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Insights into Water Cluster Instabilities in Gas Diffusion Layers of Polymer Electrolyte Fuel Cells

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4D X-ray tomographic microscopy (XTM) offers the possibility to obtain detailed insights into the water removal process through gas diffusion layers (GDL) of polymer electrolyte fuel cells (PEFC) [1-4]. Recent work on droplet formation and detachment cycle [5, 6] has provided insights into the inter-action between a percolating water cluster feeding a droplet on the GDL surface and allowed the cal-culation of the capillary pressure in the water cluster via surface curvature analysis. The work of Mu-larzcyk et al. [6] was limited to the analysis of a single percolating water cluster using a small active area of 0.005 mm2. Here we extend the previous study by using a catalyst coated membrane with 8 small active areas (0.0625 mm2) thereby, allowing the analysis of the development of multiple perco-lating water clusters, in addition to increasing statistics [7].

An operando XTM cell was imaged at the TOMCAT beamline of the Swiss Light Source with a scan rate of 1 Hz for 180 s after a current jump from OCV to 1 A/cm2 at 30℃ cell temperature and 100 % relative humidity of anode and cathode feed gases. In total 11 water breakthrough points were identi-fied that percolated from the 8 isolated active areas through a Toray TGP-H-060 GDL (10 %wt PTFE). This presentation will discuss the percolation process of individual water clusters with respect to their through-plane and in-plane growth to identify correlations between the water volume, the local pore structure and the stability of the water cluster –droplet network (see Figure 1).

Participation

In-Person

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