Contribution ID : **50** Type : **Oral**

In-situ X-ray powder diffraction for Li-ion batteries: The effects of Ni on inhibiting the separation of Cu during the lithiation and delithiation of Cu6Sn5 anodes

Monday, 2 December 2019 11:20 (15)

Lithium-ion batteries have found numerous applications in modern technologies, especially in portable devices, and increasingly in electric vehicles and renewable energy storage applications. Sn-based lithium-ion battery anodes have a higher theoretical storage capacity of 993 mAh g-1 vs. 372 mAh g-1 compared to commercial carbon-based anodes. Their better safety profile due to a lower risk of lithium dendrite formation is also desirable. However, Sn-based anodes suffer from inferior cycling performance due to the enormous stresses during the lithiation and delithiation process. Alloying Sn with Cu can reduce the reaction stresses in the anode, as Cu does not react with Li, and acts as a stress buffer. Cu6Sn5 is therefore a promising candidate material to replace carbon-based anodes. However, the separation of Cu during the second stage of the lithiation reaction limits the kinetics and degrades the cyclability of the anodes. This study proposes an effective method of inhibiting the separation of Cu via the addition of Ni. Ni occupies the Cu positions in the Cu6Sn5 crystal structures to form (Cu, Ni)6Sn5, and therefore alters the crystal structure of the anode, leading to the formation of superstructures that were identified using the Australian Synchrotron PD beamline. As a result, Ni partially blocks the diffusion pathways of Li and therefore inhibits the Cu separation reaction, while the superstructure provides additional Li storage sites to increase the capacity of the anodes.

Speakers Gender

Female

Travel Funding

Yes

Level of Expertise

Student

Do yo wish to take part in the poster slam

No

Primary author(s) : TAN, Xin Fu (University of Queensland)

Co-author(s) : GU, Qinfen (Australian Synchrotron (ANSTO)); Dr MCDONALD, Stuart (The University of Queensland); NOGITA, Kazuhiro (The University of Queensland)

Presenter(s) : TAN, Xin Fu (University of Queensland)

Session Classification : Session 1

Track Classification : Advanced materials