Kun Qian

Assistant Professor

School of Physical Sciences

Great Bay University

Education Background

PhD in Materials Science and Engineering (2013 - 2019)

Tsinghua University, China

Supervisor: Prof. Baohua Li & Prof. Feiyu Kang

Visiting Student (2017-2018)

Delft University of Technology, the Netherlands

Supervisor: Prof. Marnix Wagemaker

Bachelor in Mineral Processing Engineering (2009 - 2013)

Wuhan University of Technology, China

Research and Work Experience

2024 – Present Assistant Professor

Great Bay University, School of Physical Sciences

2021 – 2024 Postdoctoral Researcher

University of California, San Diego, USA

2019 – 2021 Postdoctoral Researcher

Northern Illinois University, USA

Research Interests

We are dedicated to researching materials and devices for clean energy, with a long-standing commitment to employing advanced in-situ characterization techniques in material synthesis, performance testing, and failure analysis. Our primary focus is on investigating the interface degradation and failure mechanisms of lithium-ion batteries. We utilize various in-situ x-ray and neutron characterization methods to explore the structure-property relationships of materials under diverse conditions, including thermal and electrochemical environments.

Currently, the active topics include:

1. Small-angle scattering with x-ray and neutrons on liquid solutions: Our team employs small-angle scattering techniques using both X-ray and neutron sources to examine the structural characteristics of liquid solutions. This approach provides valuable insights into the properties and behavior of liquids at the nanoscale level.

2. Neutron depth profiling on lithium transport in solids: We utilize neutron depth profiling techniques to investigate the transport of lithium ions within solid materials. This methodology offers crucial insights into the mechanisms controlling lithium-ion conductivity and diffusion in various solid-state systems.

3. Synchrotron x-ray imaging on nanoscale structure of materials: We collaborated on synchrotron x-ray imaging methods to probe the nanoscale structure of energy storage materials. This enables comprehensive examinations of their composition, morphology, and organization, facilitating a deeper understanding of their properties-performance relationship.

Furthermore, our interests extend to ultra-fast spectroscopy and paired distribution function analysis, along with their in-situ characterization on materials and devices. By integrating diverse characterization techniques, Prof. Qian’s group endeavors to advance our comprehension of material behavior and devise innovative strategies for enhancing their properties and functionalities across a range of applications.

Our group have extensive user experience at prestigious research facilities globally, including the Advanced Photon Source at Argonne National Laboratory, Shanghai Synchrotron Radiation Facility, China Spallation Neutron Source, and the Reactor Institute at Delft University of Technology in the Netherlands. Additionally, they maintain research collaborations with the CMRR and CARR reactors on neutron science.

Last but not least

Prof. Qian's group is keenly interested in high-throughput methodologies and remains dedicated to advancing research in this field. Their focus is on leveraging cutting-edge artificial intelligence to accelerate data analysis and predict material properties efficiently. Candidates with different backgrounds are welcomed to apply for the research positions in our research cluster.

Publication Record & Research Experience:

- Published 34 papers in peer-reviewed journals such as Advanced Energy Materials, Energy Storage Materials, Nano Energy and Journal of Materials Chemistry A, etc.

- Authorized 5 Chinese invention patents, one of which has been successfully transferred to industry.

- Participated in national natural science foundation projects and US Department of Energy basic research projects.

- Collaborated with multinational enterprise on joint research and development initiatives.

- Funded by the National Education Ministry Project (China).

Selected Publications

【1】**Kun Qian**, Zhou Yu, Yuzi Liu, David J Gosztola, Randall E Winans, Lei Cheng*, Tao Li* , Understanding fluorine-free electrolytes via small-angle X-ray scattering (**2022, Journal of Energy Chemistry**)

【2】**Kun Qian**, Soenke Seifert, Randall E Winans, Tao Li*, Understanding Solvation Behavior of the Saturated Electrolytes with Small/Wide-Angle X-ray Scattering and Raman Spectroscopy (**2021, Energy & Fuels**)

【3】**Kun Qian,** Yuzi Liu, Xinwei Zhou, David J. Gosztola, Hoai Nguyen, Tao Li*, Decoupling the degradation factors of Ni-rich NMC/Li metal batteries using concentrated electrolytes (**2021， Energy Storage Materials**)

【4】Lihan Zhang, Chenglong Zhao, Xianying Qin, Shuwei Wang, Lunhua He, **Kun Qian***, Ting Han, Zhangping Yang, Feiyu Kang, Baohua Li*, Heterogeneous Degradation in Thick Nickel-Rich Cathodes During High-Temperature Storage and Mitigation of Thermal Instability by Regulating Cationic Disordering (**2021， Small**)

【5】**Kun Qian**, Randall E. Winans, and Tao Li*, Insights into the nanostructure, solvation, and dynamics of liquid electrolytes through small-angle X-ray scattering (**2020， Advanced Energy Materials**)

【6】**Kun Qian**, Yuxiu Liu, Binhua Huang, Duan Huan, Marnix Wagemaker, Ming Liu, Yan-Bing he, Baohua Li*, and Feiyu Kang*, Increase and Discretization of Energy Barrier on Individual $LiNi_xCo_yMn_yO_2$ (x+2y =1) Particles with the Growth of Li_2CO_3 Surface Film (**2019, Journal of Material Chemistry A)**

【7】Dongqing Liu, Zulipiya Shadike, Ruoqian Lin, **Kun Qian**, Hai Li, Kaikai Li, Shuwei Wang, Qipeng Yu, Ming Liu, Swapna Ganapathy, Xianying Qin, Quan-Hong Yang, Marnix Wagemaker*, Feiyu Kang, Xiao-Qing Yang*, Baohua Li*, Review of Recent Development of In Situ/Operando Characterization Techniques for Lithium Battery Research (**2019, Advanced Materials**)