Acid Distribution and Durability of HT-PEM Fuel Cells with Different Electrode Supports -
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The durability of high-temperature polymer electrolyte membrane fuel cells (HT-PEMFCs) was studied with phosphoric acid doped membranes of polybenzimidazole (PBI). One of the challenges for this technology is the loss and instability of phosphoric acid resulting in performance degradation after long-term operation. The effect of the gas diffusion layers (GDL) on acid loss was studied. Four different commercially available GDLs were subjected to passive ex situ acid uptake by capillary forces and the acid distribution mapped over the cross-section. Materials with an apparent fine structure made from carbon black took up much more acid than materials with a more coarse apparent structure made from graphitized carbon. The same trend was evident from thermally accelerated fuel cell tests at 180 °C under constant load where degradation rates depended strongly on the choice of GDL material, especially on the cathode side. Acid was collected from the fuel cell exhaust at rates clearly correlated to the fuel cell degradation rates, but amounted to less than 6% of the total acid content in the cell even after significant degradation. Long-term durability of more than 5,500 h with a degradation rate of 12 µV h⁻¹ at 180 °C and 200 mA cm⁻² was demonstrated with the GDL that retained acid most efficiently.

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