

## YUSHAN YAN

Distinguished Engineering Professor

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Yushan Yan is the Distinguished Engineering Professor in the Department of Chemical and Biomolecular Engineering and the founding Associate Dean for Research and Entrepreneurship for the College of Engineering at the University of Delaware.

He studied Chemical Physics (BS) at the University of Science and Technology of China (1983-1988), Heterogeneous Catalysis at the Dalian Institute of Chemical Physics of the Chinese Academy of Sciences (1988-1992), and Chemical Engineering (MS & PhD) at the California Institute of Technology (1992-1996).

He worked for AlliedSignal Inc. as Senior Staff Engineer and Project Leader (1996-1998) before joining the faculty at the University of California Riverside (UCR) (Assistant Professor, 1998; Associate Professor, 2002; Professor, 2005; University Scholar Professor, 2006-2010; University of California Presidential Chair 2010-2011; Department Chair 2008-2011).

He was elected Fellow of the American Association for the Advancement of Science (2008) and was recognized by the International Zeolite Association with the Donald Breck Award (2010), the Nanoscale Science and Engineering Forum Award by the American Institute of Chemical Engineers (2016), and the Electrochemical Society Energy Technology Division Award (2018). He chaired the Gordon Research Conference for Nanoporous Materials of 2013.

His research has been supported by industry and governmental agencies including the National Science Foundation (e.g., NIRT), Department of Defense (e.g., SERDP and MURI), Environmental Protection Agency (e.g., TSE), and Department of Energy (e.g., EERE and ARPA-E). Notably he was one of 37 awardees in the Department of Energy's ARPA-E OPEN 2009 for his fuel cell technology (the inaugural open call for proposals that received about 3700 concept papers) and one of 66 awardees in OPEN 2012 for his redox flow battery concept (the 2<sup>nd</sup> open call for proposals that received 6600 concept papers).

He has supervised 29 postdocs, 24 PhD students, 12 MS students, 33 undergraduate students, 7 high school students, and 12 visiting faculty. Twenty of his former postdoc and PhD students hold faculty positions in China, Australia, Canada, and US.

At UCR, he served as AIChE Chapter Advisor for 5 years, hosted the Western Regional Student Conference, led the first ABET 2000 accreditation process for 4 years for both chemical and environmental engineering programs, chaired Faculty Search Committee, and served as the Department Chair for 3 years. He has also organized/chaired many sessions/symposiums in various national and international meetings.

He has been an inventor on 25+ issued and pending patents, some of which were licensed to form startup several startup companies including NanoH<sub>2</sub>O and OH-Energy. He has served these startups in the capacity of cofounder, chief scientific advisor, or advisory board member. The nanocomposite desalination membrane technology he co-invented was commercialized by NanoH<sub>2</sub>O that was acquired by LG Chemicals in 2014.

He has delivered 190+ invited lectures including Plenary, Keynote, and Named Lectures in major international conferences and chemical engineering departments. His 220+ published articles have been widely cited in the scientific community (h-index = 63, average citation/paper = 60, total citation = 13,000+, ~40 papers with citations > 100, Web of Science) and extensively covered by the media, e.g., New Scientist, C&EN News (ACS), Interface (ECS), Materials Today, Materials 360 (MRS), Chemical Engineering Progress (AIChE), Business Week, China Press, Chinese Daily News, The News Journal, CNN.com, CNBC, KABC, and VOA.

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## EDUCATION

- 1997            **PhD, Chemical Engineering**  
*California Institute of Technology, Pasadena, CA*
- 1988            **BS, Chemical Physics**  
*University of Science and Technology of China, Hefei, China*

## EMPLOYMENT

- 07/2011 – date    **Department of Chemical and Biomolecular Engineering, University of Delaware,**  
Newark, DE  
*Founding Associate Dean for Research and Entrepreneurship, College of Engineering (2014-date); Distinguished Engineering Professor (2011-date),*
- 09/1998 – 07/2011    **Department of Chemical and Environmental Engineering, University of California, Riverside,** Riverside, CA  
*Department Chair (2008-2011), University of California Presidential Chair (2010), University Scholar Professor (2006), Professor (2005), Associate Professor (2002), Assistant Professor (1998)*
- 01/2007 – 07/2007    **Chemical Engineering, California Institute of Technology, Pasadena, CA**  
Visiting Associate
- 09/1996 – 09/1998    **AlliedSignal Inc.,** Des Plaines, IL  
Senior Staff Engineer/Project Leader
- 09/1992 – 08/1996    **Chemical Engineering, California Institute of Technology, Pasadena, CA**  
Research Assistant
- 09/1988 – 09/1992    **Heterogeneous Catalysis, Dalian Inst. Chem. Phys., Chinese Academy of Sciences,**  
Dalian, China  
Research Assistant

## HONORS AND RECOGNITIONS

- 2018 Energy Technology Division Award, The Electrochemical Society  
2016 Nanoscale Science and Engineering Forum Award, American Institute of Chemical Engineers  
2015 Institute of Advanced Studies Lecture, *Hong Kong University of Science and Technology*  
2011-2016 Qiushi Professor (Visiting), *Zhejiang University*  
2011-2014 Hengyi Professor (Visiting), *Zhejiang University*  
2011 27<sup>th</sup> Outstanding Alumni Lecture, *Dalian Institute of Chemical Physics, Chinese Academy of Sciences*  
2011 Distinguished Engineering Professor, *University of Delaware*  
2010 Donald Breck Award, *International Zeolite Association*  
2010 Presidential Chair, *University of California*  
2008 6<sup>th</sup> Annual Progy Award, *Best Scientific Innovation, PETA*  
2008 Fellow, *American Association for the Advancement of Science*  
2008 ChangJiang Professor (Visiting at *Zhejiang University*), *Chinese Ministry of Education*  
2007 Top 100 Most Cited Papers (28<sup>th</sup>) Since 1975, *Ind. Eng. Chem. Res. American Chemical Society*

2006 University Scholar (inaugural), *University of California, Riverside*  
2003 Overseas Young Investigator, *Chinese Academy of Sciences*  
2001 Faculty Development Award, *University of California, Riverside*  
2000 Regent's Faculty Fellowship, *University of California, Riverside*  
1998 Guest Professor, *Department of Chemistry, Jilin University, China*  
1997 Recognition of Contribution, *AlliedSignal Inc.*  
1994 Li Ming Scholarship Award, *California Institute of Technology*  
1990 Presidential Award for Excellence, *Chinese Academy of Sciences*

### **PROFESSIONAL MEMBERSHIP**

- American Institute of Chemical Engineers (AIChE)
- American Chemical Society (ACS)
- Electrochemical Society (ECS)
- Materials Research Society (MRS)
- North American Membrane Society (NAMS)
- International Zeolite Association (IZC)

### **POPULAR PRESS**

New Scientist, C&EN News (ACS), Interface (ECS), Materials Today, Materials 360 (MRS), Chemical Engineering Progress (AIChE), Business Week, China Press, Chinese Daily News, The News Journal, CNN.com, CNBC, KABC, and VOA.

### **JOURNAL ARTICLES**

- 230+ papers
  - 14,000+ total citations
  - **h index = 63**
  - **Average citation/paper = 61**
  - **40+ papers with citations > 100**
1. Y. Zhao, S. Gu, K. Gong, J. Zheng, J. Wang and Y. Yan, Iodine Redox-Mediated Electrolysis for Energy-Efficient Chlorine Regeneration from Gaseous HCl, *Journal of The Electrochemical Society*, 2017, 164, E138.
  2. J. Yu, M. Wang, P. Xu, S.-H. Cho, J. Suhr, K. Gong, L. Meng, Y. Huang, J.-H. Byun, Y. Oh, Y. Yan and T.-W. Chou, Ultrahigh-rate wire-shaped supercapacitor based on graphene fiber, *Carbon*, 2017, 119, 332.
  3. J. Yu, W. Lu, J. P. Smith, K. S. Booksh, L. Meng, Y. Huang, Q. Li, J.-H. Byun, Y. Oh, Y. Yan and T.-W. Chou, A High Performance Stretchable Asymmetric Fiber-Shaped Supercapacitor with a Core-Sheath Helical Structure, *Adv. Energy Mater.*, 2017, 7.
  4. J. Li, W. Lu, Y. Yan and T.-W. Chou, High performance solid-state flexible supercapacitor based on Fe<sub>3</sub>O<sub>4</sub>/carbon nanotube/polyaniline ternary films, *Journal of Materials Chemistry A*, 2017, 5, 11271.
  5. M. Dunwell, Q. Lu, J. M. Heyes, J. Rosen, J. G. Chen, Y. Yan, F. Jiao and B. Xu, The Central Role of Bicarbonate in the Electrochemical Reduction of Carbon Dioxide on Gold, *Journal of the American Chemical Society*, 2017, 139, 3774.
  6. D.-Z. Chen, J. Yu, W. Lu, Y. Zhao, Y. Yan and T.-W. Chou, Temperature effects on electrochemical performance of carbon nanotube film based flexible all-solid-state supercapacitors, *Electrochimica Acta*, 2017, 233, 181.

7. Z. Zhuang, S. A. Giles, J. Zheng, G. R. Jenness, S. Caratzoulas, D. G. Vlachos and Y. Yan, Nickel supported on nitrogen-doped carbon nanotubes as hydrogen oxidation reaction catalyst in alkaline electrolyte, *Nature Communications*, 2016, **7**.
8. J. Zheng, S. Zhou, S. Gu, B. Xu and Y. Yan, Size-Dependent Hydrogen Oxidation and Evolution Activities on Supported Palladium Nanoparticles in Acid and Base, *Journal of the Electrochemical Society*, 2016, **163**, F499.
9. J. Zheng, W. Sheng, Z. Zhuang, B. Xu and Y. Yan, Universal dependence of hydrogen oxidation and evolution reaction activity of platinum-group metals on pH and hydrogen binding energy, *Science Advances*, 2016, **2**.
10. C. Zhang, L. Xu, Y. Yan and J. Chen, Controlled Synthesis of Pt Nanowires with Ordered Large Mesopores for Methanol Oxidation Reaction, *Scientific Reports*, 2016, **6**.
11. B. Zhang, R. B. Kaspar, S. Gu, J. Wang, Z. Zhuang and Y. Yan, A New Alkali-Stable Phosphonium Cation Based on Fundamental Understanding of Degradation Mechanisms, *Chemsuschem*, 2016, **9**, 2374.
12. J. Yu, W. Lu, S. Pei, K. Gong, L. Wang, L. Meng, Y. Huang, J. P. Smith, K. S. Booksh, Q. Li, J.-H. Byun, Y. Oh, Y. Yan and T.-W. Chou, Omnidirectionally Stretchable High-Performance Supercapacitor Based on Isotropic Buckled Carbon Nanotube Films, *Acs Nano*, 2016, **10**, 5204.
13. Y. Xie, W. Zhang, S. Gu, Y. Yan and Z.-F. Ma, Process engineering in electrochemical energy devices innovation, *Chinese Journal of Chemical Engineering*, 2016, **24**, 39.
14. T. Sun, L. Xu, Y. Yan, A. A. Zakhidov, R. H. Baughman and J. Chen, Ordered Mesoporous Nickel Sphere Arrays for Highly Efficient Electrocatalytic Water Oxidation, *Acs Catalysis*, 2016, **6**, 1446.
15. T. Sun, L. Xu, S. Li, W. Chai, Y. Huang, Y. Yan and J. Chen, Cobalt-nitrogen-doped ordered macro-/mesoporous carbon for highly efficient oxygen reduction reaction, *Applied Catalysis B-Environmental*, 2016, **193**, 1.
16. B. P. Setzler, Z. Zhuang, J. A. Wittkopf and Y. Yan, Activity targets for nanostructured platinum group-metal-free catalysts in hydroxide exchange membrane fuel cells, *Nature Nanotechnology*, 2016, **11**, 1020.
17. K. Schwarz, B. Xu, Y. Yan and R. Sundararaman, Partial oxidation of step-bound water leads to anomalous pH effects on metal electrode step-edges, *Physical Chemistry Chemical Physics*, 2016, **18**, 16216.
18. E. G. Mahoney, W. Sheng, M. Cheng, K. X. Lee, Y. Yan and J. G. Chen, Analyzing the electrooxidation of ethylene glycol and glucose over platinum-modified gold electrocatalysts in alkaline electrolyte using in-situ infrared spectroscopy, *Journal of Power Sources*, 2016, **305**, 89.
19. X. Lu, Y. Peng, Z. Wang and Y. Yan, A facile fabrication of highly b-oriented MFI zeolite films in the TEOS-TPAOH-H<sub>2</sub>O system without additives, *Microporous and Mesoporous Materials*, 2016, **230**, 49.
20. L. Long, Y. Yan, X. Gao and H. Kang, Three-dimensional finite element simulation and application of high-strength bolts, *Steel and Composite Structures*, 2016, **20**, 501.
21. Y. Liu, B. Zhang, C. L. Kinsinger, Y. Yang, S. Seifert, Y. Yan, C. M. Maupin, M. W. Liberatore and A. M. Herring, Anion exchange membranes composed of a poly(2,6-dimethyl-1, 4-phenylene oxide) random copolymer functionalized with a bulky phosphonium cation, *Journal of Membrane Science*, 2016, **506**, 50.
22. H. Li, Q. Pan, Y. Ma, X. Guan, M. Xue, Q. Fang, Y. Yan, V. Valtchev and S. Qiu, Three-Dimensional Covalent Organic Frameworks with Dual Linkages for Bifunctional Cascade Catalysis, *Journal of the American Chemical Society*, 2016, **138**, 14783.

23. D. Li, Y. Yan and H. Wang, Recent advances in polymer and polymer composite membranes for reverse and forward osmosis processes, *Progress in Polymer Science*, 2016, **61**, 104.
24. R. B. Kaspar and Y. Yan, Communication-Patterned Electrodes to Increase Water Back-Diffusion in Hydroxide Exchange Membrane Fuel Cells, *Journal of the Electrochemical Society*, 2016, **163**, F593.
25. R. B. Kaspar, J. A. Wittkopf, M. D. Woodroof, M. J. Armstrong and Y. Yan, Reverse-Current Decay in Hydroxide Exchange Membrane Fuel Cells, *Journal of the Electrochemical Society*, 2016, **163**, F377.
26. J. Jiang, M. Gao, W. Sheng and Y. Yan, Hollow Chevrel-Phase NiMo<sub>3</sub>S<sub>4</sub> for Hydrogen Evolution in Alkaline Electrolytes, *Angewandte Chemie-International Edition*, 2016, **55**, 15240.
27. K. Gong, F. Xu, J. B. Grunewald, X. Ma, Y. Zhao, S. Gu and Y. Yan, All-Soluble All-Iron Aqueous Redox-Flow Battery, *Acs Energy Letters*, 2016, **1**, 89.
28. M. Dunwell, Y. Yan and B. Xu, A surface-enhanced infrared absorption spectroscopic study of pH dependent water adsorption on Au, *Surface Science*, 2016, **650**, 51.
29. Y. Zhou, Q. Lu, Z. Zhuang, G. S. Hutchings, S. Kattel, Y. Yan, J. G. Chen, J. Q. Xiao and F. Jiao, Oxygen Reduction at Very Low Overpotential on Nanoporous Ag Catalysts, *Advanced Energy Materials*, 2015, **5**.
30. J. Zheng, Z. Zhuang, B. Xu and Y. Yan, Correlating Hydrogen Oxidation/Evolution Reaction Activity with the Minority Weak Hydrogen-Binding Sites on Ir/C Catalysts, *Acs Catalysis*, 2015, **5**, 4449.
31. J. Zheng, Y. Yan and B. Xu, Correcting the Hydrogen Diffusion Limitation in Rotating Disk Electrode Measurements of Hydrogen Evolution Reaction Kinetics, *Journal of the Electrochemical Society*, 2015, **162**, F1470.
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33. Z. Zhan, N. Ma, H. Yan, Y. Peng, Z. Wang and Y. Yan, Heat treatment for improving performance of inner-side zeolite NaA membranes on composite hollow fibers, *Journal of Membrane Science*, 2015, **485**, 94.
34. J. Yu, L. Wang, X. Lai, S. Pei, Z. Zhuang, L. Meng, Y. Huang, Q. Li, W. Lu, J.-H. Byun, Y. Oh, Y. Yan and T.-W. Chou, A durability study of carbon nanotube fiber based stretchable electronic devices under cyclic deformation, *Carbon*, 2015, **94**, 352.
35. P. Xu, B. Wei, Z. Cao, J. Zheng, K. Gong, F. Li, J. Yu, Q. Li, W. Lu, J.-H. Byun, B.-S. Kim, Y. Yan and T.-W. Chou, Stretchable Wire-Shaped Asymmetric Supercapacitors Based on Pristine and MnO<sub>2</sub> Coated Carbon Nanotube Fibers, *Acs Nano*, 2015, **9**, 6088.
36. M. D. Woodroof, J. A. Wittkopf, S. Gu and Y. S. Yan, Exchange current density of the hydrogen oxidation reaction on Pt/C in polymer solid base electrolyte, *Electrochemistry Communications*, 2015, **61**, 57.
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38. A. C. Tibbitts, L. E. Mumper, C. J. Kloxin and Y. S. Yan, A Single-Step Monomeric Photo-Polymerization and Crosslinking via Thiol-Ene Reaction for Hydroxide Exchange Membrane Fabrication, *Journal of the Electrochemical Society*, 2015, **162**, F1206.
39. T. Sun, C. Zhang, J. Chen, Y. Yan, A. A. Zakhidov, R. H. Baughman and L. Xu, Three-dimensionally ordered macro-/mesoporous Ni as a highly efficient electrocatalyst for the hydrogen evolution reaction,

40. W. Sheng, Z. Zhuang, M. Gao, J. Zheng, J. G. Chen and Y. Yan, Correlating hydrogen oxidation and evolution activity on platinum at different pH with measured hydrogen binding energy, *Nature Communications*, 2015, **6**.
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42. X. Lu, Y. Peng, Z. Wang and Y. Yan, Rapid fabrication of highly b-oriented zeolite MFI thin films using ammonium salts as crystallization-mediating agents, *Chemical Communications*, 2015, **51**, 11076.
43. R. B. Kaspar, M. P. Letterio, J. A. Wittkopf, K. Gong, S. Gu and Y. Yan, Manipulating Water in High-Performance Hydroxide Exchange Membrane Fuel Cells through Asymmetric Humidification and Waterproofing, *Journal of the Electrochemical Society*, 2015, **162**, F483.
44. Y. Huang, S. Gu, Y. Yan and S. F. Y. Li, Nonaqueous redox-flow batteries: features, challenges, and prospects, *Current Opinion in Chemical Engineering*, 2015, **8**, 105.
45. S. Gu, J. Wang, R. B. Kaspar, Q. Fang, B. Zhang, E. B. Coughlin and Y. Yan, Permethyl Cobaltocenium (Cp-2\*Co+) as an Ultra-Stable Cation for Polymer Hydroxide-Exchange Membranes, *Sci Rep*, 2015, **5**.
46. K. Gong, X. Ma, K. M. Conforti, K. J. Kuttler, J. B. Grunewald, K. L. Yeager, M. Z. Bazant, S. Gu and Y. Yan, A zinc-iron redox-flow battery under \$100 per kW h of system capital cost, *Energy & Environmental Science*, 2015, **8**, 2941.
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48. Q. Fang, J. Wang, S. Gu, R. B. Kaspar, Z. Zhuang, J. Zheng, H. Guo, S. Qiu and Y. Yan, 3D Porous Crystalline Polyimide Covalent Organic Frameworks for Drug Delivery, *Journal of the American Chemical Society*, 2015, **137**, 8352.
49. S. M. Alia and Y. Yan, Palladium Coated Copper Nanowires as a Hydrogen Oxidation Electrocatalyst in Base, *Journal of the Electrochemical Society*, 2015, **162**, F849.
50. Z. Zhuang, W. Sheng and Y. Yan, Synthesis of Monodisperse Au@Co<sub>3</sub>O<sub>4</sub> Core-Shell Nanocrystals and Their Enhanced Catalytic Activity for Oxygen Evolution Reaction, *Advanced Materials*, 2014, **26**, 3950.
51. C. Zhang, H. Yang, T. Sun, N. Shan, J. Chen, L. Xu and Y. Yan, Synthesis of three-dimensionally ordered macro-/mesoporous Pt with high electrocatalytic activity by a dual-templating approach, *Journal of Power Sources*, 2014, **245**, 579.
52. C. Zhang, L. Xu, N. Shan, T. Sun, J. Chen and Y. Yan, Enhanced Electrocatalytic Activity and Durability of Pt Particles Supported on Ordered Mesoporous Carbon Spheres, *Acs Catalysis*, 2014, **4**, 1926.
53. Z. Zhan, J. Shao, Y. Peng, Z. Wang and Y. Yan, High performance zeolite NaA membranes synthesized on the inner surface of zeolite/PES-PI blend composite hollow fibers, *Journal of Membrane Science*, 2014, **471**, 299.
54. J. A. Wittkopf, J. Zheng and Y. Yan, High-Performance Dealloyed PtCu/CuNW Oxygen Reduction Reaction Catalyst for Proton Exchange Membrane Fuel Cells, *Acs Catalysis*, 2014, **4**, 3145.
55. W. Sheng, A. P. Bivens, M. Myint, Z. Zhuang, R. V. Forest, Q. Fang, J. G. Chen and Y. Yan, Non-precious metal electrocatalysts with high activity for hydrogen oxidation reaction in alkaline electrolytes, *Energy &*

- Environmental Science*, 2014, **7**, 1719.
56. J. Shao, Z. Zhan, J. Li, Z. Wang, K. Li and Y. Yan, Zeolite NaA membranes supported on alumina hollow fibers: Effect of support resistances on pervaporation performance, *Journal of Membrane Science*, 2014, **451**, 10.
  57. Y. Peng, H. Lu, Z. Wang and Y. Yan, Microstructural optimization of MFI-type zeolite membranes for ethanol-water separation, *Journal of Materials Chemistry A*, 2014, **2**, 16093.
  58. M. Myint, Y. Yan and J. G. Chen, Reaction Pathways of Propanal and 1-Propanol on Fe/Ni(111) and Cu/Ni(111) Bimetallic Surfaces, *Journal of Physical Chemistry C*, 2014, **118**, 11340.
  59. E. G. Mahoney, W. Sheng, Y. Yan and J. G. Chen, Platinum-Modified Gold Electrocatalysts for the Hydrogen Oxidation Reaction in Alkaline Electrolytes, *Chemelectrochem*, 2014, **1**, 2058.
  60. J. Ma, J. Shao, Z. Wang and Y. Yan, Preparation of Zeolite NaA Membranes on Macroporous Alumina Supports by Secondary Growth of Gel Layers, *Industrial & Engineering Chemistry Research*, 2014, **53**, 6121.
  61. Y. Liu, J. Wang, Y. Yang, T. M. Brenner, S. Seifert, Y. Yan, M. W. Liberatore and A. M. Herring, Anion Transport in a Chemically Stable, Sterically Bulky alpha-C Modified Imidazolium Functionalized Anion Exchange Membrane, *Journal of Physical Chemistry C*, 2014, **118**, 15136.
  62. S. Gu, B. Xu and Y. Yan, in *Annual Review of Chemical and Biomolecular Engineering, Vol 5*, eds. J. M. Prausnitz, M. F. Doherty and R. A. Segalman, 2014, vol. 5, pp. 429.
  63. S. Gu, K. Gong, E. Z. Yan and Y. Yan, A multiple ion-exchange membrane design for redox flow batteries, *Energy & Environmental Science*, 2014, **7**, 2986.
  64. M. Gao, W. Sheng, Z. Zhuang, Q. Fang, S. Gu, J. Jiang and Y. Yan, Efficient Water Oxidation Using Nanostructured alpha-Nickel-Hydroxide as an Electrocatalyst, *Journal of the American Chemical Society*, 2014, **136**, 7077.
  65. Q. Fang, Z. Zhuang, S. Gu, R. B. Kaspar, J. Zheng, J. Wang, S. Qiu and Y. Yan, Designed synthesis of large-pore crystalline polyimide covalent organic frameworks, *Nature Communications*, 2014, **5**.
  66. Q. Fang, S. Gu, J. Zheng, Z. Zhuang, S. Qiu and Y. Yan, 3D Microporous Base-Functionalized Covalent Organic Frameworks for Size-Selective Catalysis, *Angewandte Chemie-International Edition*, 2014, **53**, 2878.
  67. S. M. Alia, Y. S. Yan and B. S. Pivovar, Galvanic displacement as a route to highly active and durable extended surface electrocatalysts, *Catalysis Science & Technology*, 2014, **4**, 3589.
  68. S. M. Alia, K. Duong, T. Liu, K. Jensen and Y. Yan, Palladium and Gold Nanotubes as Oxygen Reduction Reaction and Alcohol Oxidation Reaction Catalysts in Base, *Chemsuschem*, 2014, **7**, 1739.
  69. J. Wang, S. Gu, R. B. Kaspar, B. Zhang and Y. Yan, Stabilizing the Imidazolium Cation in Hydroxide-Exchange Membranes for Fuel Cells, *Chemsuschem*, 2013, **6**, 2079.
  70. J.-P. Tessonnier, S. Goubert-Renaudin, S. Alia, Y. Yan and M. A. Barteau, Structure, Stability, and Electronic Interactions of Polyoxometalates on Functionalized Graphene Sheets, *Langmuir*, 2013, **29**, 393.
  71. W. Sheng, M. Myint, J. G. Chen and Y. Yan, Correlating the hydrogen evolution reaction activity in alkaline electrolytes with the hydrogen binding energy on monometallic surfaces, *Energy & Environmental Science*, 2013, **6**, 1509.

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75. S. M. Alia, B. S. Pivovar and Y. Yan, Platinum-Coated Copper Nanowires with High Activity for Hydrogen Oxidation Reaction in Base, *Journal of the American Chemical Society*, 2013, **135**, 13473.
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78. C. Zhou, Z. Liu, X. Du, D. R. G. Mitchell, Y.-W. Mai, Y. Yan and S. Ringer, Hollow nitrogen-containing core/shell fibrous carbon nanomaterials as support to platinum nanocatalysts and their TEM tomography study, *Nanoscale Research Letters*, 2012, **7**, 1.
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80. B. Zhang, S. Gu, J. Wang, Y. Liu, A. M. Herring and Y. Yan, Tertiary sulfonium as a cationic functional group for hydroxide exchange membranes, *Rsc Advances*, 2012, **2**, 12683.
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82. J. Li, J. Shao, Q. Ge, G. Wang, Z. Wang and Y. Yan, Influences of the zeolite loading and particle size in composite hollow fiber supports on properties of zeolite NaA membranes, *Microporous and Mesoporous Materials*, 2012, **160**, 10.
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## INVITED LECTURES

1. “Zeolite ZSM-5 membranes for separation and catalysis”, **9/27/99**, Department of Chemistry, University of California, Riverside, California.
2. “Assembly of nanoporous thin films”, **10/14/99**, Southern California Society for Microscopy and Microanalysis (SCSMM), University of California, Irvine, California.
3. “Zeolite thin films as low  $k$  inter-metal dielectrics”, **1/28/00**, Honeywell Wafer Fabrication Materials, STAR Center, Sunnyvale, California.
4. “Zeolite thin films and porous materials”, **2/17/00**, Praxair Research Center, Tonawanda, New York.
5. “Zeolite membranes by in-situ crystallization”, **3/10/00**, Kennecott Undergraduate Seminar, Chemical Engineering, University of Nevada at Reno, Reno, Nevada.
6. “Design, synthesis, and novel applications of zeolite thin film and coatings”, **3/10/00**, Research Seminar, Chemical Engineering, University of Nevada at Reno, Reno, Nevada.
7. “Design, synthesis, and novel applications of zeolite thin film and coatings”, **8/4/00**, Department of Applied Chemistry, Waseda University, Tokyo, Japan.
8. “Design, synthesis, and novel applications of zeolite thin film and coatings”, **8/12/00**, Department of Chemistry, Jilin University, Changchun, China.
9. “Zeolite low- $k$  dielectrics”, **3/19/01**, Advanced Process Research & Development Laboratory (APRDL) of Motorola and AMD, Austin, Texas.
10. “Zeolite low- $k$  dielectrics”, **3/19/01**, International Sematech, Austin, Texas.
11. “Zeolite low- $k$  dielectrics”, **4/20/01**, Advanced Micro Devices (AMD), Sunnyvale, California.
12. “Design, synthesis, and novel applications of zeolite thin film and coatings”, **5/15/01**, Chemical Engineering, University of Louisville, Louisville, Kentucky.
13. “Zeolite low- $k$  dielectrics”, **8/2/01**, Novellus Systems, San Jose, California.
14. “Design, synthesis, and environmental applications of zeolite based membrane and coatings”, **9/10/01**, United States Environmental Protection Agency, Washington D.C.
15. “Design, synthesis, and novel applications of zeolite thin film and coatings”, **9/20/01**, Chemical Engineering, University of Southern California, Los Angeles, California.
16. “Design, synthesis, and novel applications of zeolite thin film and coatings”, **10/3/01**, Chemical Engineering, University of Rochester, Rochester, New York.
17. “Design, synthesis, and novel applications of zeolite thin film and coatings”, **10/15/01**, Chemical Engineering and Materials Science, University of California, Davis, California.
18. “Fuel cells – power for the future”, **2/27/02**, American Chemical Society, Orange County Section, University of California, Riverside, California.
19. “Zeolite nanoparticles: building blocks for hierarchical porous structures”, **4/29/02**, American Ceramic Society, St. Louis, Missouri.
20. “Silica zeolite low- $k$  dielectrics”, **7/12/02**, Honeywell International, Sunnyvale, California.
21. “Silica zeolite low- $k$  dielectrics”, **9/27/02**, Advanced Micro Devices (AMD), Sunnyvale, California.
22. “Silica zeolite low- $k$  dielectric thin films”, **11/15/02**, Electrical Engineering and Computer Science, University of California, Berkeley, California.
23. “Polymer-zeolite nanocomposite membranes”, **11/18/02**, Twentieth Annual Membrane/Separations Technology Planning Conference, Newton, Massachusetts.
24. “Design, synthesis, and novel applications of zeolite thin film and coatings”, **11/21/02**, Chemical Engineering, University of Massachusetts, Amherst, Massachusetts.
25. “Zeolite films: from chips to space station”, **12/2/02**, Oak Ridge National Laboratory, Tennessee.
26. “Zeolite films: from chips to space station”, **1/17/03**, Chemical Engineering, University of California at Los Angeles, California.

27. "Zeolite films: from chips to space station", **2/6/02**, Chemical Engineering, Northwestern University, Evanston, Illinois.
28. "Zeolite thin films", **2/14/03**, First UC Symposium of Surface Science, University of California, Riverside, CA.
29. "Silica zeolite low-*k* dielectric thin films", **4/4/03**, T. J. Watson Research Center, Yorktown Heights, New York.
30. "Silica zeolite low-*k* dielectric thin films", **4/4/03**, Engelhard, Iselin, New Jersey.
31. "Zeolite films: from chips to space station", **4/10/03**, Chemical Engineering, University of California, Santa Barbara, California.
32. "Zeolite nanoparticles: building blocks for hierarchical porous structures", **4/15/03**, Chemical Engineering, University of Southern California, Los Angeles, California.
33. "Microporous and mesoporous silica low-*k* dielectric thin films for computer chips", **8/1/03**, Pre-Conference School, The International Symposium on Zeolites and Microporous Crystals (ZMPC2003), The University of Tokyo, Japan (Cancelled due to SARS).
34. "Zeolite thin films: from chips to space station", The International Symposium on Zeolites and Microporous Crystals (ZMPC2003), **8/3-6/03**, Sapporo, Japan (Cancelled due to SARS).
35. "Silica zeolite low-*k* dielectric thin films", **8/20/03**, Intel, Portland, Oregon.
36. "Hierarchically porous silica hollow fibers by spider silk templating", **10/7/03**, The 36<sup>th</sup> Annual Symposium of the Southern California American Vacuum Society Meeting, Anaheim, California.
37. "Design, synthesis and novel applications of zeolite nanoparticles", **10/20/03**, The 55<sup>th</sup> Pacific Coast Regional and Basic Science Division Fall Meeting of the American Ceramic Society, Oakland, California.
38. "Zeolite nanocomposite membranes and carbon nanotube based electrodes for fuel cells", **11/9/03-11/10/03**, The Knowledge Foundation's 4<sup>th</sup> Annual International Conference NANOSTRUCTURED MATERIALS 2003 – Production and Application in Fuel Cells & other Energy Devices, Miami Beach, Florida.
39. "Zeolite thin films – from chips to space station", **11/13/03**, Department of Chemical Engineering, California Institute of Technology, California.
40. "Zeolite thin films – from chips to space station", **12/12/03**, Department of Chemistry, Fudan University, Shanghai, China.
41. "Zeolite thin films: from chips to space station", **12/22/03**, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, Dalian, China.
42. "Zeolite nanoparticles: building blocks for hierarchical porous structures and functional films", **12/26/03**, Department of Chemistry, Jilin University, Changchun, China.
43. "Zeolite nanoparticles: from computer chips to fuel cells", **3/9/04**, Nanoparticles 2004, Orlando, Florida.
44. "Polymer-zeolite nanocomposite membranes for PEM fuel cells and gas separation", **3/29/04**, Session of Nanotechnology and the Environment, 2004 ACS Annual Meeting, Anaheim, California.
45. "Silica Zeolite Low-*k* Dielectric Films", **3/28/04**, Session of Polymers in Micro- and Nano-Electronics, 2004 ACS Annual Meeting, Anaheim, California.
46. "Zeolite thin films: from chips to space station", **4/21/04**, Department of Chemistry, Georgetown University, Washington D.C.
47. "Zeolite thin films: from chips to space station", **9/23/04**, Department of Chemical Engineering, Ohio State University, Columbus, Ohio.
48. "Fuel cells: acid functionalized zeolite polymer nanocomposite membranes and carbon nanotube based electrode catalyst", **11/10/04** [Cancelled due to illness], Department of Chemistry, University of California, Santa Barbara, California.
49. "Portable power: a high energy density and low cost fuel cell", **11/11/04**, PROJECT T2 A Technology Transfer Conference, Larta Institute, Los Angeles, California.
50. "Silica zeolite low-*k* films", **12/16/04**, Chevron-Texaco Research Center, Richmond, California.
51. "Portable power: a high energy density and low cost fuel cell", **12/16/04**, Nanosys Inc., Palo Alto, California.
52. "Carbon nanotube based electrocatalysts for fuel cells", **3/16/05**, Murphree Award Symposium in honor of M. E. Davis at the 2005 American Chemical Society Annual Meeting, San Diego, California.
53. "Zeolite thin films and fuel cells", **3/22/05**, UOP, Des Plaines, Illinois.
54. "Carbon nanotube based electrocatalysts for fuel cells", **5/19/05**, Oklahoma State Nanonet Conference, Oklahoma State University, Stillwater, Oklahoma.

55. "Zeolite Thin Films: From Computer Chips to Space Station", **Gordon Research Conference** on Zeolite and Layer Materials, 7/3/05-7/8/05, Mount Holyoke College, South Hadley, Massachusetts.
56. "Zeolite thin films: from chips to space station", **9/20/05**, Department of Chemical & Petroleum Engineering, University of Kansas, Lawrence, Kansas.
57. "Zeolite thin films: from chips to space station", **10/12/05**, Department of Chemistry, University of La Verne, La Verne, California.
58. "Zeolite thin films: from chips to space station", **12/15/05**, PACIFICHEM 2005, Honolulu, Hawaii.
59. "Zeolite thin films: from chips to space station", **3/1/06**, Department of Chemistry, University of California Riverside, Riverside, California.
60. "Engineering of zeolite coatings for corrosion protection of aluminum alloys", **3/12/06-3/16/06**, The Research Topical Symposium (RTS) – Smart Coatings: Advanced Function Using New Materials, at the 2006 Annual Meeting of the National Association for Corrosion Engineers, San Diego, California.
61. "Carbon nanotube supported electrocatalysts for hydrogen and methanol fuel cells", **3/12/06-3/16/06**, The 135<sup>th</sup> TMS Annual Meeting, San Antonio, Texas.
62. "Engineering and assembly of zeolite nanoparticles: from chips to fuel cells", **3/26/06-3/30/06**, Reaction and Supramolecular Assembly in Complex Fluids at the 2006 American Chemical Society Annual Meeting, Atlanta, Georgia.
63. "Carbon nanotube supported electrocatalysts for hydrogen and methanol fuel cells", **3/26/06-3/30/06**, Nanoparticles in Energy Processes: Friend & Foe III. Nanoparticle-Based Catalysts and Sorbents at the 2006 American Chemical Society Annual Meeting, Atlanta, Georgia.
64. "Advancing fuel cell technology by carbon nanotubes and zeolite nanoparticles", **5/1/06**, Virginia Tech, Department of Chemical Engineering, Blacksburg, Virginia.
65. "Novel applications of zeolite thin films: past, present, and the future", **7/17/06**, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, Dalian, China.
66. "Zeolite thin films: from chips to space station", **7/20/06**, Dalian University of Technology, School of Chemical Engineering, Dalian, China.
67. "Pure-silica-zeolite low-dielectric-constant films: past, present, and the future", **7/29/06**, Pre-conference School, the International Symposium on Zeolites and Microporous Crystals (ZMPC2006), Tokyo, Japan.
68. "Zeolite thin films: from chips to space station" [**Keynote Lecture**], 7/30/06-8/2/06, The International Symposium on Zeolites and Microporous Crystals (ZMPC2006), Yonago, Japan.
69. "Zeolite thin films: from chips to space station – a progress report from 2000", **8/9/06**, Jilin University, Department of Chemistry, Changchun, China.
70. "Zeolite thin films: from chips to space station", **8/18/06**, Zhejiang University of Technology, Hangzhou, China.
71. "Novel applications of zeolite thin films: past, present, and the future", **8/21/06**, Zhejiang University, Hangzhou, China.
72. "Nanotechnology for cheaper and more durable fuel cells", **3/8/07**, University of California – Canada Energy Workshop, University of California at Davis, CA.
73. "Nanotechnology for cheaper and more durable fuel cells", **3/29/07**, Department of Chemical Engineering, California Institute of Technology, Pasadena, CA.
74. "Nanotechnology for cheaper and more durable fuel cells", **4/13/07**, UC System-Wide Technology Transfer Forum on NANOTECHNOLOGY, San Francisco, CA.
75. "Nanotechnology for cheaper and more durable fuel cells", **8/6/07**, Jilin University, Department of Chemistry, Changchun, China.
76. "Nanotechnology for cheaper and more durable fuel cells", **8/10/07**, Peking University, Department of Chemistry, Beijing, China.
77. "Advanced applications of zeolite thin films: beyond separation and catalysis" [**Keynote Lecture**], **8/12/07-8/17/07**, 15<sup>th</sup> International Zeolite Conference, Beijing, China.
78. "Zeolite thin films: from computer chips to space station", **8/18/07**, Institute of Process Engineering, Chinese Academy of Sciences, Beijing, Beijing, China.
79. "Nanotechnology for cheaper and more durable fuel cells", **8/23/07**, Zhejiang University, Department of Chemical and Biological Engineering, Hangzhou, China.
80. "Nanotechnology for cheaper and more durable fuel cells", **10/5/07**, University of California, Los Angeles, Department of Mechanical and Aerospace Engineering, Los Angeles, California.
81. "Nanotechnology for cheaper and more durable fuel cells", **12/14/07**, University of California, Los

- Angeles, Department of Materials Science, Los Angeles, California.
82. "Zeolite thin films and coatings", **1/10/08**, Qualcomm (broadcasted to their worldwide locations), San Jose, California.
  83. "Nanotechnology for cheaper and more durable fuel cells", **1/25/08**, Arizona State University, Department of Chemical Engineering, Phoenix, Arizona.
  84. "Nanotechnology for cheaper and more durable fuel cells", **2/12/08**, Georgia Institute of Technology, Department of Materials Science and Engineering, Atlanta, Georgia.
  85. "Zeolite Thin Films and Fuel Cells", **3/28/08**, Pacific Northwest National Lab, Washington.
  86. "Zeolite thin films: From computer chips to space station", **4/15/08**, Kansas State University, Department of Chemical Engineering, Manhattan, Kansas.
  87. "Zeolite Thin Films for Energy, Environment, and Electronics", **5/23/08**, Acceptance Lecture of Changjiang Scholar Award, School of Chemical Engineering and Materials Science, Zhejiang University, Hangzhou, China.
  88. "Nanotechnology for cheaper and more durable fuel cells", **5/26/08**, Dalian Institute of Chemical Physics Symposium (XVI) on Fuel Cells, Dalian, China.
  89. "Materials for Sustainable Energy: The Next Frontier for Chemical Engineering", **7/26/08**, The 34<sup>th</sup> West Lake Forum, Zhejiang University, Hangzhou, China.
  90. "Zeolite thin films: From computer chips to space station", **10/9/08**, Department of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis, Minnesota.
  91. "Zeolite thin films: From computer chips to space station", **10/22/08**, Department of Chemical Engineering, Texas A&M University, College Station, Texas.
  92. "Fuel cell vehicles of the future: The materials challenges to make it real". **12/3/08**, University of California, Palm Desert Graduate Center, Palm Desert, California.
  93. "Zeolite thin films: From computer chips to space station", **1/18/09**, Jilin University Zhuhai Workshop on Porous Materials, Zhuhai, China.
  94. "New fuel cell materials: Low-Pt and non-Pt catalysts and hydroxide exchange membranes", **2/16 – 2/17/09**, Vancouver to Northeast USA Fuel Cell and Hydrogen Cluster Connection Workshop, Vancouver, Canada.
  95. "Fuel cell vehicles of the future: The materials challenges to make it real", **4/4/09**, La Verne University, La Verne, CA.
  96. Panelist, "Energy Summit", Coachella Valley Association of Governors, **4/17/09**, Palm Springs, CA
  97. "Nanotechnology for cheaper and more durable fuel cells", **7/3/09**, The 4<sup>th</sup> Sino-US Nano Meeting , July 2-3, 2009, USTC, Hefei, China
  98. "Nanotechnology for cheaper and more durable fuel cells", **8/11/09**, Chemistry Department, Zhejiang University, Hangzhou China.
  99. "Nanotechnology for cheaper and more durable fuel cells", **8/15/09**, 2009 China – Workshop on Fuel Cell Science and Technology, Shanghai Jiao Tong University, China
  100. "Zeolite thin films: From computer chips to space station" **8/17/09 (Distinguished Lecture)**, Changchun Institute of Applied Chemistry, Changchun, China.
  101. "Quaternary Phosphonium based Polymers: A New Class of Hydroxide Exchange Membranes", **9/10/09**, 3<sup>rd</sup> Sunrise Springs Fuel Cell Workshop, Santa Fe, NM.
  102. "Zeolite thin films: From computer chips to space station", **10/14/09 (Plenary Lecture)**, The 15<sup>th</sup> Chinese National Zeolite Conference, Luoyang, Henan, China.
  103. "Nanotechnology for cheaper and more durable fuel cells", **10/28/09**, Department of Chemical Engineering, Yale University, New Haven, CT
  104. "Nanotechnology for cheaper and more durable fuel cells", **2/1/10**, Department of Electrical Engineering, University of California, Riverside, CA.
  105. "The Next 20 Years in Energy: Moving toward a clean/safe/sustainable energy future," **3/10/10**, Bourns College of Engineering 20<sup>th</sup> Anniversary Celebration, University of California, Riverside, CA.
  106. "Solar hydrogen and fuel cells: Toward a clean safe and sustainable energy future," **3/17/10**, Catalysis Center, University of Delaware.
  107. "Zeolite Thin Films: From computer chips to space station", **5/23-5/26/10 (Plenary Lecture)**, The 5<sup>th</sup> International Zeolite Membrane Meeting, Loutraki, Greece.
  108. "Solar hydrogen and fuel cells: Toward a clean safe and sustainable energy future", **6/5/10**, 5<sup>th</sup> Sino-US Nano Forum, Suzhou Institute of Nanotechnology and Nanobioncs (SINANANO), Chinese Academy of Sciences, Suzhou, China.

109. “Solar hydrogen and fuel cells: Toward a clean safe and sustainable energy future”, **6/10/10**, Department of Chemistry, Fudan University, China.
110. “Fuel cells and solar hydrogen: Toward a clean safe and sustainable energy future”, **7/11/10**, 8<sup>th</sup> International Symposium on New Materials and Nanomaterials for Electrochemical Systems, Shanghai, China.
111. “Zeolite thin films: From computer chips to space station”, **7/16/10**, Research Institute of Petroleum Processing, Sinopec, Beijing, China.
112. “Polymer hydroxide exchange membranes: Fuel cells, energy storage, and solar hydrogen”, **7/26/10**, Gordon Research Conference on Membranes, New London, NH.
113. “Polymer hydroxide exchange membranes: Fuel cells, energy storage, and solar hydrogen”, **8/24/10 (Plenary Lecture)**, The American Chemical Society Annual Fall Meeting, Boston, MA.
114. “Fuel cells and solar hydrogen: Toward a clean safe and sustainable energy future”, **8/31/10**, Department of Chemical and Biomolecular Engineering, University of Illinois, Urbana-Champaign, IL.
115. “Polymer hydroxide exchange membranes: Fuel cells, energy storage, and solar hydrogen”, **9/28/10**, F-Cell, Stuttgart, Germany.
116. “Fuel cells, energy storage, and solar hydrogen: Toward a clean safe and sustainable energy future”, **10/8/10**, Department of Chemical Engineering, University of California, Berkeley
117. “Polymer hydroxide exchange membranes: Fuel cells, energy storage, and solar hydrogen”, **10/10 – 10/15/10**, The Electrochemical Society Meeting, Las Vegas, NV.
118. “Fuel cells and solar hydrogen: Toward a clean safe and sustainable energy future”, **11/16/10**, Department of Chemical Engineering, University of Texas, Austin, TX.
119. “Zeolite thin films: From computer chips to space station” **1/5/10**, Department of Chemical Engineering, Nanjing University of Technology, Nanjing, China.
120. “Fuel cells, energy storage, and solar hydrogen: Toward a clean safe and sustainable energy future”, **1/28/11**, Energy Materials Center, Cornell University, Ithaca, NY
121. “Fuel cells, energy storage, and solar hydrogen: Toward a clean safe and sustainable energy future”, **3/1/11**, Department of Chemical Engineering, University of New Mexico
122. “Fuel cells, energy storage, and solar hydrogen: Toward a clean safe and sustainable energy future”, **3/18/11**, Department of Chemical Engineering, Michigan Technological University.
123. “Membranes: From zeolites to polymers”, **3/29/11**, E. V. Murphree Award Symposium in honor of Norman Li, American Chemical Society Annual Meeting, Anaheim, CA.
124. “Fuel cells, energy storage, and solar hydrogen: Toward a clean safe and sustainable energy future”, **4/28/11**, Department of Chemical Engineering, University of California, Santa Barbara, CA.
125. “Polymer Hydroxide Exchange Membranes: Fuel Cells, Energy Storage, and Solar Hydrogen”, **7/2/11**, 6<sup>th</sup> Sino-US Nano Forum, Jilin University, Changchun, China.
126. “Fuel cells, energy storage, and solar hydrogen: Toward a clean safe and sustainable energy future”, **7/8/11 (Distinguished Alumni Lecturer)**, Dalian Institute of Chemical Physics, Chinese Academy of Sciences
127. “Fuel cells, energy storage, and solar hydrogen: Toward a clean safe and sustainable energy future”, **7/11/11**, School of Automotive Studies, Tongji University, Shanghai, China
128. “Fuel cells, energy storage, and solar hydrogen: Toward a clean safe and sustainable energy future”, **10/6/11**, Center for Catalytic Science and Technology, Annual Review, University of Delaware, Newark, DE
129. “Fuel cells, energy storage, and solar hydrogen: Toward a clean safe and sustainable energy future”, **10/26/11**, Department of Chemical Engineering, Lehigh University, Bethlehem, PA
130. “Hydroxide exchange membranes: Fuel cells, energy storage, and solar hydrogen”, **11/9/11**, The 6<sup>th</sup> Sino-US Chemical Engineering Conference, Beijing, China
131. “Fuel cells, energy storage, and solar hydrogen: Toward a clean, safe and sustainable energy future”, **11/10/11**, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing, China
132. “Fuel cells, energy storage, and solar hydrogen: Toward a clean, safe and sustainable energy future”, **11/10/11**, School of Chemical Engineering, Beijing University of Chemical Technology, Beijing, China
133. “Fuel cells, energy storage, and solar hydrogen: Toward a clean, safe and sustainable energy future”, **11/11/11**, Department of Chemical Engineering, Tianjin University, Tianjin, China
134. “Fuel cells, energy storage, and solar hydrogen: Toward a clean, safe and sustainable energy future”, **11/14/11**, Department of Chemistry, Northeastern University, Shenyang, China

135. "Fuel cells, energy storage, and solar hydrogen: Toward a clean, safe and sustainable energy future", **12/5/11**, Department of Chemical Engineering, Stanford University, Palo Alto, CA
136. "Zeolite Thin Films: From Computer Chips to Space Station", **12/9/11**, Northeast Corridor Zeolite Association, University of Pennsylvania, Philadelphia, PA.
137. "Clean Energy: Flash without Flame", **3/7/12**, Distinguished Engineering Professor Inaugural Lecture, University of Delaware, Newark, DE
138. "Clean Energy: Flash without Flame", **3/29/12**, Daegu Gyeongbuk Institute of Science and Technology, Daegu, Korea
139. "Sustainable Energy: Flash without Flame", **4/15/12**, TEDxUD, Inaugural Meeting, University of Delaware, Newark, DE
140. "Clean Energy: Flash without Flame", **6/12/12**, University of Delaware Energy Institute (UDEI) Annual Review, University of Delaware, Newark, DE
141. "Zeolite Thin Films for Water and Energy Applications", **8/1/12 (Keynote Lecture)**, ZMPC 2012, Hiroshima, Japan
142. "Hydroxide Exchange Membranes for Energy Conversion and Storage", **8/22/2012**, The 1<sup>st</sup> International Symposium on Polymer Ecomaterials (PEM2012), Changchun, China
143. "Hydroxide exchange membrane fuel cells", **10/18/2012**, University of Delaware Energy Institute Fuel Cell Workshop.
144. "Zeolite thin films and coatings", **11/14/2012**, ExxonMobil, Clinton, NJ
145. "Hydroxide exchange membranes: Fuel cells, solar hydrogen and flow batteries", **1/10/2013**, Tsinghua and UD Workshop on Energy and Environment, Tsinghua University, Shenzhen, China.
146. "Clean energy: Hydroxide exchange membrane fuel cells and flow batteries", **5/15/13**, UD Energy Institute Annual Review.
147. "Hydroxide Exchange Membrane Fuel Cells: New Membranes and Catalysts", **6/14/2-13**, Dalian Institute of Chemical Physics Symposium on Fuel Cells, Dalian, China.
148. "Adamantane-Centered 3D Covalent Organic Frameworks as Ultra-Low-*k* Materials", **6/18/2013**, 6<sup>th</sup> International Zeolite Membrane Meeting (IZMM 2013), Jeju Island, South Korea.
149. "Hydroxide Exchange Membranes: Fuel cells, electrolyzers, solar hydrogen, and flow battery", **7/25/13**, Anion-Exchange Membranes for Energy Generation Technologies Workshop, University of Surrey, Guilford, UK.
150. "Nonprecious Metal Catalysts for Fuel Cells, Electrolyzers, and Solar Hydrogen Generators", **9/9/13**, American Chemical Society Meeting, Indianapolis, Indiana.
151. "Clean Energy: Flash without Flame", **9/26/13**, Department of Chemical Engineering, University of Missouri.
152. "Hydroxide exchange membranes and zeolite membranes", **11/8/13**, Air Liquide, Newark, DE.
153. "Clean Energy: Flash without Flame", **11/19/13**, University of Science and Technology of China, Hefei, China
154. "Hydroxide exchange membranes for electrochemical energy conversion and storage", **5/29/14**, Department of Applied Chemistry, Beijing University of Chemical Technology, Beijing, China.
155. "Hydroxide exchange membranes for electrochemical energy conversion and storage", **6/4/14**, The 5<sup>th</sup> AEARU5 Advanced Materials Workshop, Hong Kong University of Science and Technology, Hong Kong, China.
156. "Hydroxide exchange membranes for electrochemical energy conversion and storage", **7/20/14 (Keynote Lecture)**, The 10<sup>th</sup> International Congress on Membranes and Membrane Processes (ICOM2014), Suzhou, China.
157. "Hydroxide Exchange Membrane Fuel Cells: New Membranes and Catalysts", **7/24/14**, Wuhan University, China.
158. "Catalysts for Hydroxide Exchange Membrane Fuel Cells", **7/28/14**, Department of Applied Chemistry, Beijing University of Chemical Technology, Beijing, China.
159. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis for fuel cells", **11/14/14**, Annual Review, Center for Catalytic Science and Technology, University of Delaware, Newark, DE.
160. "Covalent organic frameworks (COFs): From design to applications", **11/12/14**, ExxonMobil, Clinton, NJ.
161. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis for fuel cells", **11/12/14**, The Catalysis Society of New York, Summerset, New Jersey.

162. "Polymer Hydroxide Exchange Membranes for Electrochemical Energy Conversion and Storage", **11/17/14**, Membrane Research and Innovation Activities around the World, American Institute of Chemical Engineers Annual Meeting, Atlanta, GA.
163. "Double Membrane Redox Flow Batteries for Economical and Efficient Renewable Electricity Storage", **11/17/14**, Inorganic Materials Plenary: Honorary Session for Prof. Michael Tsapatsis, American Institute of Chemical Engineers Annual Meeting, Atlanta, GA.
164. "Covalent organic frameworks (COFs): from design to applications", **12/15/14**, Northeast Corridor Zeolite Association, University of Pennsylvania, Philadelphia, PA.
165. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis and polymer electrolytes for fuel cells", **1/13/15**, Chemical Engineering, Drexel, Philadelphia, PA.
166. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis and polymer electrolytes for fuel cells", **3/5/15**, Chemical Engineering, Ohio State University, Columbus, OH.
167. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Non-precious metal hydrogen and oxygen evolution catalysts, **5/26/2015 (keynote)**, The Electrochemical Chemical Society Meeting, Chicago, IL.
168. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis and polymer electrolytes for fuel cells", **6/19/15**, Institute of Advanced Studies Lecture, Hong Kong University of Science and Technology, Hong Kong, China.
169. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis and polymer electrolytes for fuel cells", **6/22/15**, SUSTC Chemical Science Lectureship, South University of Science and Technology of China, Shenzhen, China.
170. "Polymer hydroxide exchange membrane fuel cells: Electrocatalysis and polymer electrolytes", **6/23/15**, Department of Chemistry, Xiamen University, Xiamen, China.
171. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis and polymer electrolytes for fuel cells", **6/25/15**, Ningbo Institute of Materials Technology and Engineering, Ningbo, China.
172. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis and polymer electrolytes for fuel cells", **9/30/15**, Chemical Engineering, University at Buffalo, Buffalo, NY.
173. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis and polymer electrolytes for fuel cells", **10/14/15 (Keynote Lecture)**, Sino-US Chemical Engineering Conference, Shanghai, China.
174. "Zeolite Thin Films: From Computer Chips to Space Station", **10/16/15**, Sinopec, Beijing, China.
175. "Covalent organic frameworks (COFs): From design to applications", **10/16/15**, Sinopec, Beijing, China.
176. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis and polymer electrolytes for fuel cells", **10/20/15**, Energy Institute, Texas A&M University, College Station, TX.
177. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis and polymer electrolytes for fuel cells", **10/21/15**, Chemical Engineering, University of Houston, Houston, TX.
178. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis and polymer electrolytes for fuel cells", **10/26/15**, Nano Science, Arizona State University, Tempe, AZ.
179. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis and polymer electrolytes for fuel cells", **1/22/16**, Fuel Cell Catalysis Workshop, Zhejiang University, Hangzhou, CHina.
180. "Organic covalent frameworks: From design to applications", **1/25/16**, Porous Materials Workshop, Jilin University, Zhuhai, China.
181. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis and polymer electrolytes for fuel cells", **3/30/16**, Department of Chemical Engineering, University of New Mexico, Albuquerque, NM.
182. "AMFC Challenges: Electrocatalysis", **4/1/16**, DOE AMFC Workshop, Phoenix, AZ.
183. "Electrocatalysis for hydroxide exchange membrane fuel cells, **5/30/16 (Keynote Lecture)**, ECS meeting, San Diego, CA.
184. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis and polymer electrolytes for fuel cells", **7/21/16 (Plenary Lecture)**, Global Chinese Chemical Engineering

- Symposium, Singapore.
185. "Covalent organic frameworks and membranes", **8/20/16 (Keynote Lecture)**, 7<sup>th</sup> International Zeolite Membrane Materials, Dalian, China
  186. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis and polymer electrolytes for fuel cells", **9/21/16**, Department of Chemistry, Nanjing University, Nanjing, China
  187. "Platinum-free fuel cells for zero-emission cars", **9/25/16 (Plenary Lecture)**, 2016 International Forum on Advanced Materials, organized by the Chinese Academy of Sciences and Engineering, Nanjing, China
  188. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis and polymer electrolytes for fuel cells", **9/29/16**, Department of Chemical Engineering, University of Oklahoma, Norman, Oklahoma
  189. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis", **11/21/16 (Plenary Lecture)**, Nanoscale Science and Engineering Forum Award Lecture, American Institute of Chemical Engineers, San Francisco, CA
  190. "Activity Targets for Nanostructured PGM-Free Catalysts in Hydroxide Exchange Membrane Fuel Cells", **12/7/2016**, Alkaline Membrane Fuel Cell: Catalysis and Materials, Wuhan University, Wuhan, China
  191. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis", **1/24/2017**, Chemical Engineering, University of Waterloo, Waterloo, Canada
  192. "Highly conductive, stable and robust hydroxide exchange membranes based on poly(aryl piperidinium)", **2/16/2017**, Polymers for Fuel Cells, Energy Storage, and Conversion, an ACS Polymer Division Workshop, Asilomar, CA
  193. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis", **4/6/17**, Department of Electrical and Computer Engineering, University of Delaware, Newark, DE
  194. "Toward a Distributed Renewable Electrochemical Energy and Mobility System: Electrocatalysis", **4/11/17**, Department of Chemical Engineering, Kansas State University, Manhattan, KS
  195. "Artificial roots and the ammonia economy: Electrochemical ammonia synthesis and direct ammonia fuel cells", **5/22/2017**, RE<sup>3</sup>Workshop 2017, University of Louisville, Louisville Kentucky
  196. "Platinum-free fuel cells for affordable zero-emission cars", **9/19/2017**, Chemical Engineering, Oklahoma State University,
  197. "Platinum-free fuel cells for affordable zero-emission cars", **10/12/2017**, Chemical Engineering, University of Virginia, Richmond, VA
  198. "Platinum-free fuel cells for affordable zero-emission cars", **10/31/2017**, Electrochemistry Fundamentals Tutorial, AIChE Annual Meeting, Minneapolis, MN
  199. "Polymer Electrolytes for Electrochemical Energy Devices", **11/1/2017**, Materials Science and Engineering Plenary, AIChE Annual Meeting, Minneapolis, MN
  200. "Hydroxide Exchange Membrane Fuel Cells for Affordable Zero-Emission Cars", The 19<sup>th</sup> National Conference on Electrochemistry & ECS-CSE Joint Symposium on Electrochemistry of Energy & Environment, **12/4/2017**, Shanghai, China
  201. "Platinum-free fuel cells for affordable zero-emission cars", **12/11/2017**, Institute of Chemistry, the Chinese Academy of Sciences, Beijing, China
  202. "Platinum-free fuel cells for affordable zero-emission cars", **12/13/2017**, Department of Materials Science and Engineering, Peking University, Beijing China
  - 203.