Jack (Liliang) Huang

Phone: 949-522-1520 | **Email:** jackhuanghll@gmail.com | U.S. Green Card Holder

Engineer with 10+ years of experience in nanomaterials and batteries design, fabrication, and testing. Excellent verbal and written communication skills demonstrated through 20+ publications, 9 patents, and 8 conference presentations. Extensive experience leading multidiscipinary groups.

EDUCATION

09/2015-06/2020 **Ph.D. in Materials Science and Engineering, Northwestern University**

09/2011-06/2015 **B.S. in Materials Science and Engineering, Zhejiang University, China (Rank: 1/99)**

SKILLS

Nanofabrication (etching, EBL, photolithography, FIB, E-beam and thermal evaporation, sputtering, colloidal nanoparticle synthesis), materials characterization (TEM, SEM, EDX, XRD, XAS, XPS, AFM, etc), failure analysis, quality validation, coding (Python, MATLAB, etc.), design of experiments, Li- and Na-ion battery electrode/solid-state electrolyte synthesis, electrochemical testing (CV, GITT, EIS, etc.) using various electrochemistry instruments (Arbin, BioLogic, Maccor, etc.)

EXPERIENCE

03/2023-present **R&D Tech Lead, Sidus Energy**

- Collaborating with IBM's battery research team on joint R&D efforts to commercialize innovative transition metal-free battery technology
- Performing design of experiments for materials processing, battery assembly, and testing, and conducting root cause analysis of failures to improve yield
- Introduced a dry-processing technique for the transition metal-free cathode, streamlining the manufacturing process and enhancing energy density
- Developed a series of novel electrolytes with exceptional compatibility with lithium metal anodes, effectively reducing self-discharge and enhancing battery lifespan
- Collaborating with external vendors to validate and optimize materials, including carbon, separators, and cathode materials
- Interfacing with internal battery manufacturing teams to scale up processes for mass production
- Drafting patents and technical reports on innovative battery materials technology

09/2020-02/2023 **Postdoctoral Scholar, Berkeley Lab, USA** **Advisor:** Prof. Gerbrand Ceder

- Developed next-generation cathode and solid-state electrolyte materials for Li-ion and Na-ion batteries, leading to two publications
- Pioneered a novel design strategy to simultaneously improve rate performance (by 30%) and cycling lifetime (by 5%) of Li-ion batteries by introducing Li-deficiency into cation-disordered rocksalt cathodes
- Improved the energy density of cation-disordered batteries by incorporating an ion-exchange-based chemical processing strategy
- Introduced the concept of high-entropy into solid-state electrolyte design, achieving orders-of-magnitude higher ionic conductivities in sodium NASICON structures, even with fixed Na contents
- Performed design of experiments to optimize the performance of battery materials and applied failure analysis techniques to improve yield
- Characterized novel cathode materials using synchrotron X-ray absorption/scattering, electrochemical tests (GITT, EIS, CV, etc.), TEM, SEM, EDS, etc.
- Led 4 projects with interdisciplinary teams of 20+ members from Berkeley Lab, UC Berkeley, Argonne National Laboratory, and Brookhaven National Laboratory
- Mentored 2 first-year graduate students

09/2015-06/2020 **Ph.D. Student, Northwestern University, USA** **Advisor:** Prof. Chad A. Mirkin

- Optimized lithography-based techniques (photolithography, scanning probe block-copolymer lithography, and polymer pen lithography) to fabricate nanoparticles arrays for (electro)catalyst screening

- Pioneered several scalable and general strategies to synthesize/manufacture novel, highly-active nanoparticle-based catalysts which are actively being used in Teraprint and Mattiq (start-up companies)
- Explored nanoparticle catalyst properties and formation mechanisms using techniques including TEM, SEM, EDS, AFM, XPS, XRD, cyclic voltametry, chronoamperometry, etc.
- Led 8 projects with interdisciplinary teams of 20+ members from 4 deparments leading to 9 journal publications, 3 conference presentations, and 2 patent applications
- Represented the group to meet with industry associates and helped write several multi-PI proposals resulting in >$10 million in funding from NSF, DOE, and private foundations

PUBLICATIONS (✶ indicates equal contribution)

[20] **Huang, L.**; Liu, M.; Lin, H.; Xu, Y.; Wu, J.; Dravid, V. P.; Wolverton, C.; Mirkin, C. A. High-index facet nanoparticle shape regulation by dealloying. *Science* **2019**, *365*, 1159

[19] Shen, B.✶; **Huang, L.**✶; Shen, J.; Hu, X.; Zheng, C.; Wolverton, C.; Mirkin, C. A. Morphology engineering in multi-component hollow metal chalcogenide nanoparticles. *ACS Nano* **2023**, *17*, 4642

[18] **Huang, L.**; Zhong, P.; Ha, Y.; Cai, Z.; Xie, F.; Byeon, Y.; Huang, T.; Sun, Y.; Hau, H.; Kim, H.; Balasubramanian, M.; McCloskey, B. D.; Yang, W.; Ceder, G. Optimizing Li-excess cation-disordered rocksalt cathode design through partial Li deficiency. *Adv. Energy Mater.* **2023**, *13*, 2202345

[17] **Huang, L.**; Shen, B.; Lin, H.; Shen, J.; Jibril, L.; Zheng, C.; Wolverton, C.; Mirkin, C. A. Regioselective deposition of metals on seeds within a polymer matrix. *J. Am. Chem. Soc.* **2022**, *144*, 4792

[16] Shen, B.✶; **Huang, L.**✶; Shen, J.; He, K.; Zheng, C. Z.; Dravid, V. P.; Wolverton, C.; Mirkin, C. A. Crystal structure engineering in multimetallic high-index facet nanocatalysts. *Proc. Natl. Acad. Sci. U.S.A.* **2021**, *118*, e2105722118

[15] Shen, B.✶; **Huang, L.**✶**;** Shen, J.; Meng, L.; Kluender, E. J.; Wolverton, C.; Tian, B.; Mirkin, C. A. Synthesis of metal-capped semiconductor nanowires from heterodimer nanoparticle catalysts. *J. Am. Chem. Soc.* **2020**, *142*, 18324

[14] **Huang, L.**; Zheng, C. Z.; Shen, B.; Mirkin, C. A. High-index facet metal alloy nanoparticles as fuel cell electrocatalysts. *Adv. Mater.* **2020**, *32*, 2002849

[13] **Huang, L.**; Lin, H.; Zheng, C. Z.; Kluender, E. J.; Golnabi, R.; Shen, B.; Mirkin, C. A. Multimetallic high-index faceted, heterostructured nanoparticles. *J. Am. Chem. Soc.* **2020**, *142*, 4570

[12] **Huang, L.**; Chen, P.; Liu, M.; Fu, X.; Gordiichuk, P.; Yu, Y.; Wolverton, C.; Kang, Y.; Mirkin, C. A. Catalyst design by scanning probe block copolymer lithography. *Proc. Natl. Acad. Sci. U.S.A.* **2018**, *115*, 3764

[11] Chen, P.; Du, J. S.; Meckes, B.; **Huang, L.;** Xie, Z.; Hedrick, L. J.; Dravid, P. V.; Mirkin, C. A. The structural evolution of three-component nanoparticles in polymer nanoreactors. *J. Am. Chem. Soc.* **2017**, *139*, 9876

[10] **Huang, L.**; Mao, Y.; Wang, G.; Xia, X.; Xie, J.; Zhang, S.; Du, G.; Cao, G.; Zhao, X. Ru-decorated knitted Co_3O_4 nanowires as robust carbon/binder-free catalytic cathode for lithium-oxygen batteries. *New J. Chem.* **2016**, *40*, 6812

[9] Arshad, M.; **Huang, L.**; Ullah, A. Lipid-derived monomer and corresponding bio-based nanocomposites. *Polym. Int.* **2016**, *65*, 653

[8] Wang, G.; **Huang, L.**; Huang, W.; Xie, J.; Du, G.; Zhang, S.; Zhu, P.; Cao, G.; Zhao, X. Nanostructured porous RuO_2/MnO_2 as highly efficient catalyst for high-rate Li–O_2 batteries. *Nanoscale* **2015**, *7*, 20614

[7] Wang, G.; **Huang, L.**; Liu, S.; Xie, J.; Zhang, S.; Zhu, P.; Cao, G.; Zhao, X. Understanding moisture and carbon dioxide involved interfacial reactions on electrochemical performance of lithium-air batteries catalyzed by gold/manganese-dioxide. *ACS Appl. Mater. Interfaces* **2015**, *7*, 23876

[6] Zhang, Y.; Zhu, P.; **Huang, L.**; Xie, J.; Zhang, S.; Cao, G.; Zhao, X. Few-layered SnS_2 On few-layered reduced graphene oxide as Na-ion battery anode with ultralong cycle life and superior rate capability. *Adv. Funct. Mater.* **2015**, *25*, 481

[5] Lai, L.; **Huang, L.;** Wu, J. $K_2TiO(C_2O_4)_2$-mediated synthesis of rutile TiO_2 mesocrystals and their ability to assist photodegradation of sulfosalicylic acid in water. *RSC Adv.* **2014**, *4*, 49280

[4] Koo, K.; Shen, B.; Baik, S.; Mao, Z.; Smeets, P. J. M.; Cheuk, I.; He, K.; Reis, R.; **Huang, L.**; Ye, Z.; Hu, X.; Mirkin, C. A.; Dravid, V. P. Uncovering the formation mechanism of high-index facet nanoparticlesfrom a metal salt. *Nat. Commun.* **2023**, *14*, 3790

[3] Zhong, P.; Xie, F.; Barroso-Luque, L.; **Huang, L.**; Ceder, G. Modeling intercalation chemistry with multi-redox reactions by sparse lattice models in disordered rocksalt cathodes. *PRX Energy*, **2023**, *2*, 043005

[2] Ye, Z.; Shen, B.; Kang, D.; Shen, J.; Huang, J.; Wang, Z.; **Huang, L.**; Wolverton, C.; Mirkin, C. A. A data-driven approach

for the guided regulation of exposed facets in nanoparticles. *Nat. Synth.* **2024**, *3*, 922

[1] Ye, Z.; Shen, B.; Kang, D.; Huang, J.; Wang, Z.; Wahl, C.; Shin, D.; Huang, L.; Shen, J.; Wolverton, C.; Mirkin, C. A. Using surface composition and energy to control the formation of either tetrahexahedral or hexoctahedral high-index facet nanostructures. *J. Am. Chem. Soc.* **2024**, *146*, 13519

PATENTS (✶ indicates PI)

[9] Mirkin, C.✶; **Huang, L.**; Lin, H. Tetrahexahedra nanoparticles. US11673197B2

[8] Mirkin, C.✶; **Huang, L.**; Kang, Y. Nanocatalysts for electrochemical hydrogen production and catalyst screening methods. WIPO (PCT), WO2019070817A1

[7] **Huang, L.;** Zhu, W.; Situ, L. Local high-concentration electrolyte for lithium metal secondary battery adapted to halide-containing positive electrode material, and preparation method and application thereof. P. R. China Patent, CN117154223A

[6] Zhou, H.; **Huang, L.**; Yuan, Y.; Yuan, Y.; Zhang, H. Preparation method and application of modified NASICON type solid electrolyte. P. R. China Patent, CN116960447A

[5] Li, Q.; **Huang, L.**; Zhu, W.; Han, Z. An automatic device for measuring the dynamic and static viscosity of slurry. P. R. China Patent, 2023224841696

[4] **Huang, L.**; Zhu, W.; Zhou, H.; Li, Q.; Han, Z. Carbon coating method of lithium ion battery anode material. P. R. China Patent, CN117117150A

[3] **Huang, L.**; Zhu, W.; Li, Q.; Han, Z. High-concentration mixed electrolyte suitable for lithium metal negative electrode. P. R. China Patent, CN117117317A

[2] Xie, J.✶; **Huang, L.**; Wang, G.; Zhao, X.; Cao, G. Nanostructure Ti/TiO_2 composite electrode, preparation method and application thereof. P. R. China Patent, CN105186007A

[1] Xie, J.✶; **Huang, L.**; Wang, G.; Tang, Z.; Zhu, P.; Zhao, X.; Cao, G. A nanostructured Co_3O_4/Ru composite electrode for Li-air batteries. P. R. China Patent, CN105070923A

SELECTED AWARDS

09/2021 Chinese government award for outstanding self-financed students abroad

08/2019 Park AFM Scholarship

06/2019 International Precious Metals Institute (IPMI) Student Award

06/2015 Zhejiang Province Outstanding Graduates Awards

10/2014 Chu Kochen Scholarship (*Highest student honor*, awarded to top 12 undergraduates across the university)

05/2014 Chinese Government Scholarship for Oversea Summer Research Program

10/2013 National Scholarship, Air Products & Chemicals Scholarship

09/2011-09/2014 Zhejiang University Outstanding Student Leader Awards, Zhejiang University First-Class Scholarship

OUTREACH

09/2018-present Peer reviewer for *J. Am. Chem. Soc.*, *J. Mater. Chem. A*, *Chem. Eur. J.*, *et al.*

06/2021-02/2023 Ceder group event coordinator

- Organized group retreat preparation and led the scientific discussion sessions
- Responsible for onboarding new members and organizing regular group recreational activites

10/2018-06/2020 Volunteer for Science in the Classroom (SITC) program

- Taught science experiments to a classroom of 3rd-4th grade students, many from underserved communities

08/2018-02/2020 Volunteer for Science in the Community Center (SICC) program

- Mentored kids on hands-on engineering projects every weekend in the local community center

11/2013-11/2014 Student President of Materials Science Department in Zhejiang University

- Organized and led an interview with *Chinese Premier* Keqiang Li, which was broadcasted by CCTV

01/2013-02/2013 International volunteer in Baroda, India

- Worked with local nonprofit organization officials and taught science classes to orphans in the slum

TEACHING

- Taught 50+ undergrad students in 2 courses: Imperfections in Materials and Thermodynamics of Materials
- Developed curriculum, hosted office hours, and graded assisgnments
- Assisted teaching of undergraduate business students in a course on commericialization of research

INVITED PRESENTATIONS

[8] *High Performance Metal Halide Batteries Enabled by Electrolyte Optimization.* Boston, MA, USA, 2023

[7] *Optimizing the Li-Excess Cation Disordered Rocksalt Cathode Design through Li Deficiency Engineering*. Tesla R&D Department Seminar. Cupertino, CA, USA, 2023

[6] *Innovating Energy Conversion and Storage by Atomic-Level Materials Structure Engineering.* Iowa State Univeristy Department Seminar. Ames, IA, USA, 2022

[5] *Multimetallic Nanostructures: Design, Synthesis, and Application as Electrocatalysts*. 2022 Catalysis Club of Chicago Young Scientist Symposium. Chicago, IL, USA, 2022

[4] *Dealloying-enabled high-index facet nanocatalyt design and synthesis.* 2021 Westlake University Yungu Young Scholar Symposium. Hangzhou, Zhejiang Province, P. R. China, 2021

[3] *Ligand-free Synthesis of High-index Facet Nanoparticles*. Gordon Research Conference (GRC) on Crystal Growth and Assembly. Manchester, NH, USA, 2019

[2] *Hydrogen Evolution Catalyst Design and Discovery by Scanning Probe Block Copolymer Lithography*. International Precious Metals Institute (IPMI) 43rd Conference. Reno, NV, USA, 2019

[1] *Ligand-Free Synthesis of High-Index Facet Nanoparticles*. 35th Annual John E. Hilliard Symposium. Evanston, IL, USA, 2019