In-Situ Synthesis of 3D-Graphene Network Embedded Tin Nanoparticles as Superior Lithium Ion Battery Anode

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3D-Graphene network embedded Sn nanoparticles (Sn@3DGN) were prepared via a simple in-situ catalysis method using SnCl$_2$ as the catalyst precursor and NaCl as the template. The 3DGN is obtained by removing the template of NaCl, as Fig. 1(a). Sn nanoparticles of ~20-30nm are encapsulated with 3-5 graphitic lays and anchored on the walls of 3DGN, as shown in Fig. 1(b). The thickness of the graphene is ~3nm and less than 1nm can also be seen (Fig.1(c)). The electrode based on the Sn@3DGN delivers the reversible capacities as high as 1100mAh/g at 0.2A/g after 100 cycles which is rarely reported, as shown in Fig. 1(d). The underlying reason of this superior performance can be based on the high electrical conductivity, smoothly contact between the electrode and the electrolyte, excellent stability of structure which attributes to the porous, ultrathin and well graphited graphene network as well as the stabilization of carbon coating around Sn nanoparticles. These insights will be of benefits in the design of other anode materials for lithium ion batteries.

![Fig. 1](image_url)

Fig. 1 (a) SEM image of Sn@3DGN; (b) TEM and HRTEM images of Sn@3DGN; (d) cycling performance of Sn@3DGN as lithium ion battery anode.