In-operando Electron Paramagnetic Resonance Spectroscopy of Lithium Anodes During Electrochemical Cycling

P. Jakes,[1] J. Wandt,[2] C. Marino,[2] H. A. Gasteiger,[2] R.-A. Eichel,[1,3] J. Granwehr[1]

[1]Institut für Energie- und Klimaforschung (IEK-9), Forschungszentrum Jülich
[2]Technical Elektrochemistry, Technische Universität München, Garching
[3]RWTH Aachen University, Institute of Physical Chemistry, Aachen

Corresponding author: Peter Jakes, E-Mail: p.jakes@fz-juelich.de

The formation of mossy lithium and lithium dendrites so far prevents the use of lithium metal anodes in lithium ion batteries. *In-operando* measurement techniques to monitor mossy lithium and dendrite formation during electrochemical cycling can help to develop solutions for this problem [1].

In-operando conduction electron paramagnetic resonance (EPR) spectroscopy [2] is presented as a modality for time-resolved monitoring of lithium plating/dissolution mechanisms in a lithium-metal/$LiFePO_4$ (LFP) cell. The experiments are made possible by a novel concentric battery cell design that is compatible with resonators used in standard EPR spectrometers operating in the X band frequency range. It is shown that the time-resolved *in-operando* EPR data are consistent with *post mortem* scanning electron microscopy (SEM) analysis.

To demonstrate the viability of the *in-operando* EPR method, two cells using different electrolytes were studied. When using an electrolyte containing fluoroethylene carbonate (FEC) additive [3], a higher reversibility of the lithium anode and a reduced formation of mossy lithium were observed.

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