DI-JIA LIU

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EDUCATION

Postdoctoral Fellow, The University of California at Berkeley. 1988-1990
Ph. D in Physical Chemistry, The University of Chicago, 1987
B. Sc. in Chemistry, Peking University, 1982

EMPLOYMENT HISTORY

Senior Chemist: Chemical Sciences & Engineering, Argonne National Laboratory, 2016 – present.
Senior Scientist: Pritzker School of Molecular Engineering, University of Chicago, 2018 - present
Chemist, Argonne National Laboratory, 2002- 2016
Senior Principal Scientist, Honeywell International Inc., 2000-2002.
Principal Scientist, Honeywell (formerly AlliedSignal Inc.), 1996-2000.
Project Leader/Senior Research Chemist, AlliedSignal Inc., 1994-1996.
Research Chemist, AlliedSignal Inc., 1990-1994.

AWARDS & RECOGNITIONS

- ***R&D 100 Award*** "Versatile Method for Preparing Highly Effective Electro-catalysts for CO_2 to Chemical Conversion", 2020
- ***R&D 100 Award*** "Fuel Cell with Ultralow Pt Loading", 2019
- ***R&D 100 Award*** "Porous Nano-network Catalyst", 2016
- ***DOE Hydrogen Program Team Award*** *by DOE, Office of Energy Efficiency & Renewable Energy as a member of Hydrogen Sorption Center of Excellence*, 2010.
- ***Outstanding Mentor Award*** *by Office of Science, U. S. Department of Energy*, 2010.
- ***Argonne National Laboratory Pacesetter Award*** *for investigation of solid oxide fuel cell using microfocused synchrotron X-ray diffraction & radiographic method*, 2006.
- ***Honeywell Aerospace Technology Achievement Award*** *for developing microturbine emission control device*, 2001
- ***Honeywell Laboratory Special Recognition Award*** *for leadership in implementing 6-Sigma process for new technology development,* 2001
- ***Honeywell Power Systems Achievement Award*** *for developing microturbine power generator post emission treatment catalyst*, 2000
- ***USA Today Quality Cup Award*** *– a national recognition for achieving major technology and manufacturing quality improvement through 6-Sigma process in record time*, 2000
- ***AlliedSignal Corporate Technical Achievement Award*** *for developing the state-of-the-art aircraft ozone converter for Boeing 777 commercial aircraft*, 1998

- ***Certification of AlliedSignal 6-Sigma Black Belt*** *for implementing manufacturing process improvement and cost saving*, 1997
- ***AlliedSignal Special Technical Recognition Award*** *for developing scanning X-ray microscopic method for polymer characterization*, 1995
- ***Elizabeth R. Norton Prize*** *for Excellence in Graduate Research*, The University of Chicago, 1986

WORK EXPERIENCES

Experience at Argonne National Laboratory

- **Project Team Leader** in developing electrocatalysts and catalytic system for CO2 to chemical conversion. (LDRD-Argonne Strategic, 2020)
- **Project Team Leader** of developing PGM-free electrocatalyst for PEM electrolyzer, funded by DOE Office of Fuel Cell Technologies. **(**2017-)
- **Project Team Leader** of developing ultralow Pt fuel cell catalyst, funded by DOE Office of Fuel Cell Technologies. (2017-)
- **Project Team Leader** of a grant on exploring complex hydride based hydrogen storage material (**$1 million**, 3 years), funded by DOE Office of Fuel Cell Technologies. (2016-)
- **Co PI of** a TAMU led project in developing MOF-based sorption materials for hydrogen storage **(**2015 -2016)
- **Lead PI** of a new research grant on exploring metal-organic frameworks as precursors for next-generation non-precious metal electrode catalyst, funded by DOE Office of Fuel Cell Technologies. (2013-)
- **Lead PI** and **Team Leader** of an Argonne-U. of Chicago team in developing novel porous polymer based hydrogen storage material **($2 million**, 5 years), funded by DOE Office of Fuel Cell Technologies. (2007-2012)
- **Lead PI** in developing aligned carbon nanotube for fuel cell electrode support (**$1 million,** two-year), funded by DOE Office of Fuel Cell Technologies. (2006-2008)
- **PI** in developing low-cost diesel and logistic fuel reforming catalysts for on-board hydrogen production and synchrotron X-ray technique for characterizing solid oxide fuel cell, funded by DOE Office of Fossil Energy. (2002-2006)
- **Lead PI** in developing porous polymer network material for on-board methane storage. (LDRD-Argonne Director Competitive, 2015-)
- **Lead PI** in developing next-generation nano-network catalyst and electrocatalyst for fuel cell and biofuel applications. (LDRD-Argonne Director Competitive, 2014-)
- **Co-PI** in developing new cathode catalyst and characterization method for lithium-air battery application, (Grand Challenge Initiative-Argonne, 2010-2012).
- **Lead PI** in developing metal-organic framework materials for carbon dioxide sequestration, conversion and electrocatalysis application (LDRD-Argonne Director Competitive, 2009-2011)
- **Co-PI** of "Soft Catalysis" team, Materials for Energy Initiative, (LDRD-Argonne Strategic, 2011-2013)
- **Co-PI** in developing a time-resolved technique of studying catalytic behavior in picosecond domain using a laser/synchrotron X-ray technique, (LDRD-Argonne Strategic 2010-2012)

- **Lead PI** in developing carbon nanotube based electrode catalyst for PEM fuel cell and direct ethanol fuel cell application, (LDRD-Argonne Strategic/Director Competitive 2007, 2007-2009)
- **Lead PI** in developing organic hydride as hydrogen storage material (LDRD-Argonne Strategic, 2004-2005)
- **Lead PI** in developing porous organic polymer for hydrogen storage application (LDRD-Argonne Director Competitive, 2004-2006)

Selected Experience at Honeywell/AlliedSignal

- **PI** and **Team Leader** of several multimillion dollar internal and DoE funded PEM fuel cell programs.
- **Lead Scientist** of an award winning, the state-of-the-art ozone catalytic converter for Boeing 777 aircraft environmental control system that generated $36 million business for AlliedSignal.
- **PI** and **Team Leader** in developing an emission control device for microturbine power generator for Honeywell Distributed Power business.
- **PI** and **Team Leader** in developing NO_x reduction catalyst for automotive emission control application to support customers such as Delphi Automotive Catalysis Com. (formerly AlliedSignal Environmental Catalysis Com.)
- **PI** and **Team Leader** in developing in-situ, real time synchrotron X-ray absorption spectroscopy for catalyst structure/property relationship study and a synchrotron X-ray scanning microscopy for characterizing polymer blend material.
- **Team Leader** in implementing 6-Sigma process at AlliedSignal Polymer and Electronic Material manufacturing facilities, achieved combined annual cost saving of $1.5 million.
- ***Industrial Six-Sigma Black Belt*** and ***Trainer,*** in charge of training, mentoring and certifying Green Belts in applying statistical design principles in R&D organization.

GRADUATE SCHOOL & POSTDOC TRAININGS

- High resolution VUV-XUV spectroscopic and dynamic study of the molecular beam using non-linear frequency mixing (postdoc study under Y. T. Lee, Nobel Laureate 1986).
- High resolution laser spectroscopic study of molecular ions using infrared tunable diode laser and different frequency mixing dye laser (graduate study under T. Oka, F.R.S.).

SELECTED LIST OF INDUSTRIAL & INSTITUTIONAL TRAININGS

- *Energy I-Corp by US Department of Energy*
- *Managing New Product Development* – Kellogg School of Business, Northwestern University.
- *Honeywell Leadership Training*.
- *Honeywell (AlliedSignal) 6-Sigma Black Belt Training*.
- Others include *Project Management, Career Development, 2-day MBA in Ecomnomic Analysis, Reactor Engineering Design, ASPEN Training, etc*.

SYNERGTIC ACTIVITIES

Senior Scientist at Pritzker School of Molecular Engineering, University of Chicago, 2018 -

Graduate Faculty Scholar Member of Northern Illinois University 2013-
Operating Agent of Annex 31 on behalf of DOE for Advanced Fuel Cell Technology Collaboration Programmne (AFC TCP) under the International Energy Agency (IEA) 2013-
Director (2008), **President** (1999) and **Program Chair** (1998) of Chicago Catalysis Club, a local branch of North American Catalysis Society.
Member of American Association for the Advancement of Science
Member of the Electrochemical Society
Member of American Chemical Society.
Member of North American Catalysis Society.
Journal Reviewer of *Nature, Science, Nature Cat. Nature Comm., Ad. Mat., J. of Am. Chem. Soc., Angew. Chem. Int. Ed., Chem. Comm., Electro. Comm., Energy & Environ Sci., Appl. Cat., ChemSusChem, J Phys. Chem., J. Chem. Phys., J. Electro. Chem. Soc., and many more.*
Supervised 8 postdocs and nearly 20 guest graduate students, coop student researchers, undergraduate interns and Faculty and Student Research Team at Argonne.
Industrial Collaboration: Toyota, General Motor, Nissan, General Electric, United Technologies, Air Products, Cummins, Honeywell, GTI. etc.
National Lab Collaboration: LANL, NREL, PNNL, ORNL, SNL, LBNL, LLNL
University Collaboration: U Chicago, Northwestern U., Northern Ill U, U of Illinois, Texas A&M, U North Carolina, Southern Illinois U., etc.

JOURNAL PUBLICATIONS & PATENTS

Published **over 100** scientific papers including **5** in Science and Nature family, and received **29** granted US patents in the fields of fuel cell, nanomaterials, electrocatalysis, CO_2 conversion, hydrogen storage and production, battery, environmental catalysis, advanced material characterization and physical chemistry in general.

2021

1. "Metal–Organic Frameworks and Metal–Organic Gels for Oxygen Electrocatalysis: Structural and Compositional Considerations" Hao Wang, Biao-Hua Chen, and Di-Jia Liu, *Adv. Mater.* **2021**, 2008023 **Corresponding Author**
2. "Rational design of platinum group metal free electrocatalysts for oxygen reduction reaction" Hao Wang, Di-Jia Liu, *Current Opinion in Electrochemistry*, **2021**, 28:100724 **Corresponding Author**

2020

3. "Capacitive Deionization Using Carbon Derived from an Array of Zeolitic-Imidazolate Frameworks" Hao Wang, Louis Edaño, Lauren Valentino, Yupo J. Lin, Varada Menon Palakkal, Dong-Li Hu, Biao-Hua Chen, Di-Jia Liu, *Nano Energy*, 77 (**2020**) 105304 **Corresponding Author**
4. "Highly selective electrocatalytic CO_2 reduction to ethanol by metallic clusters dynamically formed from atomically dispersed copper" Haiping Xu, Dominic Rebollar, Haiying He, Lina Chong, Yuzi Liu, Cong Liu, Cheng-Jun Sun, Tao Li, John V. Muntean, Randall E. Winans, Di-Jia Liu and Tao Xu, *Nature Energy*, **5**, 623–632 (**2020**) **Corresponding Author** doi.org/10.1038/s41560-020-0666-x

2019

5. “Impacts of Imidazolate Ligand to Performance of Zeolitic-Imidazolate Framework-Derived Oxygen Reduction Catalysts”, Hao Wang, Lauren R. Grabstanowicz, Heather M. Barkholtz, Dominic Rebollar, Zachary B. Kaiser, Dan Zhao, Biao-Hua Chen, and Di-Jia Liu, *ACS Energy Lett.* **2019**, 4, 10, 2500-2507. doi.org/10.1021/acsenergylett.9b01740
6. “An International Laboratory Comparison Study of Volumetric and Gravimetric Hydrogen Adsorption Measurements”, Katherine Hurst, Thomas Gennett, Jesse Adams, Mark D. Allendorf, Rafael Balderas-Xicohtencatl, Marek Bielewski, Bryce Edwards, Laura Espinal, Brent Fultz, Michael Hirscher, M. Sterlin L. Hudson, Zeric Hulvey, Michel LaTroche, Di-Jia Liu, Matthew Kapelewski, Emilio Napolitano, Zachary Perry, Justin Purewal, Vitalie Stavila, Mike Veenstra, James L. White, Yuping Yuan, Hong-Cai Zhou, Claudia Zlotea, and Philip Parilla, *ChemPhysChem* 2019, *20*, 1–14 **doi.org/10.1002/cphc.201900166**
7. “Insights into Structural Evolution of Lithium Peroxides with Reduced Charge Overpotential in Li−O_2 System” Guoqiang Tan, Lina Chong, Chun Zhan, Jianguo Wen, Lu Ma, Yifei Yuan, Xiaoqiao Zeng, Fangmin Guo, John E. Pearson, Tao Li, Tianpin Wu, Di-Jia Liu, Reza Shahbazian-Yassar, Jun Lu, Cong Liu, and Khalil Amine, *Adv. Energy Mater*. **2019, 1900662**
8. “Engineering Fe–Fe 3 C@Fe–N–C Active Sites and Hybrid Structures from Dual Metal–Organic Frameworks for Oxygen Reduction Reaction in H2 –O2 Fuel Cell and Li–O2 Battery” Hao Wang, Feng-Xiang Yin, Ning Liu, Rong-Hui Kou, Xiao-Bo He, Cheng-Jun Sun, Biao-Hua Chen, Di-Jia Liu, and Hua-Qiang Yin. *Adv. Funct. Mater.* **2019**, 1901531. DOI: 10.1002/adfm.201901531

2018

9. “Ultralow-loading platinum-cobalt fuel cell catalysts derived from imidazolate frameworks” Lina Chong, Jianguo Wen, Joseph Kubal, Fatih G. Sen, Jianxin Zou, Jeffery Greeley, Maria Chan, Heather Barkholtz, Wenjiang Ding, Di-Jia Liu, *Science* **362**, 1276–1281 (2018), DOI:10.1126/science.aau0630
10. “Spatiotemporal Operando X-ray Diffraction Study on Li–Air Battery”, Di-Jia Liu and Jiang-Lan Shui, Book chapter in *Metal–Air Batteries: Fundamentals and Applications,* First Edition. Edited by Xin-bo Zhang. **2018** Wiley-VCH Verlag GmbH & Co. KGaA.
11. “An assessment of strategies for the development of solid-state adsorbents for vehicular hydrogen storage” M. D. Allendorf, Z. Hulvey, T. Gennett, A. Ahmed, T. Autrey, J. Camp, E. S. Cho, H. Furukawa, M. Haranczyk, M. Head-Gordon, S. Jeong, A. Karkamkar, Di-Jia Liu, J. R. Long, K. R. Meihaus, I. H. Nayyar, R. Nazarov, D. J. Siegel, V. Stavila, J. J. Urban, S. P. Veccham and B. C. Wood, *Energy Environ. Sci.* 2018**, 11,** 2784--2812
12. “Hydrogen storage and fuel cells”, Di-Jia Liu, AIP Conference Proceedings, **1924**, 020008 (2018)

2017

13. “High-performance oxygen reduction catalysts in both alkaline and acidic fuel cells based on pre-treating carbon material and iron precursor” Ping Song, Heather Barkholtz, Ying Wang, Weilin Xu, Di-Jia Liu, Lin Zhuang, Science Bulletin 62(23) · October 2017
14. "High-Performance Platinum Single-Atom Electrocatalyst for Oxygen Reduction Reaction" by Jing Liu, Menggai Jiao, Lanlu Lu, Heather Barkholtz, Yuping Li, Ying Wang, Luhua Jiang, Zhijian Wu, Di-Jia Liu, Lin Zhuang, Chao Ma, Jie Zeng, Bingsen

Zhang, Dangsheng Su, Ping Song, Wei Xing, Weilin Xu, Ying Wang, Zheng Jiang, and Gongquan Sun, *Nature Communications*, | *8:15938* | *DOI: 10.1038/ncomms15938*.

15. "MO-Co@N-Doped Carbon (M = Zn or Co): Vital Roles of Inactive Zn and Highly Efficient Activity toward Oxygen Reduction/Evolution Reactions for Rechargeable Zn–Air Battery" Biaohua Chen, Xiaobo He, Fengxiang Yin,* Hao Wang, Di-Jia Liu, Ruixing Shi, Jinnan Chen, and Hongwei Yin, *Adv. Funct. Mater*. **2017**, 1700795
16. "Towards highly efficient electrocatalyst for Li−O2 batteries using biphasic N-doping cobalt@graphene multiple-capsule heterostructures," Guoqiang Tan, Lina Chong, Rachid Amine, Jun Lu, Cong Liu, Yifei Yuan, Jianguo Wen, Kun He, Xuanxuan Bi, Yuanyuan Guo, Hsien-Hau Wang, Reza Shahbazian-Yassar, Said Al Hallaj, Dean J. Miller, Dijia Liu, and Khalil Amine, *Nano Lett.*, 2017, 17 (5), pp 2959–2966, **DOI:** 10.1021/acs.nanolett.7b00207
17. "Insights into the Distinct Lithiation/Sodiation of Porous Cobalt Oxide by in Operando Synchrotron X-ray Techniques and ab initio Molecular Dynamics Simulations" Xu, Gui-Liang; Sheng, Tian; Chong, Lina; Ma, Tianyuan; Sun, Chengjun; Zuo, Xiaobing; Liu, Di-Jia; Ren, Yang; Zhang, Xiaoyi; Liu, Yuzi; Heald, Steve; Sun, Shi-Gang; Chen, Zonghai; Amine, Khalil, *Nano Lett.*, **2017**, *17* (2), pp 953–962
18. "ZIF-67 incorporated with carbon derived from pomelo peels: A highly efficient bifunctional catalyst for oxygen reduction/evolution reactions" Hao Wang, Feng-Xiang Yin, Biao-Hua Chen, Xiao-Bo He, Peng-Liang Lv, Cai-Yun Ye, Di-Jia Liu, *Applied Catalysis B: Environmental* 205 (**2017**) 55–67
19. (Invited Contribution) "Advancements in rationally designed PGM-free fuel cell catalysts derived from metal–organic frameworks" Heather M. Barkholtz and Di-Jia Liu, *Materials Horizons*, **2017**, 4, 20—37, DOI: 10.1039/c6mh00344c

2016

20. "Wrapped by graphene": An efficient way to achieve high capacity, reversible hydrogen storage through nanoencapsulated hydride, J. Zou, L. Chong, D.-J. Liu, et. al. *Science*, **2016**, *351* (6278), 1223, Special issue.
21. "Lithium Assisted "Dissolution–Alloying" Synthesis of Nanoalloys from Individual Bulk Metals", Heather M. Barkholtz, James R. Gallagher, Tao Li, Yuzi Liu, Rachel Koritala, Randall E. Winans, Jeffrey T. Miller, Di-Jia Liu, Tao Xu, *Chemistry of Materials*, **2016,** 28 (7), pp 2267–2277, DOI: 10.1021/acs.chemmater.6b00216.
22. (Invited Contribution) "Investigation of Oxygen Reduction Activity of Catalysts Derived from Co and Co/Zn Methyl-Imidazolate Frameworks in Proton Exchange Membrane Fuel Cells" Lina Chong, Gabriel A. Goenaga, Kia Williams, Heather M. Barkholtz, Lauren R. Grabstanowicz, Jeremy A. Brooksbank, Alex B. Papandrew, Thomas A. Zawodzinski Jr., Jianxin Zou, Shengqian Ma, and Di-Jia Liu, *ChemElectroChem*, **2016**, *3***,** 1 – 6, DOI: 10.1002/celc.201600163
23. (Invited Contribution) "Non-Precious Metal Catalysts Prepared By Zeolitic Imidazolate Frameworks: The Ligand Influence to Morphology and Performance" H. M. Barkholtz, L. Chong, Z. B. Kaiser, D. J. Liu, *FUEL CELLS* 16, **2016**, No. 4, 428–433 DOI: 10.1002/fuce.201500164
24. "Heterogeneous silicon mesostructures for lipid-supported bioelectric interfaces" Yuanwen Jiang, João L. Carvalho-de-Souza, Raymond C. S. Wong, Zhiqiang Luo, Dieter

Isheim, Xiaobing Zuo, Alan W. Nicholls, Il Woong Jung, Di-Jia Liu, Yucai Wang, Vincent De Andrade, Xianghui Xiao, Luizetta Navrazhnykh, David N. Seidman, Francisco Bezanilla, Bozhi Tian, *Nature Materials* | VOL 15 | September 2016 | 1023

25. (Invited Contribution) "Enhanced Performance of non-PGM Catalysts in Air Operated PEM-Fuel Cells" Heather M. Barkholtz, Lina Chong, Zachary B. Kaiser, Tao Xu, and Di-Jia Liu, *International Journal of Hydrogen Energy,* **2016,** *41 pp. 22598-22604 DOI:10.1016/j.ijhydene.2016.08.193.*

2015 & Before

26. "High-efficiency non-precious metal catalyst containing metal-organic framework precursor inside of carbon nano-network" Jianglan Shui, Chen Chen, Lauren R. Grabstanowicz, Dan Zhao and Di-Jia Liu*, *Proceedings of National Academy of Sciences*, **2015,** vol. 112, no. 34, 10629–10634 doi/10.1073/pnas.1507159112

27. "$NaBH_4$ in "Graphene Wrapper": Significantly Enhanced Hydrogen Storage Capacity and Regenerability through Nano-encapsulation", Lina Chong, Xiaoqin Zeng, Wenjiang Ding, Di-Jia Liu and Jianxin Zou, *Advanced Materials*, **2015,** *27*, 5070–5074, DOI: 10.1002/adma.201500831

28. (Invited Contribution) "Highly Active Non-PGM Catalysts Prepared from Metal-Organic Frameworks", Heather M. Barkholtz, Lina Chong, Zachary B. Kaiser, Tao Xu, and Di-Jia Liu*, Special issue on Polymer Electrolyte Membrane Fuel Cell in *Catalysis* **2015**, *5*, 955-965; doi:10.3390/catal5020955

29. "Catalytic Reaction on FeN4/C Site of Nitrogen Functionalized Carbon Nanotubes as Cathode Catalyst for Hydrogen Fuel Cells" Feng Gao, Guang-Lin Zhao, Zhou Wang, Diola Bagayoko, Di-Jia Liu, *Catalysis Communications* 62 (**2015**) 79–82, doi:10.1016/j.catcom.2015.01.015

30. "Highly Efficient Non-Precious Metal Electrocatalysts Prepared from One-Pot Synthesized Zeolitic Imidazolate Frameworks (ZIFs)" Dan Zhao, Jiang-Lan Shui, Lauren R. Grabstanowicz, Chen Chen, Sean M. Commet, Tao Xu, Jun Lu, and Di-Jia Liu*, *Advanced Materials*, **2014**, *26*, 1093–1097 DOI: 10.1002/adma.201304238. (Frontpiece article)

31. "*In Operando* spatiotemporal study of Li_2O_2 grain growth and distribution inside of operating Li-O_2 batteries" Jiang-Lan Shui, John S. Okasinski, Chen Chen, Jonathan D. Almer and Di-Jia Liu*, *ChemSusChem* **2014**, *7*, 543 – 548, DOI: 10.1002/cssc.

32. "Holistic View on Chemical Processes in Li-O_2 Battery from *Operando* Spatiotemporal Study" J. Shui, J. Okasinski, P. Kenesei, J. Almer and Di-Jia Liu*, *ECS Transaction* 58 (12) 3-14 (**2014**)

33. "Highly-Active and "Support-free" Oxygen Reduction Catalyst Prepared from Ultrahigh Surface Area Porous Polyporphyrin" Shengwen Yuan, Jiang-Lan Shui, Lauren Grabstanowicz, Chen Chen, Sean Commet, Briana Reprogle, Tao Xu, Luping Yu and Di-Jia Liu*, *Angew. Chem. Int. Ed.*, **2013,** 52(32), 8349–8353 DOI: 10.1002/anie.201302924

34. "Reversibility of anodic lithium in non-aqueous Li-O2 batteries" Jiang-Lan Shui, John S. Okasinski, Peter Kenesei, Howard A. Dobbs, Dan Zhao, Jonathan D. Almer, and Di-Jia Liu*, *Nature Comm*. **2013** 4, 2255, DOI: 10.1038/ncomms3255

35. "Degradation and revival of Li-O_2 battery cathode" Jiang-Lan Shui, Hsien-Hau Wang, and Di-Jia Liu*, *Electrochem Comm*. **2013** doi: 10.1016/j.elecom.2013.05.020

36. (Invited article in special issue Oka Festschrift) "Photodissociation Structural Dynamics of Triruthenium Dodecacarbonyl Investigated by X-Ray Transient Absorption Spectroscopy" Michael R. Harpham, Andrew B. Stickrath, Xiaoyi Zhang, Jier Huang, Michael W. Mara, Lin X. Chen, and Di-Jia Liu*, *J. Phys. Chem. A.* **2013** *117* (39), pp 9807–9813, DOI: 10.1021/jp312663q

37. "A Facile Oxidative Conversion of TiH_2 to High Concentration $Ti3^+$-Self-Doped Rutile TiO_2 with Visible-Light Photoactivity" Lauren R. Grabstanowicz, Shaomin Gao, Tao Li, Robert M. Rickard, Tijana Rajh, Di-Jia Liu, and Tao Xu, *Inorg. Chem.* **2013** 52(7): 3884-90 DOI: 10.1021/ic3026182

38. "Performance Improvement of Fuel Cells using Platinum Functionalized Aligned Carbon Nanotubes", Yuan Yuan, Joshua Smith, Gabriel Goenaga, Di-Jia Liu, Bo Zhou, and Jingbo Liu, *J. of Experimental Nanoscience*, **2013**, Vol. 8, No.6 , 633-643, DOI: 10.1080/17458080.2011.608728

39. "Porous Organic Polymers Containing Carborane for Hydrogen Storage", Shengwen Yuan, Desiree White, Alex Mason, and Di-Jia Liu*, *Int. J. of Energy Research*. **2013**, 37 (7) 732-740. DOI: 10.1002/er.1886.

40. "New Approach to High-Efficiency Non-PGM Catalysts Using Rationally Designed Porous Organic Polymers" S. Yuan, G. Goenaga, L. Grabstanowicz, J. Shui, C. Chen, S. Commet, B. Reprogle and Di-Jia Liu*, *ECS Transaction*, **2013** 58(1): 1671-1680; doi:10.1149/05801.1671ecst

41. "Understanding of Electrolyte Stability and Its Impact to Lifespan of Li-O2 Battery" Jianglan Shui, John Okasinski, Dan Zhao, Jon Almer and Di-Jia Liu*, *ECS Transactions*, 50 (25) 37-45 (**2013**)

42. Fe/N/C composite in Li–O_2 battery: Studies of the catalytic structure and activity towards oxygen evolution reaction, Jiang–Lan Shui, Naba K. Karan, Mahalingam Balasubramanian, Shu–You Li and Di-Jia Liu*, *J. Am. Chem. Soc.* **2012**, *134 (40), 16654–16661* doi:10.1021/ja3042993

43. "Micro-focused X-ray study on precipitate formation in non-aqueous Li-O2 batteries" Jiang-Lan Shui, John S. Okasinski, Dan Zhao, Jonathan D. Almer and Di-Jia Liu*, *ChemSusChem*, **2012**, 5, 2421 – 2426, DOI: 10.1002/cssc.201200555

44. "Iron imidazolate framework as precursor for electrocatalysts in polymer electrolyte membrane fuel cells", Dan Zhao, Jiang-Lan Shui, Chen Chen, Xinqi Chen, Briana M. Reprogle, Dapeng Wang and Di-Jia Liu*, *Chem. Sci.*, **2012**, 3 (11), 3200 – 3205**,** DOI: 10.1039/c2sc20657a

45. "What Happens When a Photon Strikes (Fulvalene)tetracarbonyl-diruthenium? An Answer by X-ray Transient Absorption and Picosecond IR Spectroscopy", M. R. Harpham, S. C. Nguyen, Z. Hou, J. C. Grossman, C. B. Harris, M. W. Mara, A. B. Stickrath, Y. Kanai, A. M. Kolpak, D. Lee, D-J Liu, J. P. Lomont, K. Moth-Poulsen, N. Vinokurov, L. X. Chen, and K. Peter C. Vollhardt, *Angew. Chem. Int. Ed*. **2012**, 51, 7692 –7696

46. "Tunability of Band Gaps in Metal-Organic Frameworks", Chi-Kai Lin, Dan Zhao, Wen-Yang Gao, Zhenzhen Yang, Jingyun Ye, Tao Xu, Qingfeng Ge, Shengqian Ma, and Di-Jia Liu*, **DOI:** 10.1021/ic301189m, *Inorg. Chem.* **2012**, 51, 9039−9044
47. "Improving Hydrogen Adsorption Enthalpy through Coordinatively Unsaturated Cobalt in Porous Polymer", S. Yuan, D. White, A. Mason, B. Reprogle, M. Ferrandon, L. Yu, and Di-Jia Liu*, *Macromolecular Rapid Communication*. **2012**, *33*, 407−413, DOI = 10.1002/marc.201100797
48. "Nanoporous Porphyrin Polymers for Gas Storage and Separation", Zhuo Wang, Shengwen Yuan, Alex Mason, Briana Reprogle, Di-Jia Liu*, and Luping Yu, *Macromolecules* **2012**, *45* (18), pp 7413–7419
49. "Direct Synthesis of Bimetallic Pd_3Ag Nanoalloys from Bulk Pd_3Ag Alloy", C-K Lin, Y-G Lin, T. Wu, H. M. Barkholtz, Q. Lin, H. Wei, D. L. Brewe, J. T. Miller, D-J Liu, Y. Ren, Y. Ito, and T. Xu, *Inorg. Chem*. **2012**, 51, 13281−13288
50. "Low-cost, high-efficiency non-PGM cathode catalysts using MOFs as precursors", Dan Zhao, Jianglan Shui, Chen Chen, Sean Comment, Briana Reprogle and Di-Jia Liu*, *ECS Transaction* **2012**, 50(2) 1861.
51. "Visible-Light Photocatalytic SiO2/TiO2-xCx/C Nanoporous Composites Using TiCl4 as Precursor for TiO2 and Polyhydroxyl Tannin as Carbon Source", Juzheng Zhang, Lauren R. Grabstanowicz, Shanmin Gao, Narayan S. Hosmane, Baibiao Huang, Ying Dai, Di-Jia Liu and Tao Xu, *Catalysis Science & Technology* **2012**, 2, 390-399 DOI:10.1039/C1CY00403D
52. "Cobalt Imidazolate Framework as Precursor for Oxygen Reduction Reaction Electrocatalyst", Shengqian Ma, Gabriel Goenaga, Ann Call and Di-Jia Liu*, *Chemistry: A European Journal*, (**2011**) 17, 2063 – 2067.
53. "Solid Dye-Sensitized Solar Cells Prepared through a Counter Strategy for Filling of Solid Hole Transporter", Zhenzhen Yang, Kate C. Power, Di-Jia Liu, Yang Ren, and Tao Xu, *Journal of Renewable and Sustainable Energy*, 3, 063101 (**2011**), doi:10.1063/1.3658435
54. "New Approaches to Non-PGM Catalysts through Rational Design", Di-Jia Liu*, Gabriel Goenaga, Shengqian Ma, Shengwen Yuan, Jianglan Shui, *ECS Transactions* **2011**, 30, 97-104
55. "Platinum Decorated Aligned Carbon Nanotubes: Electrocatalyst for Improved Performance of Proton Exchange Membrane Fuel Cells", Yuan Yuan, Joshua A. Smith, Gabriel Goenaga, Di-Jia Liu*, Zhiping Luo, and Jingbo Liu, *Journal of Power Sources* 196 (**2011**) 6160–6167
56. Microporous Polyphenylenes with Tunable Pore Size for Hydrogen Storage, Shengwen Yuan, Brian Dorney, Desiree White, Scott Kirklin, Peter Zapol, Luping Yu and Di-Jia Liu*, *Chem. Comm*. **2010**, 46, 4547 - 4549
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ISSUED PATENTS & PENDING APPLICATIONS

Issued US Patents

1. Nanofiber electrocatalysts **US Patent 11,033,888**
2. Carbon dioxide reduction electro catalysts prepared for metal organic frameworks, **US Patent 10,978,718**
3. Carbon supported single atom carbon dioxide reduction electro catalysts, **US Patent 10,844,501**
4. Nanofibrous electrocatalyst including nanofibrous continuous network of graphitic nanofibers having embedded catalytically active metal moieties, **US Patent 10,700,361**
5. Synthesis of electrocatalysts using metal-organic framework materials, **US Patent 10,326,145**
6. Non-platinum group metal electrocatalysts using metal organic framework materials and method of preparation, **US Patent 10,305,115**
7. Non-platinum group metal electrocatalysts using metal organic framework materials and method of preparation, **US Patent 10,305,114**
8. Low platinum catalyst and method of preparation, **US Patent 9,825,308**
9. Electrocatalysts using porous polymers and method of preparation. **US Patent 9,406,943**
10. Nanofibrous electrocatalysts, **US Patent 9,350,026**
11. Electrocatalysts using porous polymers and method of preparation. **US Patent 9012344**.

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13. Porous polymeric materials for hydrogen storage, **US Patent 8,410,185**
14. Method of fabricating electrode catalyst layers with directionally oriented carbon support for proton exchange membrane fuel cell, **US Patent 8,137,858**
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17. Aligned carbon nanotube with electro-catalytic activity for oxygen reduction reaction. **US Patent 7767616**
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22. Autothermal reforming catalyst with perovskite-type structure. **US Patent 7,507,690**
23. Environmental control system including ozone destroying catalytic converter having anodized and washcoat layer. **US Patent 7,037,878**
24. Tubular catalytic aircraft precooler. **US Patent 6,962,193**
25. Emissions Control in a Recuperated Gas Turbine Engine. **US Patent 6,584,760**
26. Environmental control system including ozone destroying catalytic converter having anodized and washcoat layer. **US Patent 6,576,199**
27. Catalytic adsorption and oxidation based carbon monoxide sensor and detection method. **US Patent 6,550,310**
28. Method of preparing a catalyst layer over a metallic surface of a recuperator. **US Patent 6,540,843**
29. An electro-catalytic oxidation (ECO) device to remove CO from reformate for fuel cell application. **US Patent 6,245,214**

Pending Applications

30. Removing CO from reformate for fuel cell application using a regenerable CO adsorption/catalytic oxidation bed (ACO) device. **WO 01/83365**
31. Regeneration methods to remove carbon monoxide from reformate fuel using an adsorption/electro-catalytic oxidation (ECO) approach. **US Patent Application 20010037948**
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33. Multiple layer electrode for improved performance. **US Patent Application 20020068213**
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