Porous Si–Carbon Nanofiber (CNF) Hybrid Material as a High Capacity Lithium Storage Material

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Although silicon has higher reversible capacity than graphite, its large volume expansion and pulverization during lithium insertion/extraction causes poor capacity retention. To address this technical issue, porous Si-carbon nanofiber (CNF) hybrid materials were prepared by chemical etching of melt-spun Si/Al-Cu-Fe alloy nanocomposite material, followed by carbonization using a pitch. CNFs were successfully grown on the surface of porous Si particles by using a remained Fe impurity after acidic etching, which acted as a catalyst for the growth of CNFs. The resulting porous Si-CNF hybrid materials showed an enhanced cycle performance compared to that of the pristine Si/Al-Cu-Fe alloy nanocomposite as well as that of bare porous Si particles up to 100 cycles. These results indicate that CNF and the carbon coating layer have an effect on the capacity retention characteristics of porous Si particles by ensuring the electrical conduction pathways in the electrode during cycling. More detailed studies of the characterization and eletrochemical properties of porous Si-CNF hybrid material will be discussed in this presentation.

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