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X-Ray Computed Tomography of Gas Diffusion Layers of PEM Fuel Cells: Calculation of Thermal Conductivity

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Abstract

Three commercially available gas diffusion layers were investigated by 3D x-ray computed tomography (CT). The carbon fibers and the 3D structure of the gas diffusion layers were clearly resolved by this lab-based technique.

Based on 3D structures reconstructed from tomography data, the macroscopic, anisotropic effective thermal conductivities of the gas diffusion layers were calculated by solving the energy equation considering a pure thermal conduction problem. The average in-plane thermal conductivity for all samples, the carbon cloth and the two carbon papers, is by about a factor 4 to 12 larger than the average through-plane thermal conductivity. Furthermore, a clear dependence of thermal conductivity on the porosity and – especially for the carbon cloth – also on the local orientation of the fibers was observed.