

**CH 692 In class w4d1**

- (1) Consider the electro-osmotic drag coefficient.
  - a. What is its physical meaning/significance?
  - b. How would you design and experiment to measure it?
  - c. How do you expect it to depend on the size and charge of the ion?
  - d. If the electro-osmotic drag coefficient goes to zero, what do corresponding transport equations reduce to? Are they consistent with dilute electrolyte theory from last term?
  
- (2) Is Nafion™ N-117 membrane 15 x 15 cm in area with a thickness of 0.18 mm and an IEC of 0.95 meq/g. If the hydrated membrane is 30% water by volume, what is the effective pH of the water domains in the Nafion?
  
- (3) The mass activity of a catalyst for PEM Hydrogen fuel cell is 100 A/g (driving ORR at 0.9 V vs RHE). The Pt loading used at the oxygen cathode is 2 mg/cm<sup>2</sup>. The rate of hydrogen crossover is 0.1 μmol s<sup>-1</sup> cm<sup>2</sup>. The membrane separator is Nafion which has conductivity of 0.01 S/cm. The fuel cell operates at 1 bar using air at the cathode at 25 °C.
  - a. What internal current (loss) does the hydrogen cross-over current represent?
  - b. What is the open circuit voltage of the cell? How does this compare to maximum from thermodynamics
  - c. What is the output voltage at the target operating current of 1 A cm<sup>-2</sup>?