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Enhanced electrochemical performance of Tin nanoparticles on Graphene nanosheet thin film anode

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Metallic Tin as anode has been considered in Li- ion batteries due to its high specific capacity and appropriate Li storage potential. However, the Sn anode experience large volume expansion during lithiation process, which inhibits from practical application. In order to overcome these limitations, one solution is to use Sn in carbon matrices such as one dimensional carbon nanotubes (CNT) or two dimensional graphene sheets.

In our study, Tin nanoparticles have been grown over Graphene Nanosheets (GNSs) through thermal evaporation. The vertically oriented GNS thin film has been synthesized by microwave plasma enhanced chemical vapor deposition at relatively low temperature (500^0C).

The thicknesses of the nanoparticle films and their surface chemistry have been investigated by scanning electron microscopy (SEM) and X-ray photoelectron spectroscopy (XPS). The electron microscopy images show that Tin nanoparticles are less than 50nm in size and are attached to the walls of graphene sheets. Electrochemical properties of Sn nanoparticles attached to the graphene sheets are studied by cyclic voltammetry (CV) and galvanostatic cycling at a constant current density. Thin film anode assembled in Swagelok cells exhibited an initial discharge capacity of 655 mA/g^1 and reduced to 606 mA/g^{-1} at the second cycle at current of 50µA. The cell gave constant discharge capacity even after 30 cycles. Similar performance has been exhibited even when the discharge current was increased upto 250µA.