Appendix A: Parameters that Used to Model PEM Fuel Cells

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>0.06[m]</td>
<td>Cell length</td>
</tr>
<tr>
<td>H_ch</td>
<td>1e-3[m]</td>
<td>Channel height</td>
</tr>
<tr>
<td>W_ch</td>
<td>9.474e-3[m]</td>
<td>Channel width</td>
</tr>
<tr>
<td>W_rib</td>
<td>9.0932e-3[m]</td>
<td>Rib width</td>
</tr>
<tr>
<td>H_gdl</td>
<td>640e-6[m]</td>
<td>GDL width</td>
</tr>
<tr>
<td>H_electrode</td>
<td>50e-6[m]</td>
<td>Porous electrode thickness</td>
</tr>
<tr>
<td>H_membrane</td>
<td>100e-6[m]</td>
<td>Membrane thickness</td>
</tr>
<tr>
<td>eps_gdl</td>
<td>0.4</td>
<td>GDL porosity</td>
</tr>
<tr>
<td>kappa_gdl</td>
<td>1.18e-11[m²]</td>
<td>GDL permeability</td>
</tr>
<tr>
<td>sigma_gdl</td>
<td>222[S/m]</td>
<td>GDL electric conductivity</td>
</tr>
<tr>
<td>wH2_in</td>
<td>0.743</td>
<td>Inlet H2 mass fraction (anode)</td>
</tr>
<tr>
<td>wH2O_in</td>
<td>0.023</td>
<td>Inlet H2O mass fraction (cathode)</td>
</tr>
<tr>
<td>wO2_in</td>
<td>0.228</td>
<td>Inlet oxygen mass fraction (cathode)</td>
</tr>
<tr>
<td>U_in_anode</td>
<td>0.2[m/s]</td>
<td>Anode inlet flow velocity</td>
</tr>
<tr>
<td>U_in_cathode</td>
<td>0.5[m/s]</td>
<td></td>
</tr>
<tr>
<td>mu_anode</td>
<td>1.19e-5[Pa*s]</td>
<td>Anode viscosity</td>
</tr>
<tr>
<td>mu_cathode</td>
<td>2.46e-5[Pa*s]</td>
<td>Cathode viscosity</td>
</tr>
<tr>
<td>MH2</td>
<td>0.002[kg/mol]</td>
<td>Hydrogen molar mass</td>
</tr>
<tr>
<td>MN2</td>
<td>0.028[kg/mol]</td>
<td>Nitrogen molar mass</td>
</tr>
<tr>
<td>MH2O</td>
<td>0.018[kg/mol]</td>
<td>Water molar mass</td>
</tr>
<tr>
<td>MO2</td>
<td>0.032[kg/mol]</td>
<td>Oxygen molar mass</td>
</tr>
<tr>
<td>D_H2_H2O</td>
<td>9.15e-5*(T/307.1[K])¹.⁷⁵ [m²/s]</td>
<td>H2-H2O</td>
</tr>
<tr>
<td>D_N2_H2O</td>
<td>2.56e-5*(T/307.15[K])¹.⁷⁵ [m²/s]</td>
<td>N2-H2</td>
</tr>
<tr>
<td>D_O2_N2</td>
<td>2.2e-5*(T/293.2[K])¹.⁷⁵ [m²/s]</td>
<td>O2-N2</td>
</tr>
<tr>
<td>D_O2_H2O</td>
<td>2.82e-5*(T/308.1[K])¹.⁷⁵ [m²/s]</td>
<td>O2-H2O</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>20+273.15[K]</td>
<td>Cell temperature</td>
</tr>
<tr>
<td>p_ref</td>
<td>101e3[Pa]</td>
<td>Reference pressure</td>
</tr>
<tr>
<td>V_cell</td>
<td>0.9</td>
<td>Cell voltage</td>
</tr>
<tr>
<td>cO2_ref</td>
<td>40.88[mol/m^3]</td>
<td>Oxygen reference concentration</td>
</tr>
<tr>
<td>cH2_ref</td>
<td>40.88[mol/m^3]</td>
<td>Hydrogen reference concentration</td>
</tr>
<tr>
<td>eps_l</td>
<td>0.3</td>
<td>Open volume fraction for fusion in porous electrodes</td>
</tr>
<tr>
<td>kappa_cl</td>
<td>kappa_gdl/5</td>
<td>Permeability (porous electrodes)</td>
</tr>
<tr>
<td>sigma_m</td>
<td>9.825[s/m]</td>
<td>Membrane conductivity</td>
</tr>
</tbody>
</table>
Appendix B: Current Distribution and Water Concentration in GDL

Current density in GDL at operating conditions (298.15 K and 1.5 atm)
Current density in GDL at operating conditions (323.15 K and 1.5 atm)
Current density in GDL at operating conditions (348.15 K and 1.5 atm)
Water concentration in GDL (298.15 K and 1.5 atm)
Water concentration in GDL (323.15 K and 1.5 atm)
Appendix C: Current Density in Membrane
Current density distribution in membrane (298.15 K and 1.5 atm)
Current density distribution in membrane (223.15 K and 1.5 atm)
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