



Numerical Analyses of Perforated Type PEM Fuel Cell's Performance

Objective

□ To design and analyse the performance of an intermediate temperature PEM fuel cell with stainless steel made perforated type flow channels instead of conventional type gas flow channels such as serpentine, inter-digitised and straight channels.

Methodology

- A three dimensional, steady state isothermal, single phase, fully coupled numerical model of a single PEM fuel cell was used to analyse the performance of this novel design concept
- The fuel cell domain was divided into several layers: *gas channel, perforated gas flow channel and gas diffusion layer for both anode and cathode and a sandwiched membrane between both anode and cathode.*
- Flow behaviour and distribution of reactant species along the fuel cell domain was closely studied to analyse the performance of this new design approach. Results obtained from CFD based numerical simulations were compared with the experimental data to validate the numerical model.

Outcome

- Increase in perforated holes diameter improves the performance of fuel cell due to increase in effective surface area of the fuel cell covered by reactant species.
- With the increase of gas channel height the residence time of flow in gas channel decreases which increases the convective flux and reduces the diffusive flux in gas channel
- Change in inlet/outlet holes location from centre to corners improves the reactant species distribution along fuel cell domain, which effectively improves the performance of the fuel cell.

