

Evaluating Speciation and Kinetics of Ionic Interactions at Electrochemical Interfaces

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Nanostructured Group-IV materials hold great promise as high-capacity conversion electrodes for electrochemical energy storage. However, stabilizing their cycling performance, it has proven to be a challenging impediment to overcome. In some cases, incorporating electrolyte additives, such as fluoroethylene carbonate, has been beneficial in mitigating recurring irreversible reactions that result in an unstable solid-electrolyte interphase (SEI) layer at the electrode/electrolyte junction. We have previously shown the critical importance that interfacial chemistry plays for producing batteries with high-capacity retention by specifically targeting pre-functionalization of the electrode active material. Building off this work, we will describe recent work aimed at spectroscopically and kinetically monitoring ion speciation dynamics at ion-storage electrodes and using these techniques to inform our design of chemical modification strategies for dynamically mitigating electrode capacity fade that results from unwanted chemical side reactions during charge discharge cycling.