146d Teom: a Novel Technique to Study Sorption in Nafion Membranes

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In this poster, the use of a novel and relatively fast technique, namely the Tapered Element Oscillating Microbalance (TEOM) is described to accurately measure equilibrium water/methanol sorption-desorption isotherms for PEMs.

The TEOM possess certain advantages over conventional gravimetric techniques in measuring sorption in polymer electrolyte membranes:

1. The steady flow of gas through the sample provides complete contact with the test material.

2.High mass resolution (1x10-6 g) and a low standard deviation.

3.The experiments can be performed over a wide range of temperatures (25 C to 500 C) and pressures (vacuum to 60 atm).

4.The microbalance employs a resonant cantilever to measure changes in inertia rather than weight; hence the data obtained is not influenced by flow patterns of gas streams, buoyancy and other aerodynamic factors.

The heart of the TEOM is an oscillating tapered test bed in which the sample is packed. This tube containing the sample vibrates constantly at its natural frequency of oscillation. There is a feedback system which maintains the oscillation of the tapered bed. The frequency is obtained optically with a transmitter and receiver located on the opposite sides of the oscillating test bed.

We have studied the effect of water and methanol sorption for Nafion membranes. Also, the water sorption was found to increase with temperature from 30 C to 90 C. It was observed that the water sorption for Nafion membrane depends both on the pretreatment of the membrane and on the temperature of sorption. Also, the effect of various cationic forms(H+, Na+, Li+, K+, Cs+) was studied for sorbate sorption in Nafion membrane.

In summary, TEOM appears to be an attractive technique for characterizing sorption-desorption behavior of proton exchange membranes.