Development of Conductive binder for Si and Sn Anodes

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Materials with high lithium storage capacity, such as silicon and tin based alloys, have recently been extensively studied for their potential applications as lithium-ion battery anodes. But the large-volume change associated with lithiation and delithiation severely hinders the practical employments. We report an effective solution to the volume-change by using conductive polymer binders. A class of new conductive polymers was developed through a combination of material synthesis, x-ray spectroscopy, density functional theory, and battery cell testing. Contrasting other polymer binders, the tailored electronic structure of the new polymer enables lithium doping under the operation condition of Si anode. The polymer thus maintains both electric conductivity and mechanical integrity during the battery operation. More importantly, this conductive polymer matrix is compatible with the lithium-ion slurry manufacturing process. This work implements the conceptual idea of combining binder and conductive additive into one material, solving the volume change problem of high capacity battery electrodes.

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