Electrochemical behavior of high entropy alloy containing silicon anode material for lithium ion battery

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The Silicon (Si) anode material is one of the most promising anode materials for the future Li ion battery industry. It has huge theoretical capacity (4200 mAh g⁻¹) that make available to apply the electric vehicles (EVs) and energy storage system (ESS). However Si anode has low electric conductivity and large volume change (>300%) during Li ion insertion/de-insertion. This problems make degradation of cycling and shrink the life of battery. To solve this problem many researchers attempted to fabricate the Si anode by alloy form.

High entropy alloys (HEAs) are very hot issue for many scientist. HEAs are defined as crystallized alloys that contain more than five principal elements. HEAs introduce a promising avenue of developing good performance materials with unique properties. In this study we use HEAs the composition of Si, Ni, Cu, Al and Zn as the anode electrode for lithium ion battery. HEAs, the composition of Si, Ni, Cu, Al and Zn were alloyed by arc melting at 1825K for 1h. We expect that HEA containing silicon has good property to prevent Si anode problem which is volume change during Li ion insertion/de-insertion. The alloy materials except the Si took a role like buffer and prevented volume expansion. To confirm this effect, microstructure and morphology were observed by XRD, XPS, SEM and TEM. HEAs anode/lithium metal coin cells (2032) were assembled in dry room atmosphere. The cycling performance with cut-off voltage of 0-1.5V. The electrochemical behavior of HEAs were determined by impedance analysis, voltage profile and cycle data.