Impact of electrolyte on protonic conductivity of perfluorosulfonic-acid membranes

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It is known that many redox-flow-battery systems are limited due to ionic conduction through the membrane (e.g., Nafion) and electrolyte solutions.[1] For example, reduction of ohmic losses is currently a focus for LBNL's high-power H_2-Br_2 redox flow battery,[2] where it has been found that the concentration of HBr greatly impacts cell performance due to changes in ionic conductivity.[3] To minimize such losses, supporting electrolytes (typically strong acids) are used, but like HBr, they may detrimentally affect Nafion's proton conductivity at various concentrations. Therefore it is of critical need to understand how strong acids interact with proton-exchange membranes and how they impact their conductivity in order to optimize supporting electrolyte selection and concentration for various flow batteries.

In this work, an H-cell is used to measure the proton conduction through the membrane in different liquid electrolytes, as shown in Figure 1. A small amount of DC current was applied through the cell, and resulted potential drop across the membrane was measured with reference electrodes, and then was converted to resistance values from Ohm's law. Various acidic solutions were utilized as supporting electrolytes, and the effect of the supporting electrolytes was investigated with various types of perfluorosulfonic-acid membranes (PFSAs) membranes.

In this talk, we will discuss on the key parameters for the supporting electrolyte to minimize ohmic losses.

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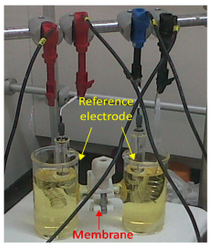

Figure 1. Test setup for measuring ionic conductivity of proton exchange membrane.