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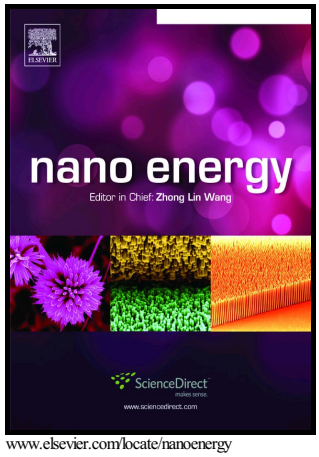

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Graphitized Porous Carbon Materials with High Sulfur Loading for Lithium-Sulfur Batteries

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Abstract

Lithium-sulfur (Li-S) batteries are next generation of chemical power sources for energy storage and electrical vehicles, because of its high theoretical capacity and high energy density with cheap nontoxicity sulfur cathode. However, for the large-scale applications it is still a major challenge to produce Li-S batteries with remarkable capacity and long stability. Herein, a graphitized carbon/sulfur composites cathode was fabricated with an ultrahigh sulfur percentage of 90 wt %, which could deliver a high initial overall discharge capacity of 1070 mAh $g^{-1}_{(S-C)}$ and a discharge capacity of 804 mAh $g^{-1}_{(S-C)}$ after 50 cycles. Even with a sulfur loading as high as 4 mg cm^{-2}, the graphitized C/S composites can still deliver a high initial overall discharge capacity of 908 mAh $g^{-1}_{(S-C)}$ and a discharge capacity of 739 mAh $g^{-1}_{(S-C)}$ after 100 cycles. The graphitized carbon with high electrical conductivity, adjustable pore size, pore volume and surface area was synthesized by using commercialized nano-$CaCO_3$ as template and graphitization catalyst. Density functional theory calculation revealed the graphitized structure exhibited stronger adhesion strength with polysulfide. Moreover, the porosity of graphitized carbon enhances the adsorption between carbon and polysulfide.