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Chemistry and Biochemistry Department Seminar
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Ion Reactions to Modulate Solid-State Electrochemistry for Next-Generation Batteries

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Rechargeable batteries, developed for electric vehicles and large-scale electrochemical energy storage, have become a critical path towards mitigating the overwhelming challenges of air pollution, climate change, and declining fossil resources. Ion reactions offer a huge playground for tuning the electronic and crystal properties of inorganic solids for battery applications. Our research focuses on resolving a longstanding question in materials electrochemistry regarding redox active solids: how does the mesoscale chemical distribution influence ion reactions at all length scales? Through manipulating the thermodynamics and kinetics of the ion intercalation chemistry, our goal is to develop experimental methodologies and establish novel design principles to enhance the electrochemical properties of ion-intercalating solids for batteries. Our studies are largely facilitated by synchrotron X-ray spectroscopic and imaging techniques that provide fundamental insights into intercalation chemistries. In this presentation, we will highlight our recent progress in understanding and improving electrode materials for lithium and sodium batteries. We design novel synthetic approaches to overcome the surface challenges of oxide cathode materials for high energy density, high power density and long cycle life. Through this presentation, the audience will receive information about the current landscape of battery technologies and future directions.

References

Journal of The Electrochemical Society 166 (2), A251-A257 (2019)
Advanced Energy Materials, 8, 1801975 (2018)
Nature Communications, 9, 2810 (2018)
Energy & Environmental Science, 11(9), 2496-2508 (2018)
Nano Letters, 18, 3241-3249 (2018)
Chemical Reviews, 117, 13123-13186 (2018)



Dr. Feng Lin is an Assistant Professor of Chemistry at Virginia Tech. He is also an affiliated faculty of Department of Materials Science and Engineering and Macromolecules Innovation Institute. Dr. holds Bachelor's degree in Materials Science and Engineering from Tianjin University (2009), and Ph.D. degree in Materials Science from Colorado School of Mines (2012). Prior to Virginia Tech, Feng worked at QuantumScape Corporation as a Senior Member of the Technical Staff (2015-2016), Lawrence Berkeley National Lab as a Postdoctoral Fellow (2013-2015), and National Renewable Energy Lab as a Graduate Research Assistant (2010-2012). He was a recipient of SLAC Spicer Young Investigator Award (2015), Finalist of Young Scientists Award of International Society of Solid State Ionics (2015), ORAU Ralph E. Powe Junior Faculty Enhancement Award (2017), and Journal of Materials Chemistry Emerging Investigator (2018).