Sn nanowire-based anode with Ti adhesion layer for Li-ion batteries.

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With an increasing demand for high-capacity power sources with higher energy densities and power densities, development efforts for new anode materials for Li-ion batteries have also intensified, since graphite (currently used as a commercial anode material) is not suitable for high-capacity power sources due to its low theoretical capacity of 372 mAh/g. Sn is one of the most attractive anode materials that can be used as an alternative to graphite, owing to its high theoretical capacity of 991 mAh/g. However, pure Sn anode has not been put into practical use because of large volumetric changes (～300%) during Li^+ insertion/extraction, which cause the pulverization and delamination of active materials from current collector during cycling.

In this research, we fabricated Sn nanowires to address this stress issue, since such a structure, with a large free surface area, could effectively accommodate the enormous volumm change of Sn. We produced Sn nanowires using electroplating with AAO(Anodic aluminum oxide) disk which has 200 nm of pore diameter and 50 μm of thickness. Electrochemical data shows that the nanowire samples demonstrate a better cycle performance than Sn films electrodeposited on Cu current collector. Nevertheless, after 10th cycle, capacity of Sn nanowires rapidly decreased, because of fractures between wires and current collector during charging and discharging. To solve this problem, a Ti layer of 50 nm thickness as adhesion layer was deposited between the wires and current collector. This modification brought about a significant improvement in cyclic stability. We also carried out materials characterization to reveal microstructural evolution occurring during charging/ discharging process.

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