Contribution ID: **100** Type: **not specified**

Neutron imaging into an operating lithium-ion battery

Monday, April 16, 2012 5:00 PM (30 minutes)

Neutron imaging is a valuable tool for in situ characterizations, similar to x-ray radiography. Using time series of neutron images, the change in attenuation of a neutron beam passing through a sample can be used to follow a change in the material over time. The utilization of neutron imaging for fuel cell liquid water metrology has been demonstrated at PSI [1] and NIST [2]. A similar approach can be applied to measure the Li movement and degradation process of electrolyte between the positive and negative electrodes of an operating lithium-ion battery. Due to the high neutron cross-section of the hydrocarbon-based solvents, neutron radiography has been used to see the absorption of the electrolyte during cycling [3].
The neutron imaging experiment was performed at the spallation neutron source (SINQ) at PSI using the cold neutron imaging beam-line ICON to investigate the electrolyte decomposition processes in an electrochemical cell. With the experimental setup neutron imaging offers the ability of viewing directly in the processes between the two electrodes. This method allows us to observe the gaseous releases indirectly by a displacement of electrolyte through the gas emission. We have compared different cell chemistries to get a better understanding of the involved processes. Finally, it was possible to observe the gas evolution process during the first charge and discharge, which clearly shows that the SEI formation on graphite leads to gas releases. In addition, gas formation was observed for the high voltage spinel due to the decomposition reaction of electrolyte at high voltages.

References:
[1] E. Lehmann, P. Boillat, G. Scherrer, G. Frei, Methods Phys. Res., Sect. A, vol. 605, 123 –126, 2009.
[2] D. S. Hussey, D. L. Jacobson, M. Arif, K. J. Coakley, D. F. Vecchia, J. Fuel Cell Sci. and Tech.,7, no. 2, 021024, 2010.
[3] M. Lanz, E. Lehmann, R. Imhof, I. Exnar, P. Novák, J. Power Sources, vol. 101, no. 2, 177 –181, 2001.
[4] A.P. Kaestner, S. Hartmann, G. Kuehne, G. Frei, C. Gruenzweig, L. Josic, F. Schmid, E.H. Lehmann, NIMA, vol 659(1), 387-393, 2011.

Primary author: Dr SOMMER, Heino (BASF SE)

Co-authors: Dr KAESTNER, Anders (Paul Scherrer Institut); Dr LEHMANN, Eberhard (Paul Scherrer Institut); Prof. NOVAK, Petr (Paul Scherrer Institut)

Presenter: Dr SOMMER, Heino (BASF SE)

Session Classification: Fuel cells / Battery electro-chemistry