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Electrochemical Performance of Sn-Co(-C) Prepared by Mechanical Alloying as Anode Material for Li-ion Batteries
기계적 합금법으로 제조한 Sn-Co(-C)의 리튬 이온 전지 음극 활물질로의 전기화학적 특성

김기태, 박성철, 이재영
한국과학기술원 재료공학과

Lithium-ion batteries are the state-of-the-art power sources for consumer electronics because of their large specific and volumetric energy density. Metals and alloys have been studied as anode materials since 1970. They react with Li to produce high capacity negative electrodes. Because of the violent reactions occurring during the alloying process between lithium atoms and the active alloys, the cycle life of these materials is generally poor. In this work, Sn-Co(-C) mechanically alloyed by ball milling was studied as anode materials for lithium-ion secondary batteries.

Mixed powders were milled for 1, 2, 4, 8, 16 and 32 h periods by commercial high energy ball mill. The slurry containing 85 wt% active material, 10 wt% Acetylen black, and 5 wt% poly(vinylidene fluoride)(PVDF) was coated on a thin copper ex-met foil. Used in the construction of these cells was a polypropylene microporous separator, electrolyte (1 M LiPF6 dissolved in ethylene carbonated/diethyl carbonate (EC:DEC) (50:50)), and lithium metal as the negative electrode.

As the mechanical alloying time increased, the crystallinity of Sn_2CoC decreased. After 16 h of ballmilling, the crystallinity of Sn_2CoC became steady state. HRTEM morphology shows that Sn_2CoC ballmilled for 16 h consists of nano garins and amorphous phase. As alloying time increased, the capacity and cycle life property increased. The capacity of Sn_2CoC ballmilled for 16 h was 596 mAh/g at first cycle. After 60 cycle, the capacity was 179.8 mAh/g. After 16 h of ballmilling, the crystallinity of SnCoC also became steady state. In TEM image, nano grain and amorphous phase were also observed at 16 h ballmilled powder. As alloying time increased, the capacity and cycle life property increased. As the cobalt content was increased, the capacity was decreased, the cycleability, however, was increased. The capacity of 16 h ballmilling was 492, 297.2 mAh/g at first and after 60 cycle, respectively.