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 Na₁₅Sn₄. 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, SnO₂ particles were uniformly deposited on reduced graphene oxide (RGO) in supercritical methanol. Then uniform carbon layer was coated on the SnO₂-RGO composite using liquid CO₂ as a coating solvent followed by calcination. During the heat-treatment, SnO₂ 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: