Performance Evaluation of a UTCFC's PEM Fuel Cell Design at Different Operating Temperatures

R. Zaffou, J. S. Yi, and P. Hagans
UTC Fuel Cells
195 Governor's Highway
South Windsor, CT 06074

Proton exchange membrane fuel cell (PEMFC) systems have increasingly received considerable attention due to its potential use as a power source for both stationary and transportation application. For transportation such as automobile, wider temperature fluctuations due to changes in ambient conditions, variation in the required load, and / or frequent startup and shutdown are expected. These considerations demand PEM fuel cell systems have the capability to operate at wide and frequent variation of operating conditions.

In a PEMFC, water management has a significant impact on performance; adequate water management ensures good membrane conductivity, as well as good transport of reactants. Insufficient membrane humidification can cause membrane dry-out, which can lower the life span of a PEMFC system. Presence of excess liquid water during operation may cause severe performance loss. In a typical PEMFC, membrane humidification and water removal are managed by vapor-phase water transport. In the case of low temperature operation, the amount of water supplied and removed to/from the cell can be reduced significantly which may become an issue for developing PEM fuel cells for transport applications.

In this study, we investigated the water management capability of a UTC Fuel Cell's design; performance was evaluated for temperatures ranging between 10 ^{0}C and 80 ^{0}C. Operability over a wide temperature range including current and voltage distribution will be demonstrated, and the temperature dependency of the kinetic parameters, the ohmic parameters and the mass transport parameters will be discussed.