Contribution ID: **39** Type: **Talks**

Understanding ion transport in fuel cells: towards in-operando experiments

Saturday, 3 September 2016 11:20 (15 minutes)

High-temperature polymer electrolyte fuel cells (HT-PEFC) are promising electrochemical energy converters. Because of the high operation temperature of 160° - 180°C HT-PEFCs have a high CO tolerance [1]. The fundamental investigation of the proton conductivity will help to optimize performance and increase sufficiency of the fuel cells. For example, the understanding of the proton diffusion mechanism in the membrane electrode assembly (MEA) plays a key role in proton conductivity of fuel cells. The MEA is the central part of the HT-PEFC, which consists of two catalytic layers separated by a proton exchange membrane, typically polybenzimidazole-type (PBI) polymer films doped with phosphoric acid (PA). Neutron scattering offers a unique opportunity to study dynamical properties of hydrogen-containing materials. Backscattering spectroscopy gives insight into local proton transport of phosphoric acid in the PBI membrane [2] and in adjacent electrode layers [3] separately as well as in the complete MEA.

[1] W. Lehnert et. al, in Innovations in Fuel Cell Technology (Eds. R. Steinberger-Wilckens, W. Lehnert), RSC Publishing, Cambridge 2010, pp 45)

[2] O. Holderer et. al, Int. J. Hydrogen Energy 39 21657 –21662 (2014)

[3] M. Khaneft et. al, J. Fuel Cells 2016

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Session Classification: Recent science from Backscattering – Contributed talks