# Rapid Synthesis of Silicon Oxycarbide (SiOC) Coating on Bismuth Nanoparticles in a Supercritical Fluid for Superior Lithium Storage

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Bismuth alloy is a highly promising anode material for LiBs because of its small volume expansion (~250%) and high volumetric capacity (3430 mAh $cm^{-3}$). However, fast capacity fading due to the volume expansion and electrical conductivity loss limits its wide utilization. Herein, we introduced a new technique to suppress the volume growth of Bi by a one-pot supercritical fluid route using silicone oil as a coating source. Supercritical Bi/SiOC composites (SC-Bi/SiOC) are simply synthesized by preparing a homogenous mixture of silicone oil and $Bi(OH)_3$ in supercritical acetone prior to a two-step pyrolysis process; cross-linking at 120 °C followed by annealing at 500 °C to form a SiOC matrix with higher stability. SC-Bi/SiOC exhibited an initial lithiation capacity of 683 mAh $g^{-1}$ and a reversible capacity above 300 mAh $g^{-1}$ at 50 mA $g^{-1}$. The electrochemical performances of SC-Bi/SiOC revealed the excellent combination of carbon and SiOC coating to prevent the volume changes of Bi while providing a well-defined electronic conductive network and excellent cyclic stability, which can be a new pathway for designing high-performance Bi alloy-based anode materials.