Loofah Sponge-Derived Sulfur-Rich Porous Carbon with Micropores and Small Mesopores as High Performance Anode Material for Lithium Ion Batteries

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We reported on the preparation of sulfur-rich porous carbon (SPC) with micropores and small mesopores from natural biomass (loofah sponge) via a high yield, cost-effective, and environmental friendly approach for the first time. The as-obtained SPC was vested with the comprehensive superiority of featuring unique microporous and small mesoporous carbon nanostructure, ultrahigh specific surface area ($3211.2 \text{ m}^2 \text{ g}^{-1}$), inherent doping of sulfur (2.98 wt%), and good electronic conductivity (1.9 S cm^{-1}). The SPC, as the anode material in lithium ion batteries (LIBs), delivered glorious electrochemical characteristics, including a large reversible capacity of $1264.4 \text{ mAh g}^{-1}$ at 0.2 C, excellent rate performance (538.6, 351.1, and 256.3 mAh g^{-1} at 2, 5, and 10 C, respectively), and good cycle stability over 400 cycles at 2 C (with 0.087% capacity fading per cycle). The enhanced electrochemical property of SPC was largely ascribed to the cooperative effect of the unique structural features and sulfur doping, which not only could enhance electrochemical activities for lithium storage, but also could promote rapid transfer of lithium ions and electrons. Furthermore, we believe that this work would provide a novel perspective on the reasonable designing of high-energy carbonaceous anode materials.

Keywords: loofah sponge; sulfur-rich carbon; micropores and small mesopores; biomass; lithium ion batteries

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