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Growth Mechanism of SnO Nanostructures and Applications as an Anode of Lithium-ion Battery

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Rechargeable lithium-ion batteries have been considered the most attractive power sources for mobile electronic devices. Although graphite is widely used as the anode material for commercial lithium-ion batteries, it cannot fulfill the requirement for higher storage capacity because of its insufficient theoretical capacity of 372 mAh/g. For the sake of replacing graphite, Sn-based materials have been extensively investigated as anode materials because they can have much higher theoretical capacities (994 mAh/g for Sn, 875 mAh/g for SnO, 783 mAh/g for SnO_2). However, these materials generate huge volume expansion and shrinkage during Li^+ intercalation and de-intercalation and result in the pulverization and cracking of the contact between anode materials and current collector. Therefore, there have been significant efforts of avoiding these drawbacks by using nanostructures.
In this study, we present the CVD growth of SnO branched nanostructures on Cu current collector without any binder, using a combinatorial system of the vapor transport method and resistance heating technique. The growth mechanism of SnO branched nanostructures is introduced. The SnO nanostructures are evaluated as an anode for lithium-ion battery. Remarkably, they exhibited very high discharge capacities, over 520mAh/g and good coulombic efficiency up to 50 cylces.