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Highly-Regular Porous Germanium Oxide Thin Film Electrode for Lithium-ion Batteries

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Because of high energy density, competitive working voltage, minimum self-discharge, and limited maintenance requirements, rechargeable lithium-ion batteries (LIBs) have been applied in various fields and regarded as the most promising power devices in the future. Due to high theoretical capacity (2152 mAh g-1), germanium oxide (GeO2) is regarded as a promising alternative anode material for LIBs. However, GeO2 suffer from volume expansion during charge and discharge, leading to a rapid capacity fading. Creating hollow or porous structure is an effective strategy to improve the cycling stability of germanium oxide anode because it can provide enough void space to accommodate volume changes of germanium oxide.
Herein, we propose a novel method to synthesize highly-regular porous GeO2 tin film anode materials assisted with the block copolymer. Polymer/inorganic nanocomposites can be obtained via a microphase separation process in a mixture solution of mixing block copolymer and precursor of metal oxide. The morphology of as-prepared porous germanium oxide tin film anodes could be characterized by scanning electron microscopy (SEM) partially and grazing incidence small-angle X-ray scattering (GISAXS) integrally. Furthermore, in-operando SAXS or Small-angle neutron scattering (SANS) measurements can be applied to investigated the evolving nanoscale morphology of electrode during charge and discharge processes.

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