Microwave Synthesized Few Layered SnS_2 Anode for High Power Sodium-ion Batteries

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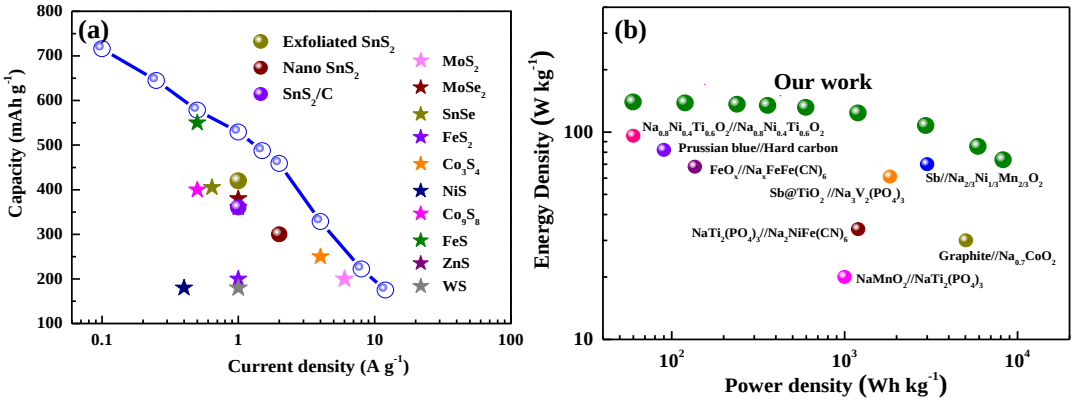
The research on sodium ion batteries as next generation energy storage device have seen an enormous growth during the past decade.[1] As a result, a variety of high performing cathodes with high capacity and superior rate capabilities have been identified. However, realization of commercial SIBs remains highly challenging due to unavailability of high performing anodes.[2] Despite a high capacity, metal oxide and metal sulfide based anodes showed an inferior rate performance that results in kinetically inferior sodium storage system. Additionally, tedious synthesis methodology to synthesis high quality anode materials should be seriously addressed. Among several anodes, SnS_2 has a greater attraction due to their unique 2-D layered structure with large interlayer spacing that provides facile sodium ion storage. In this work, we present a simple and rapidly synthesized high pure SnS_2 as a high power anode for SIBs. The microwave synthesized few layered SnS_2 exhibits a fast pseudocapacitive sodium storage, overcoming the sluggish diffusion limited storage in convention anodes. A high capacity (702 mAh g^{-1}), excellent rate performance (12 A g^{-1}), along with a remarkable stability has been delivered by SnS_2 anodes. The sodium ion full cell assembled with SnS_2 anode and $Na_3V_2(PO_4)_3$ cathode delivers a high energy of 140 Wh kg^{-1} and an extremely high power of 8.3 kW kg^{-1}. The present research delivers promising platform for development of high power SIBs.



(a) Performance comparison of SnS_2 and other anodes, and (b) Ragone plot of sodium full cells

References:

[1] H. Kim, H. Kim, Z. Ding, M.-H. Lee, K.Lim, G. Yoon, K. Kang, Adv. Energy Mater. 6 (2016) 1600943.
[2] D. Chao, P. Liang, Z. Chen, L. Bai, H. Shen, X. Liu, X. Xia, Y. Zhao, S. V. Savilov, J. Lin, Z. X. Shen, ACS Nano 10 (2016) 10211.