Analysis of Degradation Mechanisms of Si/mesoporous carbon|$LiNi_{0.5}Mn_{0.3}Co_{0.2}O_2$

Arlavinda Rezqita[a], Jürgen Kahr[a], Raad Hamid[a], Corina Täubert[a]
[a]*AIT Austrian Institute of Technology GmbH, Center for Low-Emission Transport, Giefinggasse 2, 1210 Vienna, Austria.*

E-Mail: arlavinda.rezqita@ait.ac.at

Silicon-based materials are considered to be the anode material of choice for advanced Li ion batteries[1] due to its high theoretical specific capacity (4200 mAh g^{-1}) and a low lithiation potential (~0.2 V vs. Li/ Li^+). In the previous work, we developed Si/mesoporous carbon composites as an active anode material by dispersing Si nanoparticles with particle size of 30 – 50 nm in a Resorcinol-Formaldehyde polymer, followed by pyrolysis and HF etching. In a half-cell configuration, our prepared Si/mesoporous carbon composite electrodes showed an excellent reversible capacity of 903 mAh g^{-1} at 1 C and 683 mAh g^{-1} and 2 C [2] in a state-of-the-art $LiPF_6$-based electrolyte with 5 wt.% vinylene carbonate (VC) as additive. Here, we present the electrochemical performance of Si/mesoporous carbon|$LiNi_{0.5}Mn_{0.3}Co_{0.2}O_2$ in a full cell configuration. In this study, we combine the galvanostatic cycling with Electrochemical Impedance Spectroscopy (EIS) and ex-situ X-ray Diffraction (XRD) analysis. The correlation between electrochemical performance, impedance growth, polarization, and structural changes of electrode materials when cycled at different upper cut-off potentials will be presented. For comparison, the electrochemical performance of graphite|$LiNi_{0.5}Mn_{0.3}Co_{0.2}O_2$-based full cells was investigated as well.

References:

1. X. Zuo, J. Zhu, P. Müller-Buschbaum, and Y.-J. Cheng, *Nano Energy*, **31**, 113–143 (2017).
2. A. Rezqita, M. Sauer, A. Foelske, H. Kronberger, and A. Trifonova, *Electrochim. Acta*, **247**, 600–609 (2017).