Accelerating Silicon Anode Development

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Silicon and silicon-based alloys are a promising alternative anode material to conventional graphite anodes as they offer greater specific gravimetric (3579mAh/g vs. 372 mAh/g) and volumetric capacity (2194 Ah/L vs. 779 Ah/L). While performance of a lithium ion battery is primarily determined by the materials used within, the cell design variables also play a significant role. Parameters such as electrode thickness and porosity can influence overall cell energy density, power/rate performance, and lifetime. Ideally, a cell design needs to include the effects from all relevant design variables and the interactions between these parameters.

In this poster, we present an optimization of silicon alloy anode material, including demonstration of compositional trends and sensitivity to synthesis and precursors. The effects of different binders and conductive carbons for the electrode preparation will also be shown. Finally, results for varying electrode design shows sensitivity of performance to electrode loading and porosity. The optimum performance of a material can only be demonstrated after evaluation of all these parameters, which includes many experiments.

We demonstrate an approach to accelerate the development path by studying multiple experimental parameters using combinatorial chemistry.

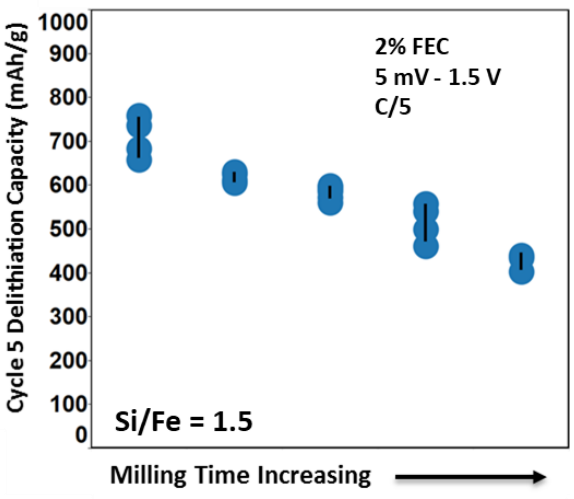

Figure 1. Example of sensitivity of performance to synthesis milling parameters.