

Short Stack Testing Conditions at EPFL

Short-stacks ($6 \times 80 \text{cm}^2$) provided by SP have been tested on dedicated set-ups which delivers the gases (air, H_2 , N_2 , CO, CH_4 , CO_2 , steam) to the stack and allows measurement of gas inlet and outlet temperatures, pressure drops and individual repeating units (RU) voltage.

The current is controlled with an electronic load, the gas flows with mass-flow controllers and the water feed (for the evaporator) with a membrane pump.

In SP stack design, the current is drawn through rod at the bottom of the stack, whereas the voltage probes are on the side (cf. schematic figure).

The inlet gases are electrically preheated while the outlet are cooled down either by air or water to condensate the steam and separate the exhaust gas.

If the exhaust gas is not analysed, it is sent back in the stack chamber to be burnt and evacuated by a chimney.

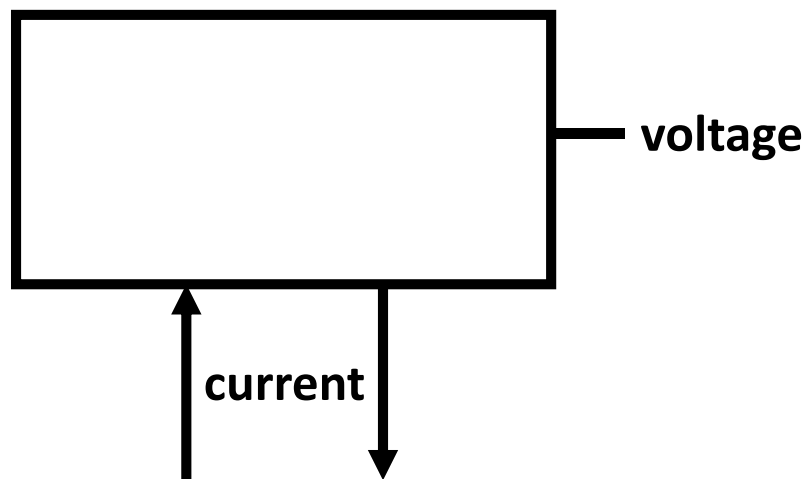


Fig. 1. schematic representation of the current and voltage in the stack

The stacks are reduced and qualified at SP before to be shipped. At EPFL they are heated up under reducing condition (forming gas: 5% H_2 and 95% N_2) up to 600°C . Above this temperature, the flow composition is set to 60% H_2 -40% N_2 up to the working temperature of 750°C . The first characterization done is an IV curve to compare with the qualification performed at SP.

The flow rates are:

H_2 3.6 Nml/min/cm²

N_2 2.4 Nml/min/cm²

Air 32 Nl/min

V-i curves are performed periodically by varying the current between the OCV and 33A, corresponding the steady-state polarization current. The current change rate is 1A/min.

The EIS measurements are performed using an IVIUM Vertex spectrometer in floating mode. For current biases $>10\text{A}$, the Vertex is used in connection with IVIUMBoost of 40A.

Measurement range:

Vertex

Current compliance: ± 10 A

Maximum output Voltage: ± 10 V

Potentiostat Bandwidth > 100 kHz

Connection: WE/RE/S/CE 4-electrode configuration

EIS frequency range: $10 \mu\text{Hz}$ to 1 MHz

EIS amplitude: 0.015 mV to 1.0 V, or 0.03% to 100% of current range

IVIUMBoost

Current compliance: ± 40 A

Maximum output Voltage: ± 10 V

Potentiostat Bandwidth > 100 kHz

Connection: 2, 3 and 4 electrodes/terminals

EIS frequency range $10 \mu\text{Hz}$ to 100 kHz

EIS amplitude 0.015 mV to 1.0 V, or 0.03% to 100% of current range