Preparation of uniform and ultrathin carbon coated Sn-RGO composite anode materials for sodium ion batteries using liquid carbon dioxide

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Tin (Sn) is one of the most promising materials for anode in sodium ion batteries (NIBs) because of its large gravimetric and volumetric capacity (847 mAh g^{-1}, 4,886 mAh cm^{-3}) and low voltage profile (< 0.1 V at Na^+ half-cell during discharge process). Sn can uptakes 3.75 Na^+ ions per formula to form $Na_{15}Sn_4$. However, volume expansion after fully sodiation is over 420% [1], which cause serious structural pulverization and loss of electric contact within the electrodes during the charge-discharge process resulting in capacity fading. Herein, to enhance the cyclability by suppressing the volume expansion, SnO_2 particles were uniformly deposited on reduced graphene oxide (RGO) in supercritical methanol. Then uniform carbon layer was coated on the SnO_2-RGO composite using liquid CO_2 as a coating solvent followed by calcination. During the heat-treatment, SnO_2 was reduced to Sn by carbothermal reduction. The Sn particles were uniformly deposited on the RGO surface (Figure 1a). The carbon coated Sn-RGO composite high reversible capacity of 420 mAh g^{-1} after 50th cycle (Figure 1(b)).

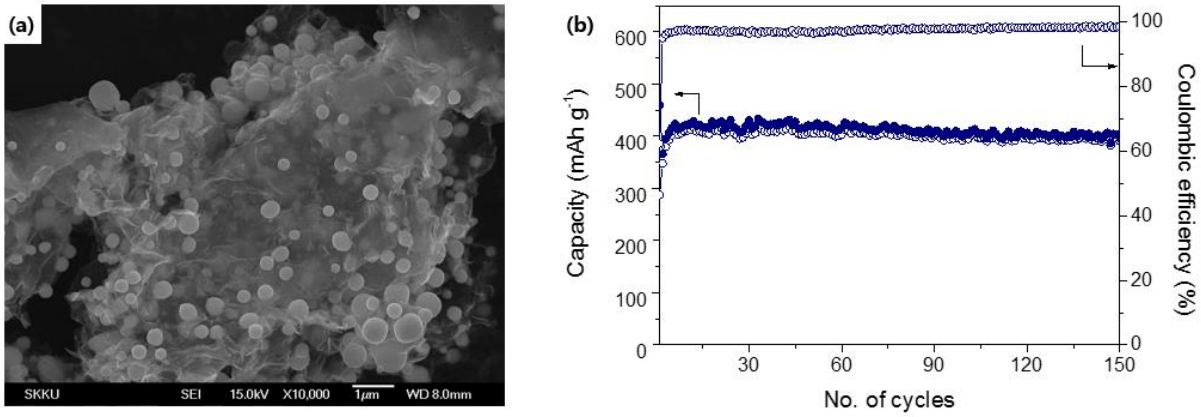

Figure 1. (a) SEM image of Sn-RGO composite and (b) electrochemical performance in NIB.

References:

[1] J.W. Wang, X.H. Liu, S.X. Mao, J.Y. Huang, Nano Lett. 12 (2012) 5897-5902.