Self-sacrificed Synthesis of Amorphous Carbon-Coated SiO_x as Anode Materials for Lithium-Ion Batteries

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Amorphous carbon coated SiO_x is developed by the self-sacrifice of self-assembled Nafion/SiO₂ and explored as anode materials for lithium-ion batteries to overcome the sever pulverization and the resultant loss of specific capacity caused by the volume expansion of Si during the lithium ions insertion/extraction process. The amorphous carbon coated SiO_x (SiO_x/C) is prepared by using self-assembled Nafion/SiO₂ as the precursor, following by magnesium reduction of SiO₂ and carbonization of Nafion ionomers. XPS, TEM and XRD results indicate that most of SiO_x was reduced to amorphous Si⁰ with small amount of Si²⁺ and Si⁴⁺, which are coated by amorphous carbon. As the amorphous carbon coating can effectively reduce the volume change of SiO_x-based material during the charge-discharge process and enhance the electronic conductivity of the material, the Nafion-derived amorphous carbon coated SiO_x exhibits improved reversible capacity, better cycling stability and rate capability than that of pure amorphous carbon at Si loading below 10 wt%

Keywords: Self-sacrificed, amorphous carbon-coated, silicon/C, anode materials, lithium-ion battery

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