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## Ionomer Transport Properties Using Interdigitated and Microelectrodes

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### Abstract

Transport through the ionomer as both a membrane and in the catalyst layer is critical for efficient fuel-cell operation. To gain this understanding, we explore the behavior of gas, water, and ion transport in ionomer membranes and thin films using novel microelectrode and interdigitated electrodes. In this work, several common ionomer membranes (including both PFSA and AEM chemistries) are evaluated using a custom microelectrode cell to determine the mass transport parameters of hydrogen and oxygen gas. These parameters are determined as a function of both water content and temperature. Numerical fitting of the current transient is used to separate diffusivity and solubility from a single chronoamperometry experiment. In addition, the electro-osmotic coefficients of these membranes are determined as a function of temperature. Finally, the proton conductivities of both thick and thin ionomer films are reported as a function of temperature and humidity evaluated using interdigitated electrodes. Together, gas transport parameters, electro-osmotic coefficients, and proton conductivities present a more complete picture of ionomer transport properties, allowing for an enhanced understanding of the limiting factors for fuel-cell performance.

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