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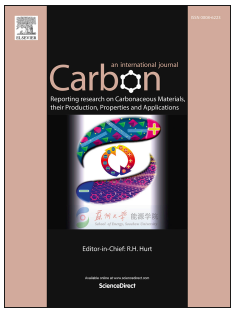

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Encapsulating selenium into macro-/micro-porous biochar-based framework for high-performance lithium-selenium batteries

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Abstract

Selenium has a similar lithiation-delithiation mechanism to sulfur but possesses an extremely higher electronic conductivity than sulfur, indicating a promising cathode material for energy storage. In this paper, a new-type porous material of macro-/micro-porous biochar-based (MMPBc) framework derived from the inner spongy layer of pomelo pericarp has been prepared by the initial carbonization and subsequent KOH activation, which is utilized as porous matrix for selenium loading to form Se/MMPBc composite. Due to an optimal weight ratio of carbonized sponge to KOH at 1 : 2, the resulting porous carbon of MMPBc-3 acquire a specific surface area of 1539.4 m^2 g^{-1} and a pore volume is 0.683 cm^3 g^{-1} and effectively hosts a 56.1 wt% of elemental selenium. Applied as the cathode material of lithium-selenium batteries, at 0.2 C the composite Se/MMPBc-3 delivers a high reversible capacity of 597.4 or 466.8 mAh g^{-1} in the 2nd or 300th cycle. Considering both the pore size distributions of serial MMPBc samples and the cycling stabilities of corresponding Se/MMPBc composites, it is an appropriate balance between the micropores and macropores of pristine MMPBc that predominantly determines the excellent electrochemical durability of corresponding Se/MMPBc composite.

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