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 °C and 80 °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.