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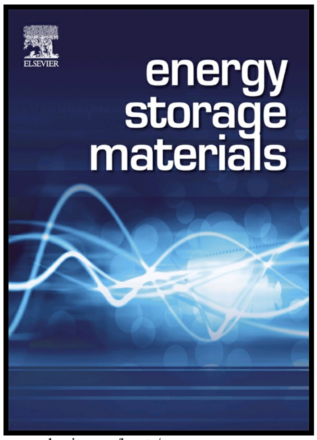

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PII: S2405-8297(17)30731-6
DOI: https://doi.org/10.1016/j.ensm.2018.01.016
Reference: ENSM300

To appear in: *Energy Storage Materials*

Received date: 5 January 2018
Revised date: 28 January 2018
Accepted date: 29 January 2018

Cite this article as: Wensheng Ma, Jiawei Wang, Hui Gao, Jiazheng Niu, Fakui Luo, Zhangquan Peng and Zhonghua Zhang, Mesoporous antimony-based nanocomposite for advanced sodium ion batteries, *Energy Storage Materials,* https://doi.org/10.1016/j.ensm.2018.01.016

Mesoporous antimony-based nanocomposite for advanced sodium ion batteries

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ABSTRACT

Developing advanced electrode materials and understanding the electrochemistry of electrode reactions are two main issues to be addressed for high-performance sodium ion batteries (SIBs). Through a one-step dealloying strategy which simultaneously incorporates the nanoarchitecture, mesoporous structure and nanocomposite of electrode materials, here we synthesized novel Sb_2O_3@Sb nanocomposite with an ultrafine bicontinuous mesoporous structure. When being used as an anode for SIBs, the Sb_2O_3@Sb nanocomposite exhibits ultrahigh specific capacity (659 mA h g^{-1}), overwhelming rate capability (200 mA h g^{-1} at 29.7 A g^{-1}) and excellent cycling stability (capacity retention of 99.8% after 200 cycles at 0.2 A g^{-1}). Coupled by a $Na_3V_2(PO_4)_3$ cathode and a Sb_2O_3@Sb anode, a full cell was further constructed and delivers excellent performance (reversible capacity, cycling stability and rate capability). Most importantly, the sodium storage mechanisms of the Sb_2O_3@Sb nanocomposite were unveiled by operando X-ray diffraction and Raman techniques.

Graphical abstract