Improved cycle performance of Cu-coated Sn Powder Negative Electrodes *via* Simple Galvanic Displacement

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Sn is one of the potential candiates for the negative electrode materials in lithium ion batteries. However, it has several problems such as the purverization, isolation, and delamination with substrate due to the large volume change during cycles. In order to reduce the stress of the volume change and aggregation between inter-particles during cycling, we conducted the Cu-coating on the surface of the Sn particles by simple and economical electroless plating process *via* galvanic displacement mechanism in the absence of external reducing agents.

The micro-sized Sn powders were immersed in 1 *M* $CuSO_4$ aqueous solution for 10 min with stirring at various temperature conditions (RT, 60℃, 80℃). As Sn has higher ionization tendency than Cu, the Cu ion is reduced to metallic Cu on the surface of Sn powders spontaneously while the Sn is dissolved to aqueous solution with oxidation. As the reaction temperature increases, the amounts of the deposited Cu increased and the better the cycle performance can be achieved. The deposited Cu plays a role in suppressing the Sn aggregation by the elimination of the direct contact between the Sn inter-particles and provides the better electrical conductivity.

For the purpose of strong adhesion of Cu and Sn powders, the Cu-coated Sn powders are annealed at 200^{o}C for 24h in Ar atmosphere. The contact between Cu and Sn is enhanced and the Cu_6Sn_5 phase is partially generated during annealing process. The annealed powders exhibits improved cycle performance because the Cu coating layer can be maintained against the volume change because of the durable adhesion strength.

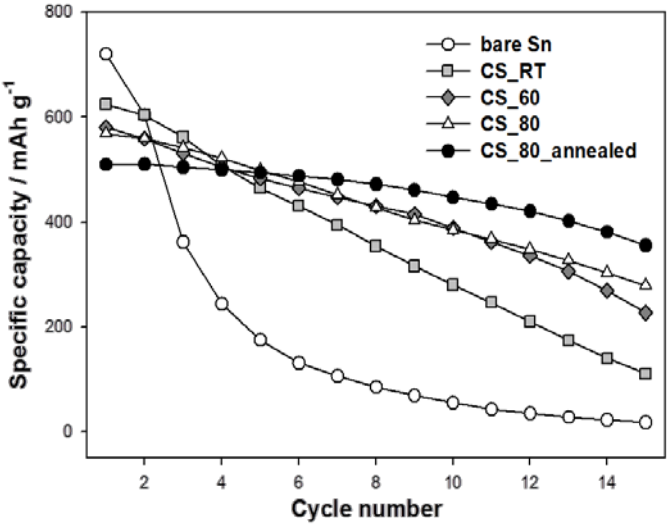

Figure 1. Cycle performance of Cu-coated Sn powder electrodes.