NPRE 470 Notes for Thursday March 17

The lecture was broken up into two parts, first Professor Miley gave an overview of his recent conference and discussed fuel cell charge transport from the textbook then Professor Lou discussed how to construct a fuel cell.

**Conference**

* The conference discussed HOH and ZPE fuel cells that ran on water.
* They went on to say that this technology could lead to cars that ran only on water.
* Professor Miley however showed his skepticism toward this idea.

**Fuel Cell Charge Transport**

* A force must act on the charge carriers for charge transport to occur.
* The equation for this transport is:

Ji = ∑k Mik Fk

* Table 4.1 in the textbook then shows the summary of transport processes relevant to charge transport. It gives the driving force, coupling coefficient and equation for conduction, diffusion and convection.
* We can then evaluate the coupling coefficients.
* The voltage loss that is associated with charge transport can be given by the equation:

ηohmic = *i*Rohmic = *i* (Relec + Rionic)

* Area-specific resistance (ASR) can also be used to calculate the ohmic loss by using the equation:

ηohmic = *j* (ASRohmic)

* The ASR of a fuel cell is given by:

ASRohmic = Afuel cell Rohmic

* ASR can then be used to find the ohmic loss for a current density, rather then just using R.
* Resistance scales with thickness, the smaller the thickness the less resistance.
* The conductivity of a carrier can be represented by:

σi = (│zi│F) ci ui

**Build Your Own Fuel Cell**

* The fuel cell Professor Lou brought in to class was a 10 Watt PEM cell
* The membrane had a thickness of 15µm
* It had been modified for Sodium borohydride (NaH4)
* Professor Lou then explained how a fuel cell comes together.
* The internal plates are made of graphite and the end plates are made of fiberglass.
* If bipolar plates are used both air and hydrogen flow through the plate.
* A special carbon cloth is used in the interior of the cell.
* Platinum is formed inside the cell by taking K3(PtCl6)3 + a reducing agent

References

1. NPRE 470 Lecture, 3/17/2011.
2. O'Hayre, Ryan P., Suk-Won Cha, Whitney Colella, and Fritz B. Prinz. *Fuel Cell Fundamentals*. 2nd ed. Hoboken: Wiley, 2009. Print.