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Effects of Microporous Layer on Water Transport Behaviour in PEM Fuel Cell Gas Diffusion Layers

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Abstract. This paper studies water transport behaviours in PEM fuel cell gas diffusion layers (GDLs) under the effects of a microporous layer (MPL) and some GDL structure parameters, namely thickness and pore size. Different paper GDL samples with and without MPL coating were used in this study. The breakthrough pressure of liquid water and water retention in the GDL were measured. The results indicate that applying MPL on the GDL substrate has greater impact on water transport behaviours in the GDL than changing the structure parameters of the GDL substrate. Compared to the GDL without MPL, the results show that applying MPL on the GDL surface considerably increases breakthrough pressure up to 4.3 times, while it greatly decreases water retention in the GDL by up to 13.7 times. For the GDL thickness, the results indicate that thicker GDL of the same structure requires up to 60% higher pressure to break through the GDL, while it can retain up to 4.8 times more water in its structure than thinner versions. In addition, the results indicate that twice-larger mean pore size GDL requires about 1.4 times lower breakthrough pressure, while it retains approximately twice more water in the GDL.