Scalable Fracture-free SiOC Glass Coating for Robust Silicon Nanoparticle Anodes in Lithium Secondary Batteries

최성훈, 정대수[1], 최장욱†
KAIST; [1]한국세라믹기술원
(jangwookchoi@kaist.ac.kr†)

A variety of silicon (Si) nanostructures and their complex composites have been lately introduced in the lithium ion battery community to address the large volume changes of Si anodes during their repeated charge–discharge cycles. Nevertheless, for large-scale manufacturing it is more desirable to use commercial Si nanoparticles with simple surface coating. Most conductive coating materials, however, do not accommodate the volume expansion of the inner Si active phases and resultantly fracture during cycling. To overcome this chronic limitation, herein, we report silicon oxycarbide (SiOC) glass as a new coating material for Si nanoparticle anodes. The SiOC glass phase can expand to some extent due to its active nature in reacting with Li ions and can therefore accommodate the volume changes of the inner Si nanoparticles without disintegration or fracture. On the basis of these combined effects, the SiOC-coated Si nanoparticles reach a high reversible capacity of 2093 mAh/g with 92% capacity retention after 200 cycles. Furthermore, the coating and subsequent secondary particle formation were produced by high-speed spray pyrolysis based on a single precursor solution.