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Insight into the 3D water distribution in PEFC Gas Diffusion Layer by In-situ X-ray Tomographic Microscopy

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Efficient water removal and water management is crucial for the performance of polymer electrolyte fuel cells (PEFC), in particular at high current density operation. In order to better understand the distribution and transport of liquid water in the gas diffusion layer, an in-situ X-ray tomographic microscopy (XTM) setup at the TOMCAT beamline of the Swiss Light Source (SLS) was developed [1] and used to study the liquid water distribution on the pore scale level with pixel sizes of 2-3 micrometer.

Due to use of the high flux ionizing synchrotron radiation, significant radiation damage may be induced during the measurement [2]. Using new CMOS camera technologies, ultra fast XTM scans can be realized even within a few seconds such that radiation damage can be limited and measurement bias is minimized.

Quantitative analysis of the phase segmented XTM data allows to derive e.g. local saturation, water cluster size, water cluster connectivity, and local water thickness analysis.

[1] J. Eller, T. Rosén, F. Marone, M. Stampanoni, A. Wokaun, F.N. Büchi, J. Electrochem. Soc., 158, B963 (2011).

[2] A. Schneider, C. Wieser, J. Roth, L. Helfen, J. Power Sources, 195 (2010), 6349

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