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Two-Phase Flow Frictional Characteristics in Porous Wall Bounded Microchannels EON SOO LEE[1], New Jersey Institute of Technology, JULIE STEINBRENNER[2], University of Colorado, Boulder, CARLOS HIDROVO[3], University of Texas, Austin, KENNETH GOODSON[4], JOHN EATON[5], Stanford University — This presents experimental results from small rectangular channels for fuel cells in which three of the channel walls are smooth, impermeable solid and the fourth wall is a porous gas-diffusion layer. Experiments were performed on a straight 200 by 500 micron by 150 mm long rectangular channel. Three walls of the channel were machined into a solid piece of acrylic. One of the 500 micron wide walls was a commercial Toray carbon paper Gas-Diffusion Layer (GDL) material held in place by a flat sheet of acrylic. Water was forced through the GDL layer from four evenly spaced holes in the flat acrylic piece. A one-dimensional, two-phase flow model was developed which included the effect of air and water flows in both the channel and GDL. The analysis from experimental measurements showed that the product of the friction factor and the gas flow Reynolds number was very nearly a constant, indicating that the model captures the critical physical features of the flow and is useful for the prediction of gas flow rate or pressure drop in a fuel cell microchannel.

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