

Neutron Imaging of Water in Fuel cells –State of the Art and Future Opportunities

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

In situ neutron imaging of operating Polymer Electrolyte Fuel Cells (PEFCs) has been increasingly used in the past 10 years in order to visualize and quantify the distribution of liquid water. The Paul Scherrer Institute (PSI) could bring an important contribution to this field, thanks to the long term collaboration between the Electrochemistry Laboratory (ECL) and the Neutron Imaging and Activation Group (NIAG), both being part of PSI.

Application to fuel cell has been a strong driver for improvements. In the last years, unprecedented spatial resolution could be reached [1-3], allowing in plane imaging (side view) of the cells besides the “traditional” through plane imaging. High resolution imaging was used to draw correlations between liquid water and mass transport losses [4], to study water transport characteristics with isotope labeling [5] and to observe the water/ice behavior in sub-zero fuel cell startup [6]. In current and future experiments, the use of limited beam time is optimized using a newly developed setup for the simultaneous imaging of 6 operating fuel cells [7]. The possibilities of detecting different phases of water (liquid/ice) with energy-selective imaging [8] in operating PEFCs will also be investigated.

- [1] P. Boillat, G. Scherer, A. Wokaun, G. Frei, and E. Lehmann, *Electrochem. Commun.* 10, 1311 (2008).
- [2] P. Boillat, G. Frei, E. H. Lehmann, G. G. Scherer, and A. Wokaun, *Electrochem. Solid-State Lett.* 13, B25 (2010).
- [3] E. Lehmann, G. Frei, G. Kühne, and P. Boillat, *Nucl. Instr. Meth. A* 576, 389 (2007).
- [4] P. Boillat, P. Oberholzer, R. Perego, R. Siegrist, A. Kaestner, E. Lehmann, G. Scherer, and A. Wokaun, *ECS Transactions* 41, 27 (2011).
- [5] P. Boillat, P. Oberholzer, B. C. Seyfang, A. Kaestner, R. Perego, G. G. Scherer, E. H. Lehmann, and A. Wokaun, *J. Phys.: Condens. Matter* 23, 234108 (2011).
- [6] P. Oberholzer, P. Boillat, R. Siegrist, R. Perego, A. Kastner, E. Lehmann, G. G. Scherer, and A. Wokaun, *J. Electrochem. Soc.* 159, B235 (2012).
- [7] P. Oberholzer, P. Boillat, R. Siegrist, A. Kaestner, E. Lehmann, G. Scherer, and A. Wokaun, *Electrochem. Commun.*, submitted for publication.
- [8] L. Josic, E. Lehmann, D. Mannes, N. Kardjilov, and A. Hilger, *Nucl. Instr. Meth. A* 670, 68 (2012).

Primary author: Dr BOILLAT, Pierre (Paul Scherrer Institut (PSI))

Co-authors: Prof. WOKAUN, Alexander (Paul Scherrer Institut (PSI)); Dr KAESTNER, Anders (Paul Scherrer Institut (PSI)); Dr LEHMANN, Eberhard (Paul Scherrer Institut (PSI)); Mr OBERHOLZER, Pierre (Paul Scherrer Institut (PSI))

Presenter: Dr BOILLAT, Pierre (Paul Scherrer Institut (PSI))

Session Classification: Fuel cells / Battery electro-chemistry