Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Insights into the Distribution of Water in Operating Proton-Exchange Membrane Fuel Cells Using H-1 NMR Imaging. RODERICK WASYLISHEN, KIRK FEINDEL, STEVEN BERGENS, Department of Chemistry, University of Alberta, Edmonton, AB Canada — The operation of proton-exchange membrane fuel cells (PEMFCs) depends critically on the amount and distribution of water throughout the FC (K.W. Feindel, S.H. Bergens, and R.E. Wasylishen *ChemPhysChem*, **2006**, 7, 67-75). To study in-situ the distribution of water in an operating PEMFC using H-1 NMR imaging we constructed PEMFCs to operate within a 10 or 30 mm coil. Recent results provide the first images of the in-plane distribution of water within the PEM. The influence of gas flow configuration in a self-humidifying PEMFC was investigated, and the results are qualitatively in agreement with predictions from several theoretical models. The maximum power output occurs when water begins to accumulate in the cathode flow field, and the integral of the image intensity from the PEM correlates with the power output. The use of H-D exchange has been found effective to introduce contrast in H-1 NMR images. Our results demonstrate that H-1 NMR imaging is capable of providing information on the in-situ operation of PEMFCs that is difficult or impossible to obtain with other PEMFC diagnostic techniques.

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Date submitted: 16 Nov 2006 Electronic form version 1.4