

CA: A2 Topic: Cost Effective Fuel Cell System
Deliverable / Milestone Code: D2-A2.1

The collaboration of the 3 partners on the project of evaporative cooling has finally led to fulfilling of the milestone with demonstrating the principle evaporative cooling of a polymer electrolyte fuel cell in a laboratory experiment. The technology level has thus been advanced in the SCCER project from TRL1 to TRL 3.



Figure 1: Optical photograph showing the surface of modified, patterned gas diffusion layer (porous carbon fibre sheet) for use for evaporative cooling in fuel cells.

Modified GDL were prepared successfully (see Figure 1) and applied for evaporative cooling in a PEFC laboratory cell. The cell was imaged using neutron radiography, the water pattern in the gas diffusion layer is shown in Figure 2.

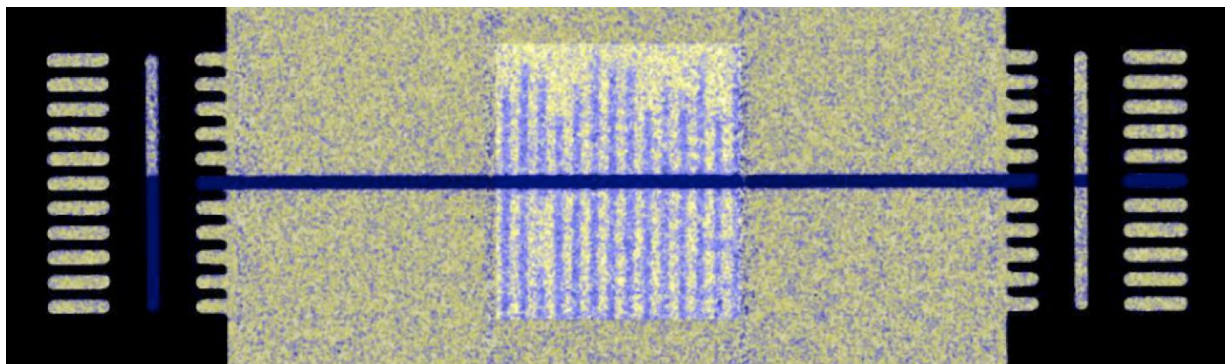


Figure 2: Water (blue) in fuel cell (active area = bright yellow domain) showing the stripe structure of the liquid water phase used for evaporative cooling during operation.

Up to a current density of more than 1 A/cm² the total heat flux in the cell is negative, proving that more heat is released from the cell by evaporation than produced by the electrochemical reaction (see Figure 3).

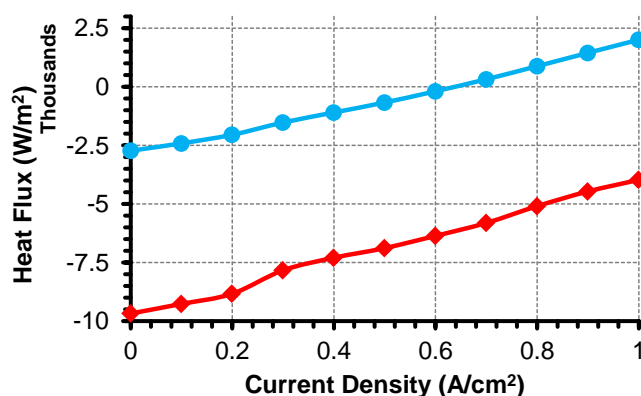


Figure 3: Heat fluxes on anode and cathode sides of the fuel cell. The sum is negative, showing the cooling by evaporation is sufficient for removing the heat from the cell by the phase change of the water in the stripes.

This validates the concept of cooling of polymer electrolyte fuel cells by evaporation of water from thin stripes in modified patterned gas diffusion layers, achieving the milestone for this activity.