

Study on Cold Start Characteristics of PEFC with Adiabatic Temperature Rise

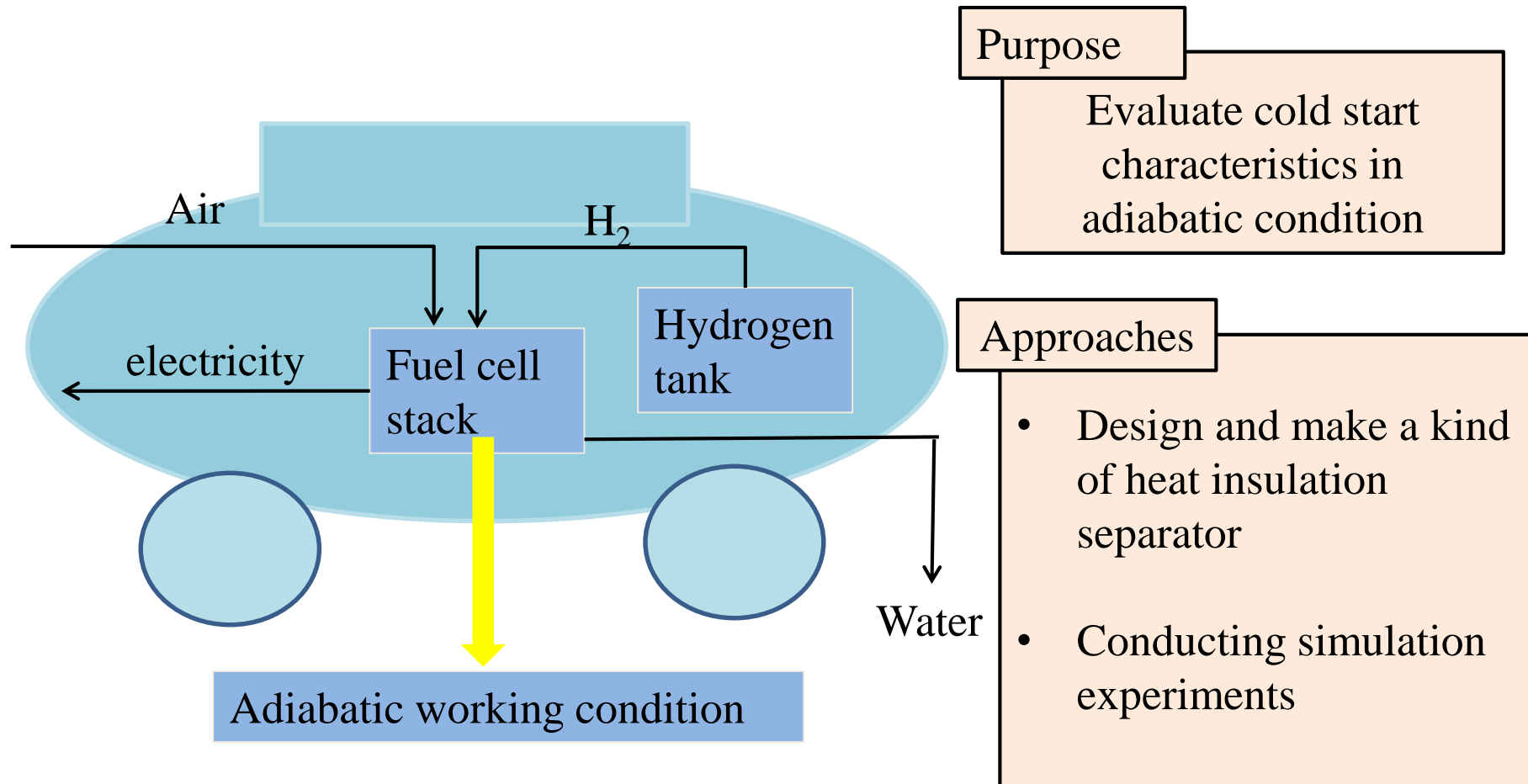
断熱温度上昇に伴うPEFC氷点下起動特性に関する研究

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Clarify cold start characteristics of PEFC used in fuel cell vehicles \longrightarrow Promotion of FCV in the market



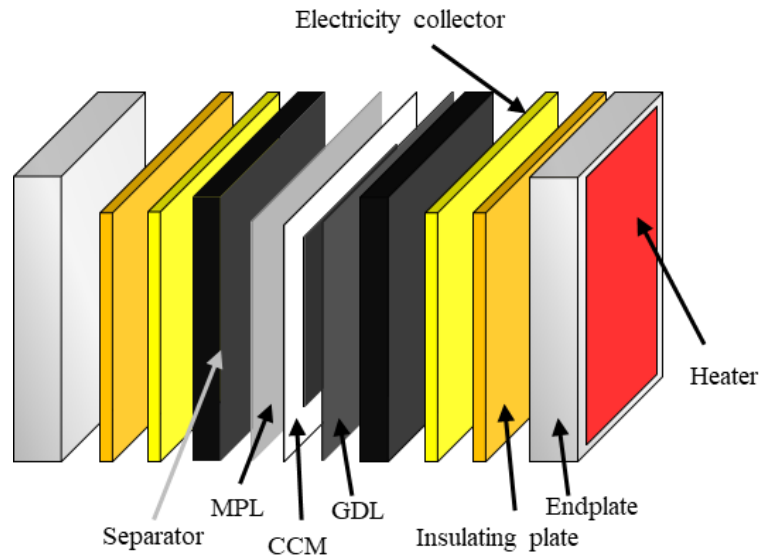


Adiabatic Condition

Achieved by eliminating the temperature difference on the both sides of insulating plates

Drawbacks

- Long time to eliminate the temperature difference
- Hard to heat the carbon separator



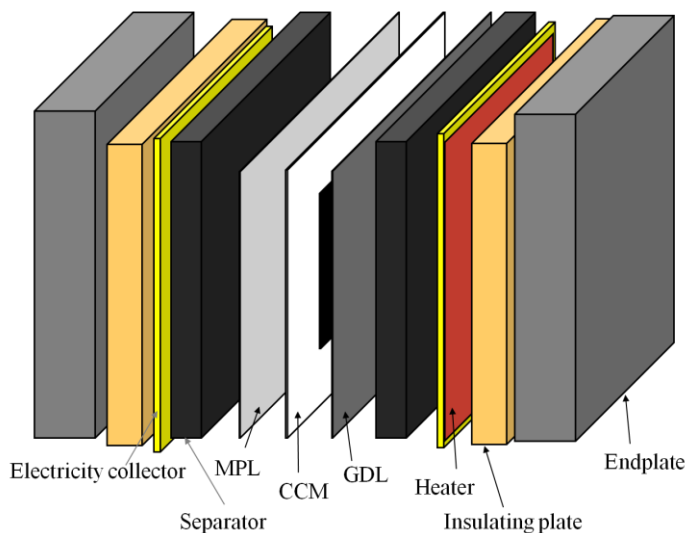


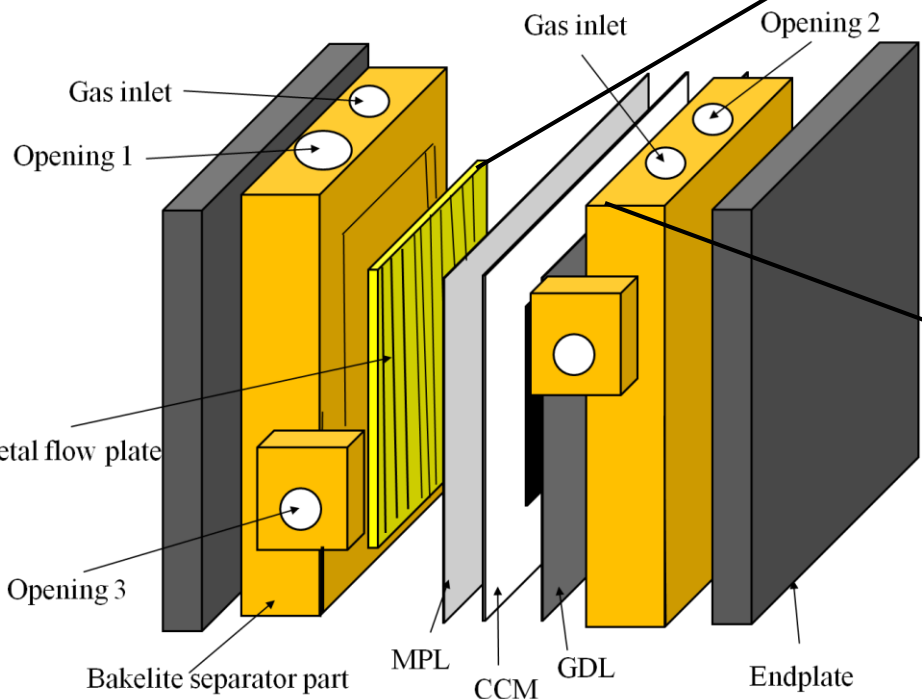
Adiabatic Condition

Achieved by controlling heaters to simulate calculated adiabatic temperature rise

Drawbacks

- Limitation of heater power
- Opposite temperature gradient





Metal flow plate part
Material: Copper
Surface treatment: Gold plating
Area: 5cm × 5cm
25 Channels, 26 Ribs

Bakelite separator part
Material: Bakelite
Opening 1: Measure voltage and resistance
Opening 2: Conduct electricity
Opening 3: Measure temperature



Thermostatic Chamber

Conditioning

5hours

Purge

3hours

Cooling

1~2hours

Cold startup

5~10minutes

Area: 5cm × 5cm

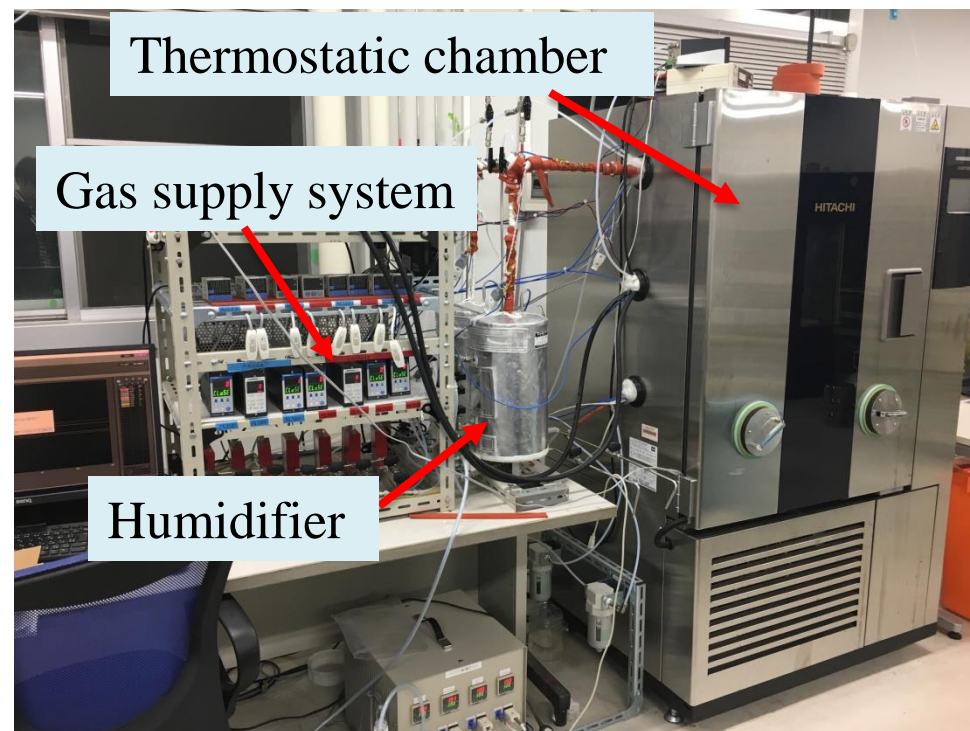
Parallel straight channels

Anode side: hydrophobic

MPL, platinum 0.1mg/cm²

Cathode side: hydrophilic

MPL, platinum 0.4mg/cm²

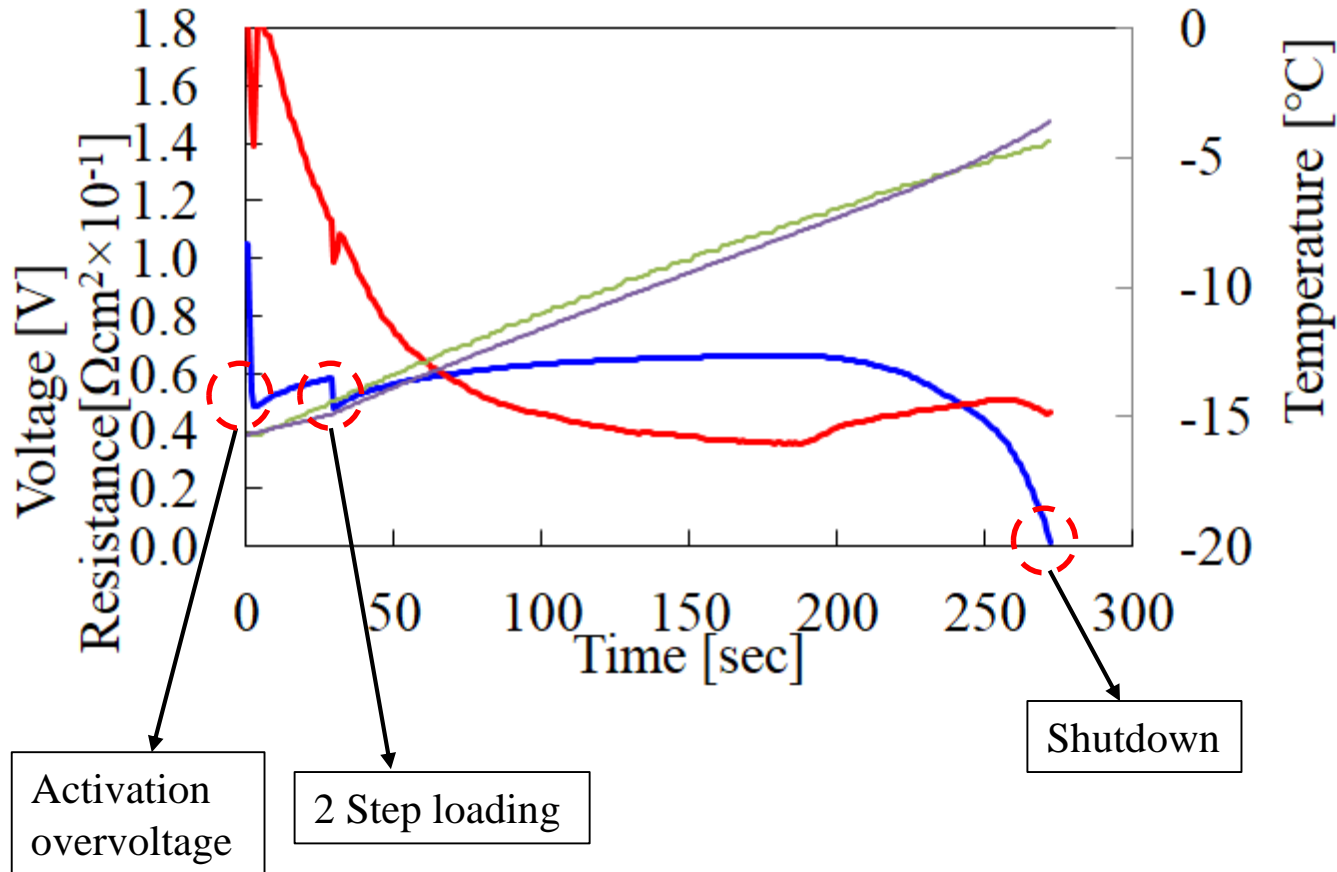




35%RH, $0.04\text{A}/\text{cm}^2 \xrightarrow{28\text{s}} 0.07\text{A}/\text{cm}^2$ through 2 step loading

Experimental results

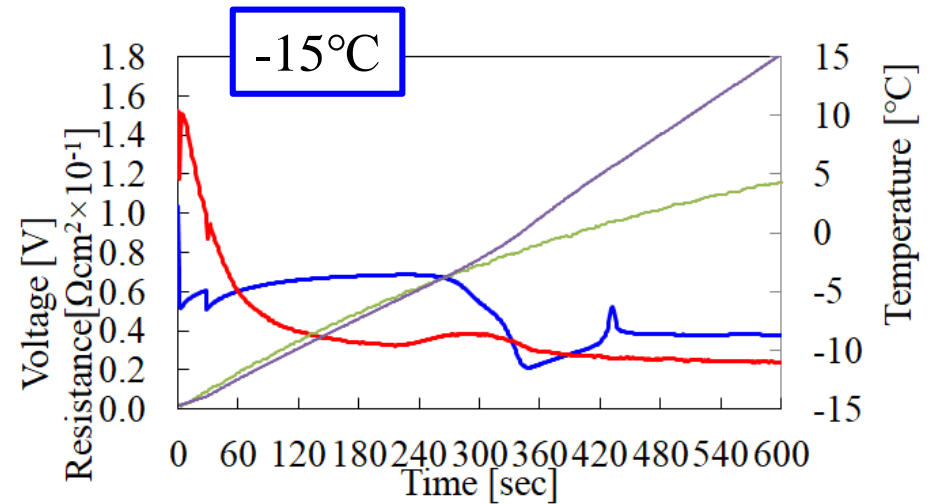
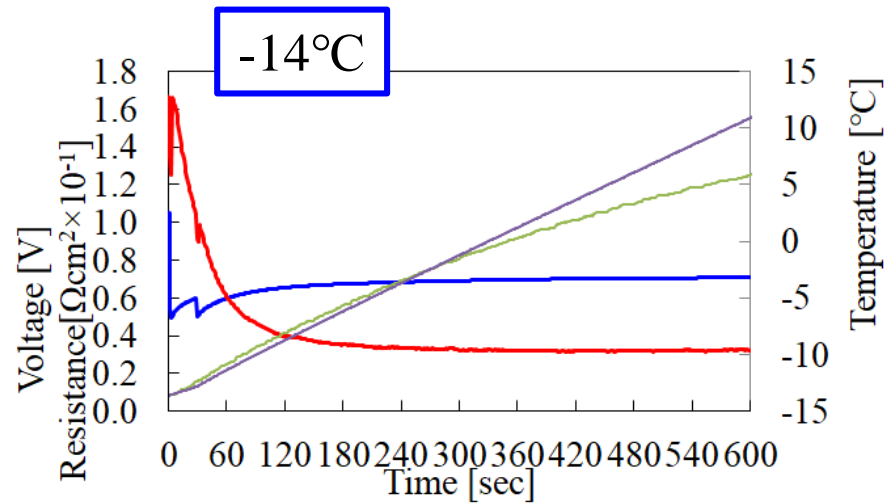
Cold startup from -16°C





35%RH, $0.04\text{A}/\text{cm}^2 \xrightarrow{28\text{s}} 0.07\text{A}/\text{cm}^2$ through 2 step loading

Experimental results





- A new kind of heat insulation separator was designed to simulate adiabatic condition using a single cell without heater.
- Cold start succeeded from -15°C through 2 step loading, but the experimental results suggested that heat insulation performance of experimental cell is needed to be improved.
- Cell with the new designed heat insulation separator was generally proved to have better heat insulation performance through experiments.