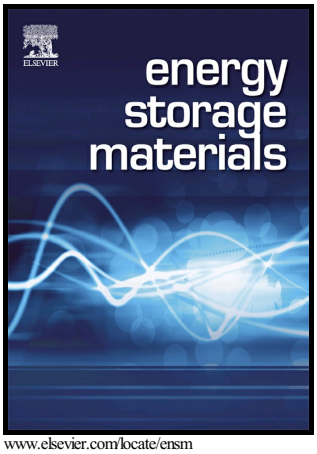

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PII: S2405-8297(18)30336-2
DOI: https://doi.org/10.1016/j.ensm.2018.06.014
Reference: ENSM424

To appear in: *Energy Storage Materials*

Received date: 20 March 2018
Revised date: 19 May 2018
Accepted date: 13 June 2018

Cite this article as: Hui Wang, Yang Jiang and Arumugam Manthiram, N-doped Fe_3C@C as an efficient polyselenide reservoir for high-performance sodium-selenium batteries, *Energy Storage Materials,* https://doi.org/10.1016/j.ensm.2018.06.014

N-doped Fe_3C@C as an efficient polyselenide reservoir for high-performance sodium-selenium batteries

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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 Fe_3C@C matrix to better entrap polyselenide and enhance the capability of the cell, whereby Fe_3C 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 $Na_3V_2O_2(PO_4)_2F$ 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 Fe_3C@C a superior host for sodium-selenium batteries.