Improving The Cycling Performance of LIBs Silicon/Carbon Anodes using Polyimide Binder

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As the market for Electric Vehicles (EVs) and Energy Storage Systems (ESSs) grows, there is a growing demand for Lithium ion batteries with high energy density.
However, graphite (372 mAh g^{-1} for LiC_6), a commercially available anode active material, is not suitable for large scale battery system such as EVs or ESSs due to its low theoretical capacity.
Although, Silicon (Si, 4200 mAh g^{-1} for $Li_{22}Si_5$ or $Li_{4.4}Si$) has a high theoretical capacity, it has not been successfully implemented in commercialized LIBs due to suffering from large volume changes (> 300 %) during alloying and dealloying. Moreover, the stresses accompanying these changes cause mechanical failure and result in severely degraded electrochemical performances of Si electrodes.
Consequently, Si/C composite anodes (Si/C anodes), wherein Si constitutes only a portion of the active material, have been proposed as an alternative to pure Si anodes. This approach exhibits certain advantages, since even if the theoretical anode capacity increases infinitely, the total theoretical capacity of the battery soon reaches saturation due to the limited theoretical capacity of the cathode.

References:

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