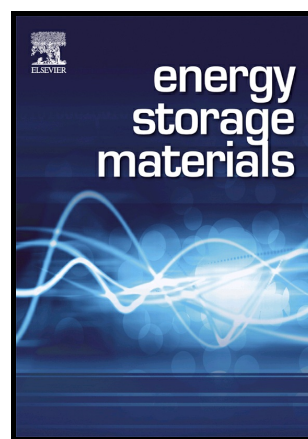


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Hui Wang, Yang Jiang, Arumugam Manthiram



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N-doped Fe₃C@C as an efficient polyselenide reservoir for high-performance sodium-selenium batteries

Hui Wang,^{a,b} Yang Jiang,^{b,*} and Arumugam Manthiram^{a,*}

^a *Materials Science & Engineering Program and Texas Materials Institute, The University of Texas at Austin, Austin, TX78712, United States*

^b *School of Materials Science and Engineering, Hefei University of Technology, Hefei, Anhui 230009, P. R. China*

*Corresponding author:

apjiang@hfut.edu.cn (Y.Jiang)

manth@austin.utexas.edu (A. Manthiram)

*Corresponding author: Tel.& Fax: +86551 62904358.

*Corresponding author: Tel: +1-512-471-1791; fax: +1-512-471-7681

ABSTRACT

Sodium-selenium batteries are receiving intense attention due to their high theoretical energy density and low cost, but their pragmatic realization are still impinged by sluggish electrode kinetics and dissolution of sodium polyselenide. Here, we present a strategy to enable porous N-doped Fe₃C@C matrix to better entrap polyselenide and enhance the capability of the cell, whereby Fe₃C serves as an efficient polyselenide reservoir via stronger chemisorption, as clearly evidenced by experimental analysis and DFT simulations. The as-fabricated half cells with 72.6 wt.% selenium content exhibit highly reversible capacities of 620 mA h g⁻¹ at 0.1C rate and 405 mA h g⁻¹ at a high rate of 5C. Moreover, the cell provides superior static stability (shelf-life) as illustrated by its 98.7% capacity retention even after storing for three months. This material is also paired with Na₃V₂O₂(PO₄)₂F cathode in full cells to realize a stable discharge capacity of 108 mAh g⁻¹ (based on the weights of both the anode cathode) at 0.1C rate over 50 cycles, thus demonstrating N-doped Fe₃C@C a superior host for sodium-selenium batteries.

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