSRL).

2008-present Journal Reviewer: Nature, Nature Nano; Nature Comm.; Light: Science & Applications; NPG Asia Materials; Scientific Report; J. Am. Chem. Soc.; Nano Letters, J. Phys. Chem. B; Chem. Mater.; ACS Nano; Langmuir; Angew. Chem. Int. Ed.; Adv. Mater.; Adv. Func. Mater.; Adv. Energy Mater.; Small; ChemSusChem; PCCP; Chem. Eur. J; Appl. Phys. Lett.; Nanoscale; J. Mater. Chem.; Polymer Chemistry; Polymer Reviews; J. Appl. Polymer Sci.; 2D Materials; Materials Today

**Professional Society Membership:** Materials Research Society (MRS)**,** American Vacuum Society (AVS).

**Graduate and Postdoctoral Advisors:**

Profs. Daoben Zhu and Yunqi Liu, Institute of Chemistry, Chinese Academy of Sciences (PhD Advisor)

Dr. David B Geohegan, Oak Ridge National Laboratory (Postdoc Advisor)

**Postdoctoral Researcher Advised:**

1) Dr. Hui Cai (Oak Ridge National Laboratory 2018-Present).

2) Dr. Ben Foley (IC Postdoc, ORNL, 2018-2019) now at Covalent Metrology

3) Dr. Xufan Li (ORNL, 2013-2017) Now Senior scientist at Honda Research Center.

4) Dr. Kai Wang (ORNL, 2014-2018) Now working at Intel Corporation.

5) Dr. Ming-Wei Lin (ORNL, 2013-2016) Now working at Texas A&M University.

6) Dr. Bin Yang (Oak Ridge National Laboratory 2015-2018) Now Professor at Hunan University

7) Dr. Ming Shao (Oak Ridge National Laboratory 2013-2015) Now Professor at Huazhong University of Science and Technology

**Ph.D. Students Advised:**

1) Mr. Olugbenga Olunloyo (UTK, 2019-present).

2) Ms. Yiyi Gu (visiting student from Technical Institute of Physics and Chemistry, CAS, 2017-2019)

3) Mr. Akinola Oyedele (UTK, 2014-2018) Now working at The Boston Consulting Group (BCG).

4) Mr. Sanjib Das (UTK, 2011-2016) Now Process Technology Engineer at Intel Corporation.