



Consider the PEM sample of FLUENT® software, discussed in the class. Let call the sample “The Original Sample” or simply as TOS. TOS has the same geometry and operational conditions as is provided in the FLUENT® tutorial. According to TOS:

1. Plot the characteristic curve of TOS until the cell voltage reaches about 0.2 V.
2. When can we assume that the concentration polarization can be neglected.

Now perform the following simulations to obtain a deep understanding about the involved phenomena. In all the following investigations, comparison should be made according to TOS. For each comparison, plot all the parameters in a single curve.

1. Effect of transfer coefficient

To obtain the effect of transfer coefficient, choose different values for the parameter α and recalculate the cell polarization curve.

2. Effect of exchange current density

To obtain the effect of exchange current density, choose different values for the parameter i_0 and recalculate the cell polarization curve.

3. Effect of crossover effect

Investigate the crossover effect in low current density zone.

4. Effect of internal resistance

Investigate the effect of internal resistance in polarization curve.

5. Effect of fuel and oxidant pressure

Recalculate the cell polarization curve under different operating pressures. Note that the input pressure remains at atmospheric value but you should change the input concentration values.

6. Effect of temperature

Investigate the effect of temperature on the polarization curve. Choose operating temperature between 50 to 80°C.

7. Effect of GDL porosity

Investigate the effect of GDL porosity on polarization curve and distribution of materials on catalyst layer.



8. Effect of input stoichiometry

Investigate the effect of stoichiometry on the polarization curve by varying the input mass of fuel and oxidant.

9. Effect of different parts thickness

Investigate the effect of the cell geometry on the polarization curve. For this investigation just vary the size of GDL and catalyst layer.

10. Effect of channel shape

Investigate the effect of channel shape on the polarization curve. For this reason put some blockages or steps in the fuel and oxygen channels.

Please note that the each student should carry on only two items according to the following table:

Student	Assigned items
Mr. Aminnia	1 and 7
Ms. Porhemmat	2 and 8
Ms. Seifi	3 and 6
Ms. Shahidian	5 and 11
Mr. Heravi	4 and 10