Designing Better Materials for Future Batteries

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High energy long life rechargeable battery is considered as key enabling technology for deep de-carbonization. Energy storage in the electrochemical form is attractive because of its high efficiency and fast response time. Besides the technological importance, electrochemical devices also provide a unique platform for fundamental and applied materials science & research since ***ion*** movement is often accompanied by inherent complex phenomena related to phase changes, electronic structure changes and defect generation. In this talk, I will discuss a few new perspectives for energy storage materials including new superionic conductors, new intercalation compounds and their interfacial engineering. With recent advances in photon and electron characterization tools and computational methods, we are able to explore ionic mobility, charge transfer and phase transformations in electrode and electrolyte materials *in operando*, and map out the structure-properties relations in novel functional metals, ceramics and gaseous materials for next generation energy storage and conversion.