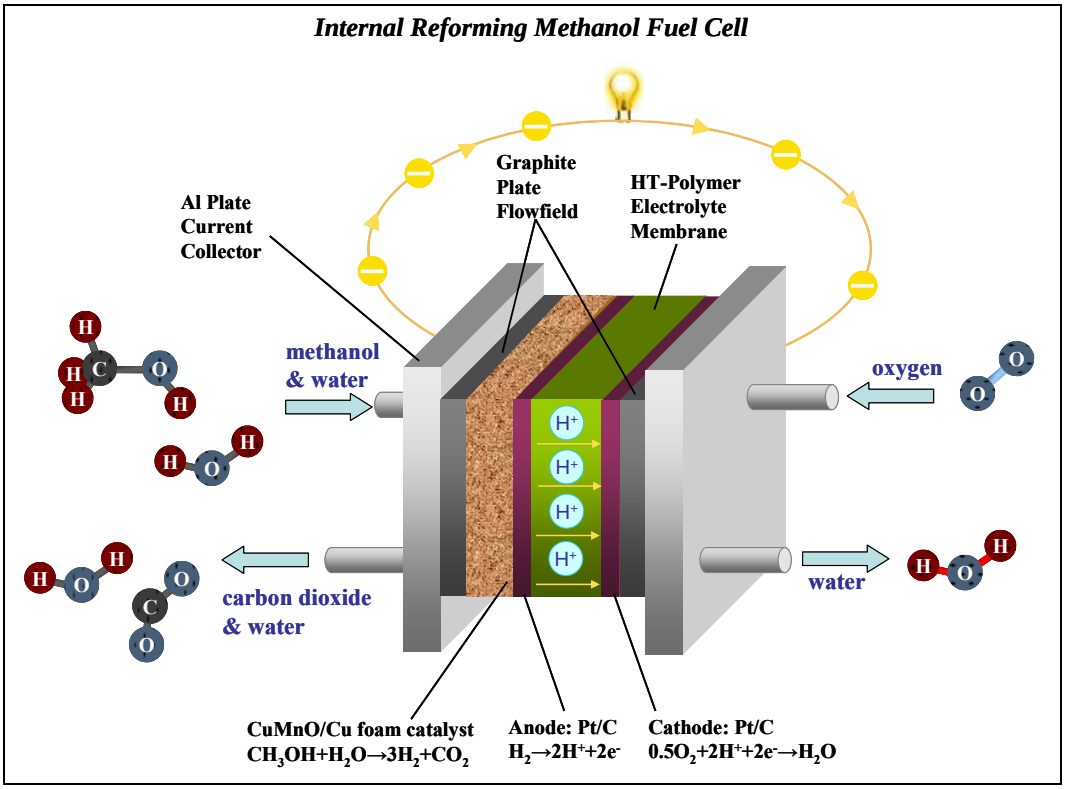
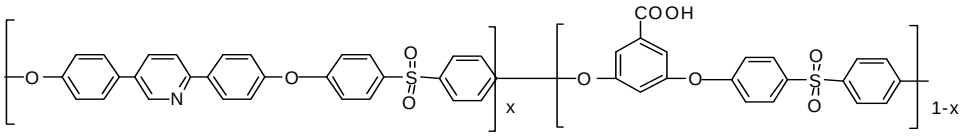
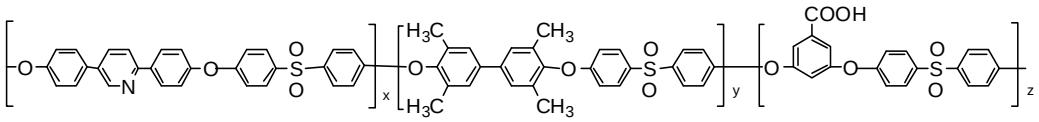


Figure 1: Integrated reformed alcohol (methanol) HT-PEMFC configuration. The fuel cell is composed of a membrane electrode assembly (MEA) comprising a high-temperature proton-conducting electrolyte membrane sandwiched between the anodic (methanol reforming catalyst for the production of CO-free hydrogen + anode electrocatalyst) and cathodic gas diffusion electrodes.

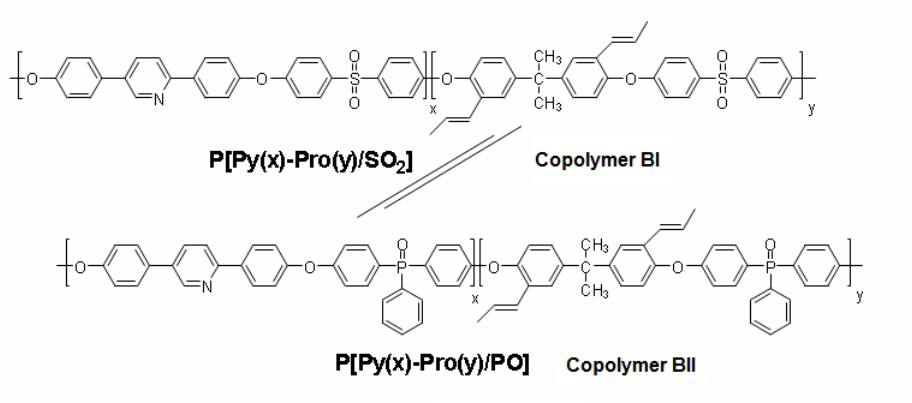


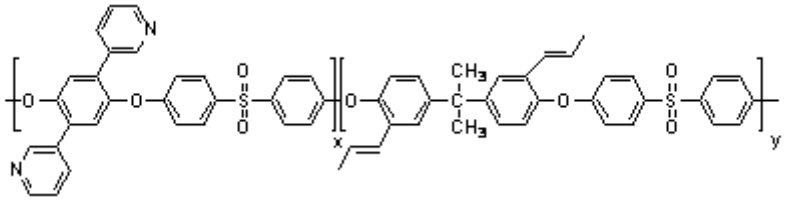
Copolymer A



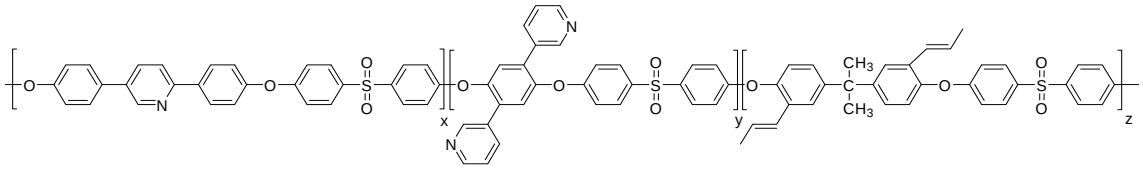
Terpolymer A

Scheme 1: Stuctures of aromatic polyethers bearing side cross-linkable carboxy groups.



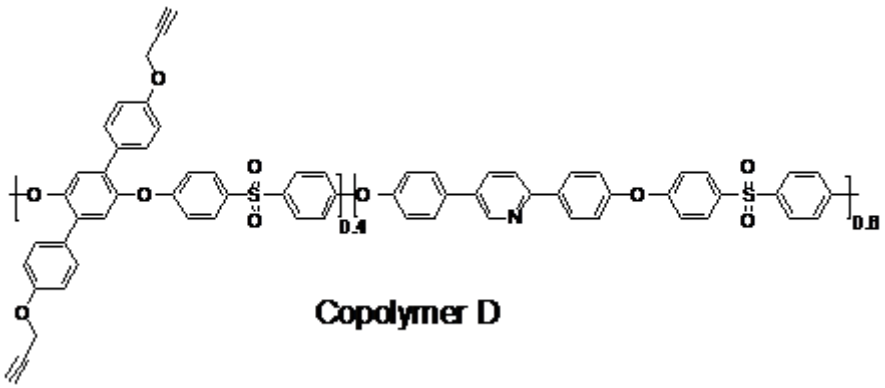


Copolymer C



Terpolymer D

Scheme 2: Structures of aromatic polyethers bearing side cross-linkable double bonds.



Scheme 3: Structures of aromatic polyethers bearing side cross-linkable triple bonds.

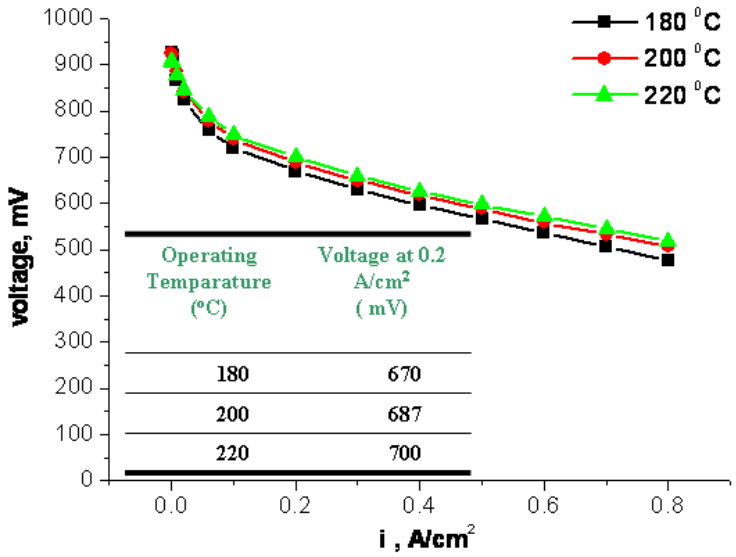


Figure 2: Current- voltage curves for the CopBIc crosslinked with bisazide at several operating temperatures ranging between 180-220°C using dry gases with anode (H_2) and cathode (Air) stoichiometric ratio of 1.2 and 2, respectively, at ambient pressure. Doping level: 195 wt.%, membrane thickness: 120μm, active area: 25cm^2.

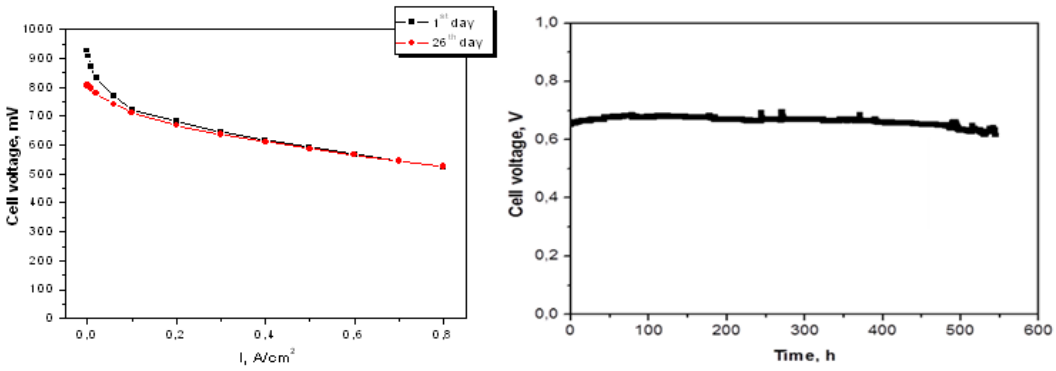


Figure 3: (a) Current- voltage curves for the TerpolB5 cross-linked with bisazide in 1st and 26th day at 210°C using dry gases with anode (H2) and cathode (Air) stoichiometric ratio of 1.2 and 2, respectively, at ambient pressure. Doping level: 320 wt. %, membrane thickness: 70-115 µm, active area: 25cm2. (b) Long term stability of cross-linked terpolB5CL at 0.2 A/cm2 and 210°C**.**

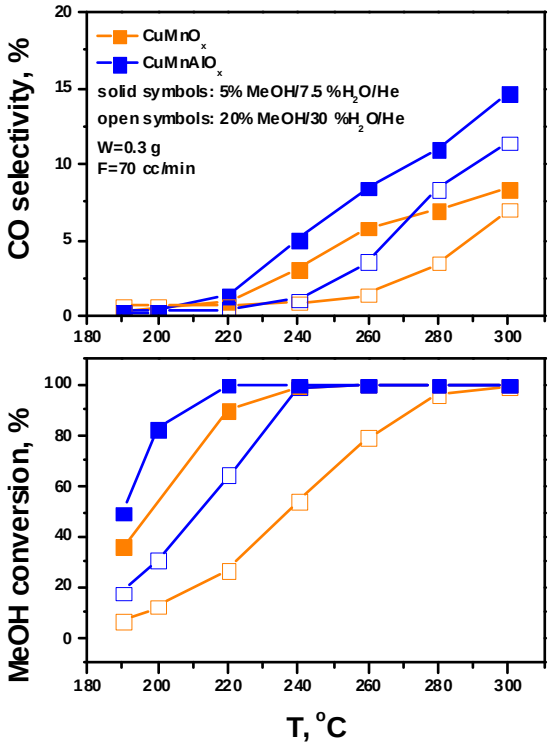


Figure 4: Activity and selectivity for steam reforming of methanol over combustion-synthesized Al-doped CuMnOx catalysts.

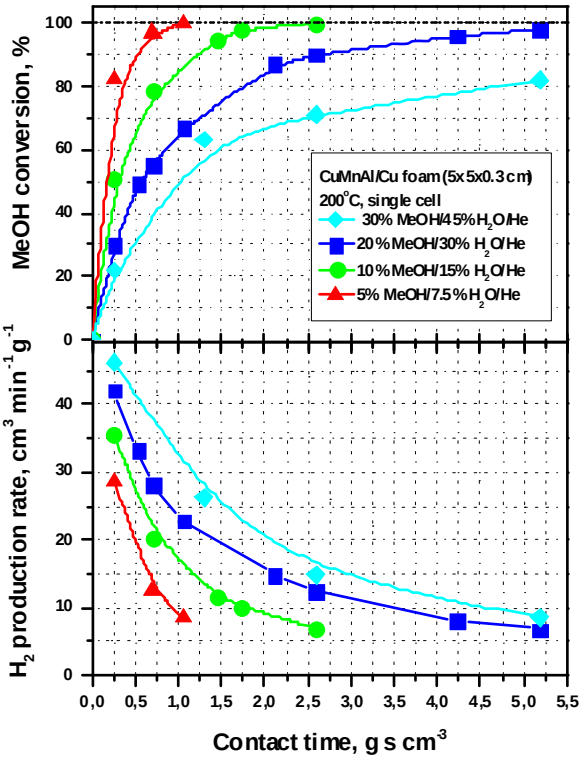


Figure 5: Activity of CuMnAlOx catalyst at 210°C

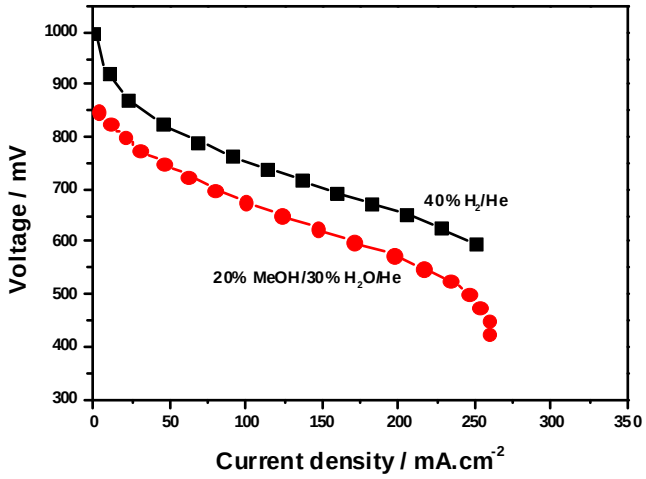


Figure 6: Polarization curves obtained at 200°C in an IRMFC composed of ADVENT TPS® MEA (22 cm^2 active area) and 4.5 g of CuMnOx on Cu foam (3 mm thickness) for two different feedstreams. 40% H_2/He (■); 20%MeOH/30%H_2O/He (75% MeOH conversion at 600 mV), W/F = 2.455 g s cm^{-3} (●).

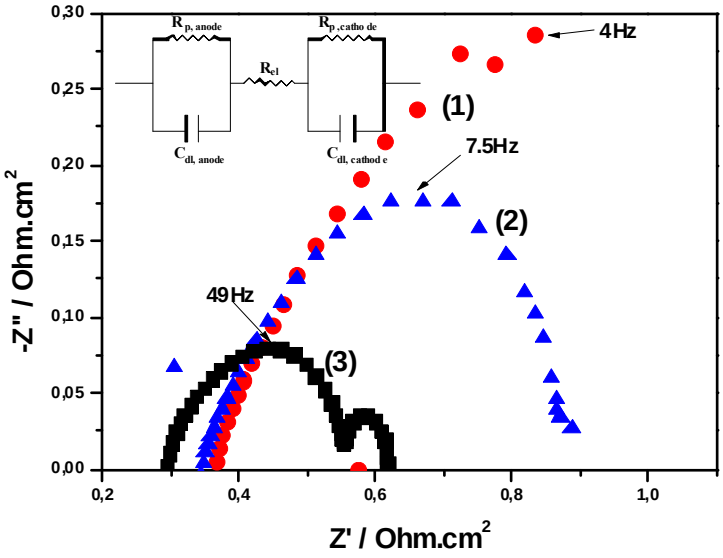


Figure 7: Effect of MeOH/H_2O mixture on the electrochemical behaviour of internal reforming methanol single cell composed of ADVENT TPS® MEA (22cm^2 active area) and 4.5g of CuMnOx on Cu foam (3 mm thickness). Impedance spectra were obtained at 200°C and 0.12 A cm^{-2} under (1) 20%MeOH/30%H_2O/He (W/F = 2.455gscm^{-3}; 600mV at 2.7A) and after switching to pure H_2 ("2": 738mV at 2.7A and "3": 728mV at 2.7A after 15h). Cathode feed: pure oxygen ($\lambda O_2 = O_2$ fed/ O_2 reacted = 2). Inset: Equivalent circuit. Rel = ionic resistance of the membrane, Rp = polarization resistance, Cdl = double-layer capacitance.

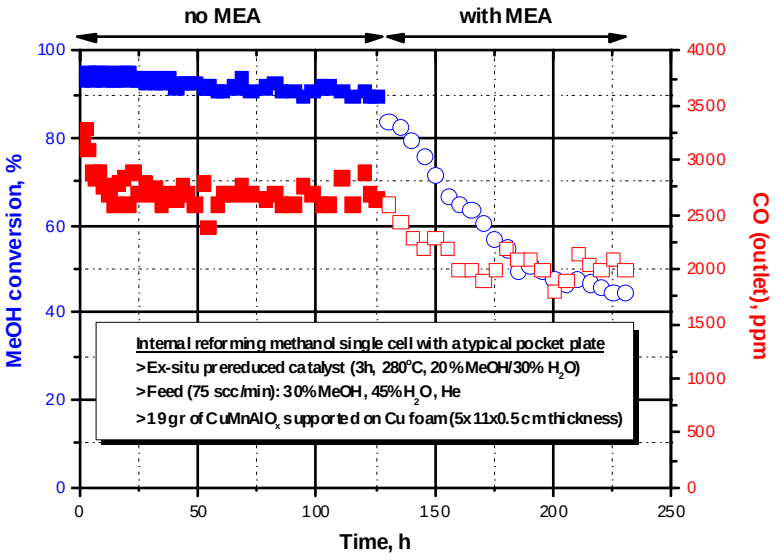


Figure 8: Long term testing of CuMnAlOx/Cu foam reformer

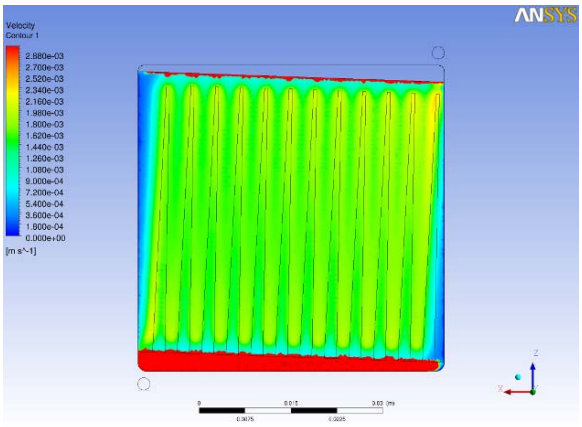


Figure 9: Flow equipartition for trapezoidal channels in the foam and an inlet/ outlet geometry of variable diameter; top view of CFD simulation

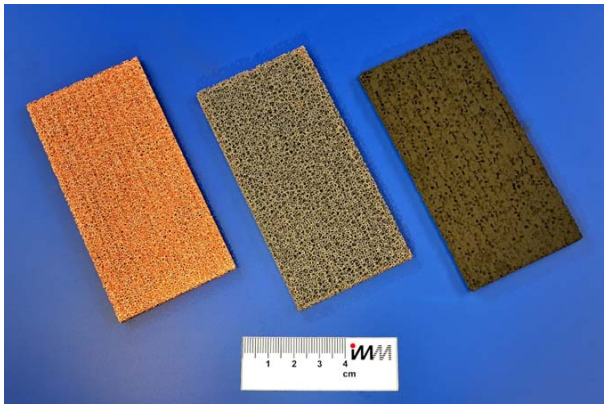


Figure 10: Copper foam after shaping by EDM (left); foam after calcination (centre) copper foam coated with catalyst (right)

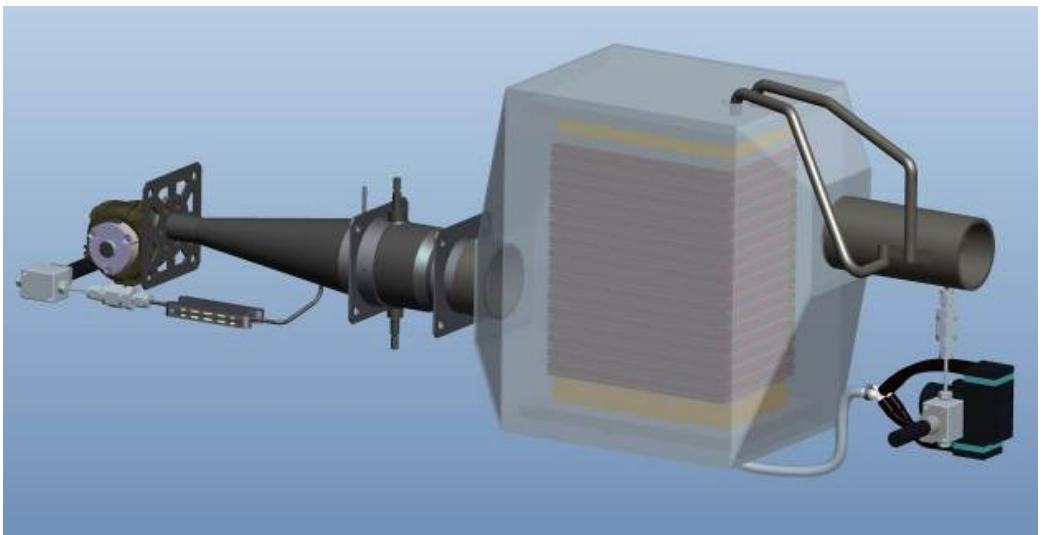


Figure 11: CAD model of the integrated, revised system

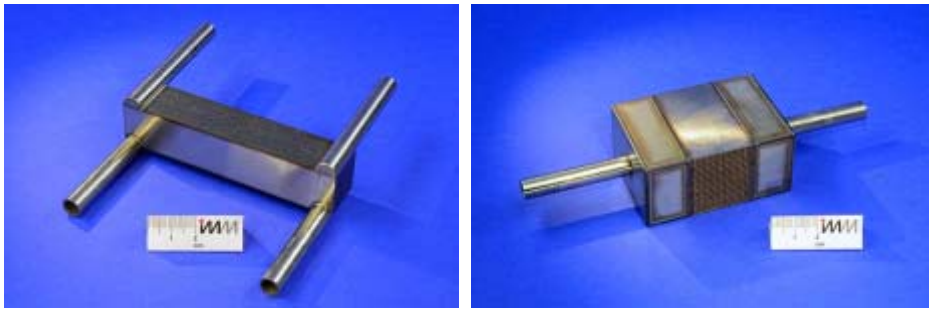


Figure 12: HX-01 (cathode air pre-heating, left); HX-02 (FC heat management, right)

Figure 13: Evaporator/ afterburner Unit (left); monolithic burner (right)

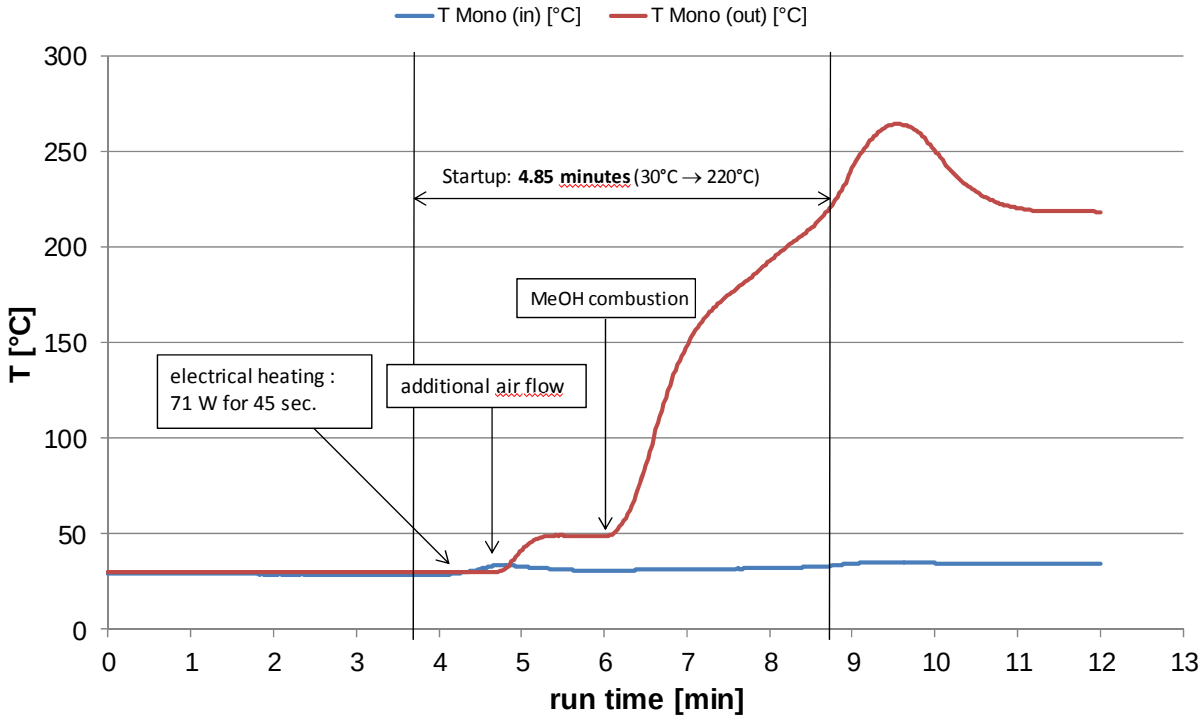


Figure 14: Results from start-up burner testin

Figure 15: Main components of the final stack (15 MEAs plus 15 reformers; indirect configuration)

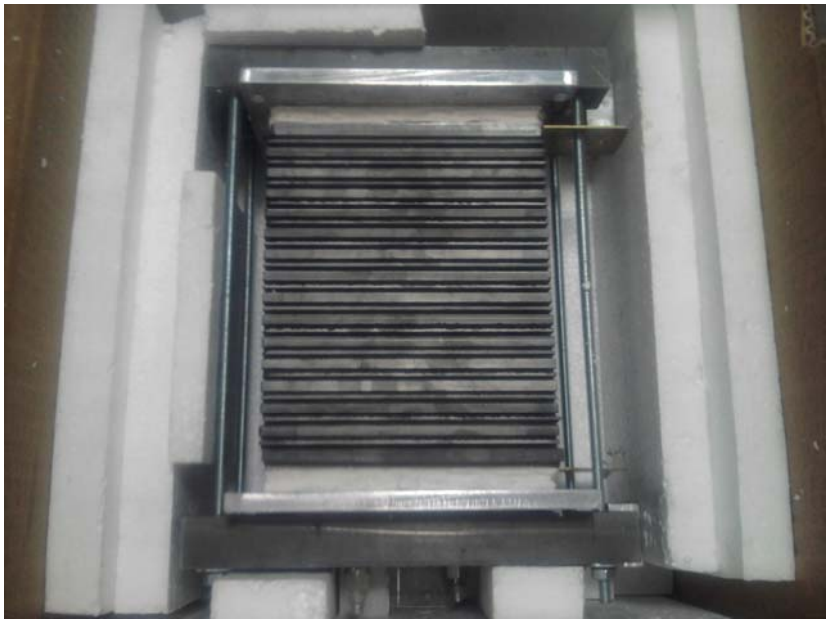


Figure 16: Final stack (15 MEAs plus 15 reformers; indirect configuration

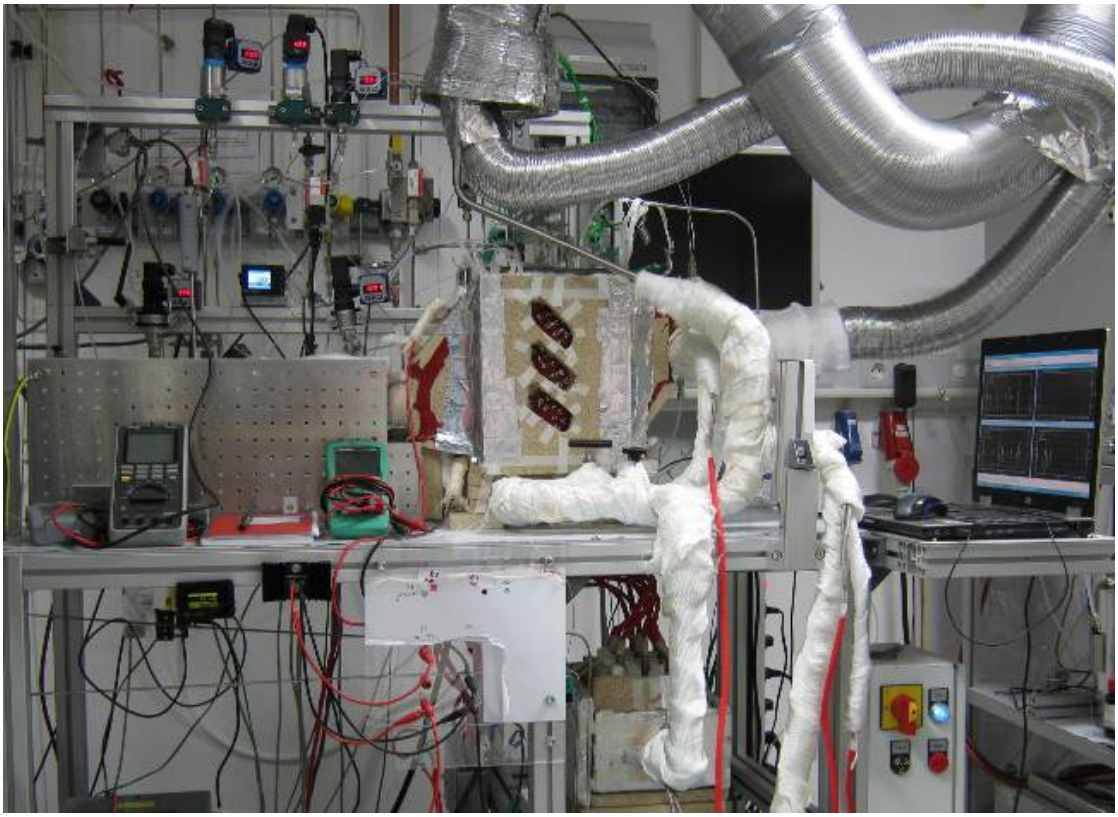


Figure 17: Revised bread-board system; start-up subsystem is on the left; fuel cell stack in the centre; methanol/water dosing, evaporation and integrated afterburner on the right