Australian Synchrotron
USER MEETING 2014
20 – 21 November
National Centre for Synchrotron Science

Contribution ID : **49** Type : **Poster**

Time-resolved phase evolution during creation of nanoporous Cu current collectors by a dealloying approach

Thursday, 20 November 2014 17:30 (90)

Dealloying, used to fabricate nanoporous metals, is a process where less noble components (e.g. Al) in the precursor (e.g. AlCu) are dissolved, leaving the nobler elements (e.g. Cu) to form a nanoporous structure. The three-dimensionally nanoporous Cu is desired in lithium-ion batteries as current collectors, which has a unique advantage in providing large surface area for active materials and can accommodate structural strain during lithiation/delithiation reactions. From the perspective of phase evolution, the phases may evolve from Al-Cu phases (fcc &alpha-Al(Cu), tetragonal Al2Cu, monoclinic AlCu or combination of them) to fcc Cu.
In-situ laboratory X-ray Diffraction (XRD) and ex-situ synchrotron XRD experimentation have been implemented to characterise the dealloying of different Al-Cu precursors in preparing fcc Cu. Experiments were carried out using Al75Cu25 (&alpha-Al(Cu) and Al2Cu) and Al65Cu35 (Al2Cu and AlCu) alloys. In the case of in-situ lab XRD experimentation, results showed that for Al75Cu25, the disappearance of &alpha-Al(Cu) and Al2Cu, and the formation of Cu began simultaneously, while for Al65Cu35, the dealloying of Al2Cu and AlCu happened in sequence with the formation of Cu. The highly resoluted ex-situ synchrotron results not only confirmed lab XRD observations, but also showed transient phases during dealloying for the first time. This study is a model example to investigate the underlying dealloying mechanism from the perspective of phase evolution, and can provide guidance for the development of nanoporous Cu current collectors for batteries.

Keywords or phrases (comma separated)

Dealloying, Nanoporous metals, In-situ phase evolution, Transient phases

Summary

Primary author(s) : Ms SONG, Tingting (RMIT University)

Co-author(s) : Dr KIMPTON, Justin (Australian Synchrotron); Dr YAN, Ming (RMIT University); Dr WEBSTER, Nathan (CSIRO); Prof. MA, Qian (RMIT University)

Presenter(s) : Ms SONG, Tingting (RMIT University)

Session Classification : Welcome Function, Poster Session, Exhibition

Track Classification : Advanced Materials