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Fracture characteristics of lithiated silicon for lithium-ion batteries

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ABSTRACT

Silicon is considered as a promising electrode material for next-generation, high-performance lithium-ion batteries (LIBs). However, silicon undergoes huge volumetric expansion of ~400% when fully lithiated. The expansion causes massive cracking and battery capacity fade and remains one of the main obstacles to the development of advanced high-capacity LIBs. Recent studies have begun to examine the mechanistic aspect of the LIBs in search for a means to circumvent the problem of electrode cracking. In this discussion, I will discuss our recent work on investigating the fracture behaviors of silicon electrodes under various electro-chemical conditions. This study provides quantitative fracture characteristics of lithiated silicon and will aid in the development of predictive models for microstructural optimization of silicon-based LIBs.