Interaction and Transport of Carbon Dioxide in Alkaline Anion Exchange Membranes

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The focus of this work is the study of carbon dioxide transport in alkaline membranes. As indicated in previous works, exposure of carbon dioxide to alkaline membranes causes a conversion of the functional groups from a hydroxide form (OH^-) to a carbonate form (CO_3^{-2}, HCO^-) [1]. In this form the membrane suffers from reduced ionic conductivity.

In an effort to understand this phenomenon carbon dioxide permeation experiments were run on Tokuyama A201 membranes. In the experiments a bare membrane was placed in a test cell and pure carbon dioxide was passed on one side of the membrane while nitrogen was passed on the other. For varying hydration and temperature conditions the transient reading of carbon dioxide in the nitrogen stream was recorded using a Horiba VIA-510 gas analyzer. It was found that when experimental data were fit using a popular single pathway diffusion limited model the general trend was not captured as indicated by fig. 1 [2,3]. As is apparent from the comparison in fig. 1 the existing model requires modification to account for possibilities such as multiple transport pathways, co-limiting transport, and interactions between the carbon dioxide molecules and the functional groups in the membrane. By investigating all of the aforementioned mechanisms new insight can be obtained in the nature of the carbonate conversion process.

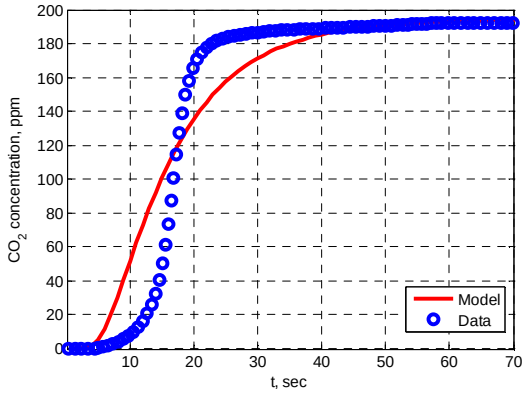

Figure 1: Comparison of the model described in [2,3] to experimental data.

References

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