Application Note BATT1020

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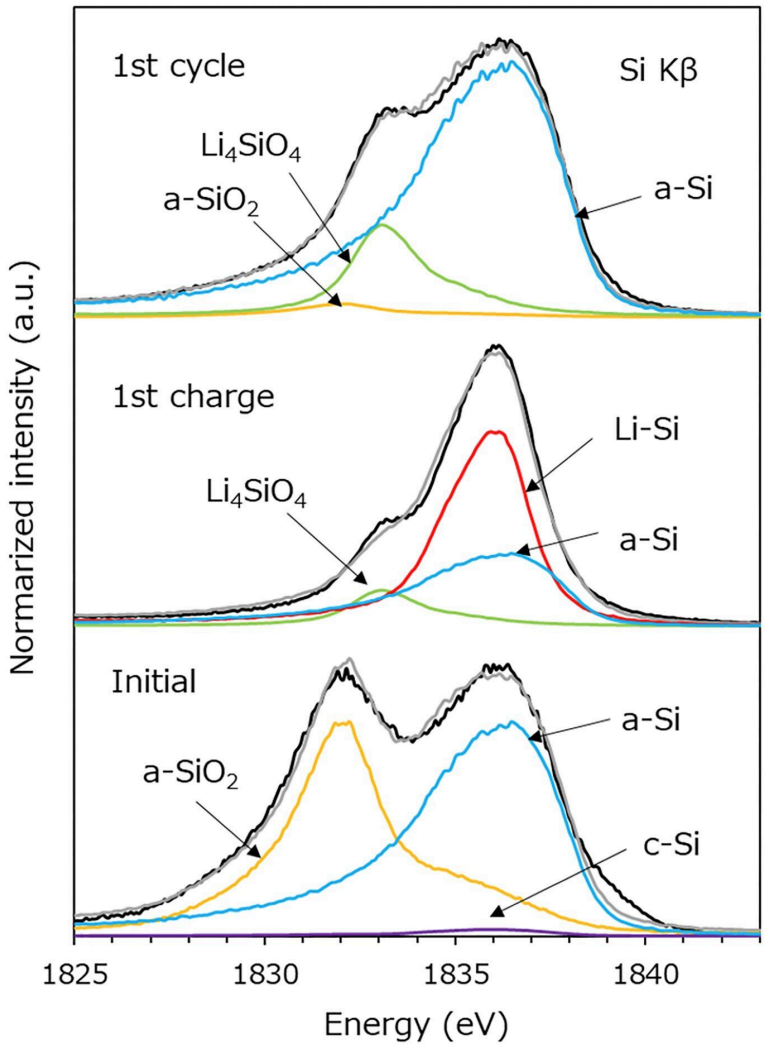
BATT1020 - Composition analysis of Li/Si Ratio and Silicate in Silicon Based Anodes

Introduction

Synchrotron radiation XAFS is generally used in chemical state analysis for metal elements. However, similar assessments can be performed with X-ray emission spectrometers (XES) as well. XES analysis for Si can also be applied to electrode reaction analysis and degradation analysis.

Chemical state analysis

- **Analysis:** Anode material
- **Analysis method:** Linear Combination Fitting
- **Use:** Improving battery lifetime
- **Analyzed materials:** Si metal anodes, SiO anodes



This figure illustrates an XES spectrum for Si Kβ upon initial charging/discharging for SiO-C composite anodes.

Linear combination fitting (LCF) was conducted using a standard spectrum for crystal Si (c-Si), amorphous Si (a-Si), $Li_{3.75}Si$ (Li-Si), SiO and Li_4SiO_4.

Results

When uncharged, SiO is comprised of a-Si and SiO_2. However, it was ascertained that with charging, Li-Si and Li_4SiO_4 are generated, and that a-Si and Li_4SiO_4 are generated after the cycle. As this shows, state analysis for compounds is also possible using the XES method with laboratory instruments.