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ACADEMIC APPOINTMENTS

Assistant Professor, Department of Chemistry, University of North Texas — Current

Physical Science Research Associate, Stanford University and SLAC National Accelerator Laboratory — 2017-2019
Supervisors: Nicholas A. Melosh and Zhi-Xun Shen

EDUCATION

Postdoctoral Researcher, Stanford University — 2012-2016
Advisors: Nicholas A. Melosh and Zhi-Xun Shen

Postdoctoral Researcher, Harvard University — 2010-2011
Advisor: Charles M. Lieber

Ph.D. in Chemistry, Harvard University — 2003-2010
Advisor: Charles M. Lieber
Thesis: *Novel nanowire heterostructures for nanoelectronic applications*

B.S. in Chemistry, Peking University — 1999-2003
Advisors: Jin Zhang and Zhongfan Liu
Thesis: *Carbon nanotubes: CVD growth and nanostructure formation*

PUBLICATIONS

1. Yan, H., Yang, F., Pan, D., Lin, Y., Li, F. H., Hohman, J. N., Solis-Ibarra, D., Dahl, J. E. P., Carlson, R. M. K., Tkachenko, B. A., Fokin, A. A., Schreiner, R. R., Galli, G., Mao, W. L., Shen, Z.-X. & Melosh, N. A. Sterically controlled mechanochemistry under hydrostatic pressure. ***Nature*** 554, 505-510 (2018).
2. Yan, H., Hohman, J. N., Li, F. H., Jia, C., Solis-Ibarra, D., Wu, B., Dahl, J. E. P., Carlson, R. M. K., Tkachenko, B. A., Fokin, A. A., Schreiner, P. R., Vailionis, A., Kim, T. R., Devereaux, T. P., Shen, Z.-X. & Melosh, N. A. Hybrid metal–organic chalcogenide nanowires with electrically conductive inorganic core through diamondoid-directed assembly. ***Nat. Mater.*** 16, 349-355 (2017).
3. Yan, H., Narashimha, K., Denlinger, J., Li, F. H., Mo, S.-K., Hohman, J. N., Dahl, J. E. P., Carlson, R. M. K., Tkachenko, B. A., Fokin, A. A., Schreiner, P. R., Hussain, Z., Shen, Z.-X. & Melosh, N. A. Monochromatic photocathodes from graphene-stabilized diamondoids. ***Nano Lett.*** 18, 1099-1103 (2018).
4. Yan, H., Choe, H. S., Nam, S., Hu, Y., Das, S., Klemic, J. F., Ellenbogen, J. C. & Lieber, C. M. Programmable nanowire circuits for nanoprocessors. ***Nature*** 470, 240–244 (2011).
5. Yao, J., Yan, H., Das, S., Klemic, J. F., Ellenbogen, J. C. & Lieber, C. M. Nanowire nanocomputer as a finite-state machine. ***Proc. Natl. Acad. Sci. U. S. A.*** 111, 2431–2435 (2014).
6. Yao, J., Yan, H. & Lieber, C. M. A nanoscale combing technique for the large-scale assembly of highly aligned nanowires. ***Nat. Nanotechnol.*** 8, 329–335 (2013).

7. Xiao, Q., Burg, J. A., Zhou, Y., Yan, H., Wang, C., Ding, Y., Reed, E., Miller, R. D. & Dauskardt, R. H. Electrically conductive copper core–shell nanowires through benzenethiol-directed assembly. ***Nano Lett.*** 18, 4900-4907 (2018).

8. Tang, S., Zhang, C., Wong, D., Pedramrazi, Z., Tsai, H.-Z., Jia, C., Moritz, B., Claassen, M., Ryu, H., Kahn, S., Jiang, J., Yan, H., Hashimoto, M., Lu, D., Moore, R. G., Hwang, C.-C., Hwang, C., Hussain, Z., Chen, Y., Ugeda, M. M., Liu, Z., Xie, X., Devereaux, T. P., Crommie, M. F., Mo, S.-K. & Shen, Z.-X. Quantum spin Hall state in monolayer 1T'-WTe_2. ***Nat. Phys.*** 13, 683–687 (2017).

9. Zhang, C., Liu, Z., Chen, Z., Xie, Y., He, R., Tang, S., He, J., Li, W., Jia, T., Rebec, S. N., Ma, E. Y., Yan, H., Hashimoto, M., Lu, D., Mo, S.-K., Hikita, Y., Moore, R. G., Hwang, H. Y., Lee, D. & Shen, Z. Ubiquitous strong electron-phonon coupling at the interface of FeSe/$SrTiO_3$. ***Nat. Commun.*** 8, 14468 (2017).

10. Tzeng, Y.-K., Zhang, J. L., Lu, H., Ishiwata, H., Dahl, J., Carlson, R. M. K., Yan, H., Schreiner, P. R., Vuckovic, J., Shen, Z.-X., Melosh, N. & Chu, S. Vertical-substrate MPCVD epitaxial nanodiamond growth. ***Nano Lett.*** 17, 1489–1495 (2017).

11. Yan, H. & Melosh, N. Nanoparticles make salty circuits. ***Nat. Nanotechnol.*** 11, 579–580 (2016).

12. Liu, N., Kim, K., Hsu, P.-C., Sokolov, A. N., Yap, F. L., Yuan, H., Xie, Y., Yan, H., Cui, Y., Hwang, H. Y. & Bao, Z. Large-scale production of graphene nanoribbons from electrospun polymers. ***J. Am. Chem. Soc.*** 136, 17284-17291 (2014).

13. Higginbotham, A. P., Kuemmeth, F., Larsen, T. W., Fitzpatrick, M., Yao, J., Yan, H., Lieber, C. M. & Marcus, C. M. Antilocalization of Coulomb blockade in a Ge/Si nanowire. ***Phys. Rev. Lett.*** 112, (2014).

14. Zhang, Y., Chang, T.-R., Zhou, B., Cui, Y.-T., Yan, H., Liu, Z., Schmitt, F., Lee, J., Moore, R., Chen, Y., Lin, H., Jeng, H.-T., Mo, S.-K., Hussain, Z., Bansil, A. & Shen, Z.-X. Direct observation of the transition from indirect to direct bandgap in atomically thin epitaxial $MoSe_2$. ***Nat. Nanotechnol.*** 9, 111–115 (2014).

15. Higginbotham, A. P., Larsen, T. W., Yao, J., Yan, H., Lieber, C. M., Marcus, C. M. & Kuemmeth, F. Hole spin coherence in a Ge/Si heterostructure nanowire. ***Nano Lett.*** 14, 3582–3586 (2014).

16. Li, F. H., Fabbri, J. D., Yurchenko, R. I., Mileshkin, A. N., Hohman, J. N., Yan, H., Yuan, H., Tran, I. C., Willey, T. M., Bagge-Hansen, M., Dahl, J. E. P., Carlson, R. M. K., Fokin, A. A., Schreiner, P. R., Shen, Z.-X. & Melosh, N. A. Covalent attachment of diamondoid phosphonic acid dichlorides to tungsten oxide surfaces. ***Langmuir*** 29, 9790–9797 (2013).

17. Hu, Y., Xiang, J., Liang, G., Yan, H. & Lieber, C. M. Sub-100 nanometer channel length Ge/Si nanowire transistors with potential for 2 THz switching speed. ***Nano Lett.*** 8, 925–930 (2008).

18. Javey, A., Nam, S., Friedman, R. S., Yan, H. & Lieber, C. M. Layer-by-layer assembly of nanowires for three-dimensional, multifunctional electronics. ***Nano Lett.*** 7, 773–777 (2007).

19. Xiang, J., Lu, W., Hu, Y., Wu, Y., Yan, H. & Lieber, C. M. Ge/Si nanowire heterostructures as high-performance field-effect transistors. ***Nature*** 441, 489–493 (2006).

20. Li, Y., Xiang, J., Qian, F., Gradecak, S., Wu, Y., Yan, H., Blom, D. A. & Lieber, C. M. Dopant-free GaN/AlN/AlGaN radial nanowire heterostructures as high electron mobility transistors. ***Nano Lett.*** 6, 1468–1473 (2006).

21. Li, Q. W., Yan, H., Zhang, J. & Liu, Z. F. Effect of hydrocarbons precursors on the formation of carbon nanotubes in chemical vapor deposition. ***Carbon*** 42, 829–835 (2004).

22. Li, Q. W., Zhang, J., Yan, H., He, M. S. & Liu, Z. F. Thionine-mediated chemistry of carbon nanotubes. ***Carbon*** 42, 287–291 (2004).

23. Yan, H., Li, Q. W., Zhang, J. & Liu, Z. F. The effect of hydrogen on the formation of nitrogen-doped carbon nanotubes via catalytic pyrolysis of acetonitrile. ***Chem. Phys. Lett.*** 380, 347–351 (2003).

24. Li, Q. W., Yan, H., Zhang, J. & Liu, Z. F. 'Pulsed' CVD growth of single-walled carbon nanotubes. ***Carbon*** 41, 2876–2878 (2003).

25. Li, Q. W., Yan, H., Ye, Y. C., Zhang, J. & Liu, Z. F. Defect location of individual single-walled carbon nanotubes with a thermal oxidation strategy. ***J. Phys. Chem. B*** 106, 11085–11088 (2002).
26. Li, Q. W., Yan, H., Cheng, Y., Zhang, J. & Liu, Z. F. A scalable CVD synthesis of high-purity single-walled carbon nanotubes with porous MgO as support material. ***J. Mater. Chem.*** 12, 1179–1183 (2002).
27. Li, Q. W., Yan, H., Li, X. H., Zhang, J. & Liu, Z. F. High-density growth of single-wall carbon nanotubes on silicon by fabrication of nanosized catalyst thin films. ***Chem. Mater.*** 14, 4262–4266 (2002).
28. Yan, H., Li, Q. W., Zhang, J. & Liu, Z. F. Possible tactics to improve the growth of single-walled carbon nanotubes by chemical vapor deposition. ***Carbon*** 40, 2693–2698 (2002).

PATENTS

1. Lieber, C. M., Wu, Y. & Yan, H. Nanoscale Wire-Based Data Storage. US Patent 8,154,002
2. Lu, W., Xiang, J., Wu, Y., Timko, B. P., Yan, H. & Lieber, C. M. Nanowire Heterostructures. US Patent 7,858,965

SELECTED PRESENTATIONS

1. Diamond meets molecule: Scientific opportunities with diamondoids. Frontier of Molecular Engineering Symposium. Chicago, IL, 2018 (contributed poster).
2. Diamondoid science and applications. DOE Materials Chemistry Principal Investigator Meeting. Gaithersburg, MD, 2018 (invited talk).
3. Low work-function, monochromatic and stable electron emitters from molecular diamond monolayers. MRS Fall Meeting, Boston, 2016 (contributed talk).
4. Conductive solid-core metal-organic chalcogenide nanowires and nanoribbons with atomic-scale structural control through diamondoid directed assembly. MRS Fall Meeting, Boston, 2016 (contributed talk).
5. Pressure-driven, steric-controlled redox reactions in transition metal organic chalcogenides. MRS Fall Meeting, Boston, 2016 (contributed talk).
6. Molecular bling: the surprising properties of small diamonds. SLAC Public Lecture Series, Menlo Park, 2014 (invited talk).
7. Design, synthesis and properties of programmable nanowire transistors for nanoscale circuits and processors. ACS March Meeting, San Diego, 2012 (invited talk).
8. Design, synthesis and properties of programmable nanowire transistors for nanoscale circuits and processors. MRS Spring Meeting, San Francisco, 2011 (contributed talk).
9. Functional semiconductor/metal oxide core/shell nanowires. MRS Fall Meeting, Boston, 2005 (contributed talk).

RESEARCH EXPERIENCE

Fundamental science and applications of diamondoids Stanford and SLAC, 2012-present

Diamondoids are molecular-size fragments of the diamond lattice. This unique class of materials allows us to vary the size and shape of diamond clusters in the nano- to molecular scales with atomic precision, and harness the novel properties emerging from this transitional regime to enable new chemistry, materials and devices that are pertinent to grand scientific challenges. I have pursued the following three projects:

(1) Diamondoid-enabled mechanochemistry. Mechanochemistry offers useful alternatives to conventional synthesis by enabling unique reaction pathways under mechanical stress. In this project I demonstrated sterically

controlled mechanochemistry under hydrostatic pressure in diamondoid-containing mechanically heterogeneous molecules. This result unveils a previously unknown bond activation mechanism, and opens up the possibility of direct conversion from mechanical into chemical energies through rational molecular engineering. This work is published in *Nature*.

(2) Diamondoid-directed self-assembly of novel electronic materials. Organic-inorganic hybrid materials have been extensively studied, yet few of them are electronically active. In this project I used diamondoids to guide the self-assembly of metal-organic chalcogenides with atomically precise structures and band-like electron transport properties. This generic synthesis allows us to manipulate the bonding configurations and electronic properties of transition metal chalcogenides beyond their pure inorganic phases, and offers new platforms for Luttinger physics, superconductivity and topological states. This work is published in *Nature Materials*.

(3) Diamondoid-based monochromatic electron source. Electron microscopy is a potentially powerful tool for sub-atomic and femtosecond-scale real-time imaging. However, its capability is hindered by the compromise between brightness and monochromaticity of the electron source. In this project I combined diamondoids with graphene to create monochromatic, high-brightness and stable photoelectron emitters. This simple and generic approach paves the way for the implementation of diamondoid-based electron guns. This work is published in *Nano Letters*.

Nanowire heterostructures and programmable circuits Harvard, 2003-2011

Creating nanowire circuits capable of complex arithmetic and memory functionalities represents one of the ultimate goals of nanowire research and bottom-up electronics. Realizing such circuits require materials and circuit architecture disruptively different from those used in conventional CMOS. To tackle these challenges, I first designed and synthesized core-shell nanowire heterostructures with nonvolatile charge-trapping-modulated transport properties. These nanowires were then assembled into a cross-bar architecture to realize multiple field-programmable circuits including two-bit adder and finite-state machine. These results represent a substantial improvement in the complexity and functionalities of nanowire circuits, and major step toward a nanocomputer built with the bottom-up paradigm. These results are published in *Nature*, *Nature Nanotechnology* and *PNAS*.

TEACHING EXPERIENCE

Mentor for graduate students Fei Hua Li, Karthik Narashimha and Hitoshi Ishiwata, Stanford	2012-2017
TA for Chem 11: Inorganic Chemistry, Harvard	2004
TA for Chem 7: General Chemistry, Harvard	2005

AWARDS

Frontier of Molecular Engineering Poster Prize, Chicago	2018
ACS Certificate of Appreciation for "*valuable contribution and dedicated service in the peer review of manuscripts submitted to ACS journals*"	2011
Creativity Award, Peking University	2003
Second prize, Challenge Cup undergraduate research competition, Peking University	2002
Award for Academic Excellence, Peking University	2000 – 2003

SERVICE

Peer reviewer for *Nano Letters*, *Advance Materials*, *Nanoscale* and *IEEE Transactions on Electronic Devices*

Co-organizer, 1st Frontier of Diamondoid Sciences Symposium, Stanford, 2012