The impact of channel path length on PEMFC flow-field design

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Distributions in reactant species concentration in a PEMFC due to local consumption of fuel and local transport of water through the membrane cause distributions in current density, temperature, and water concentration in three dimensions in a PEMFC. These distributions can lead to flooding or drying of the membrane that may shorten the life of an MEA. Changing the cell's flow-field pattern to distribute the gas more evenly is one method of minimizing these stresses. This paper investigates how 200 cm^2 serpentine flow-fields with different number of gas paths, and thus different gas path lengths, affect performance and species distribution. The results show how the local temperature, water content, and current density distributions become more uniform for serpentine flow-field designs with shorter path lengths or larger number of channels. These results may be used to develop universal heuristics and dimensionless number correlations in the design of flow-fields and stacks.

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