An original sensor for the detection of liquid water in gas distribution channels of Proton Exchange Membrane Fuel Cells (PEMFC)

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Liquid Water Issue in a PEMFC

Excess of water vapour

→ Condensation

→ Porous structures fill-in

→ Liquid water columns in gas channels

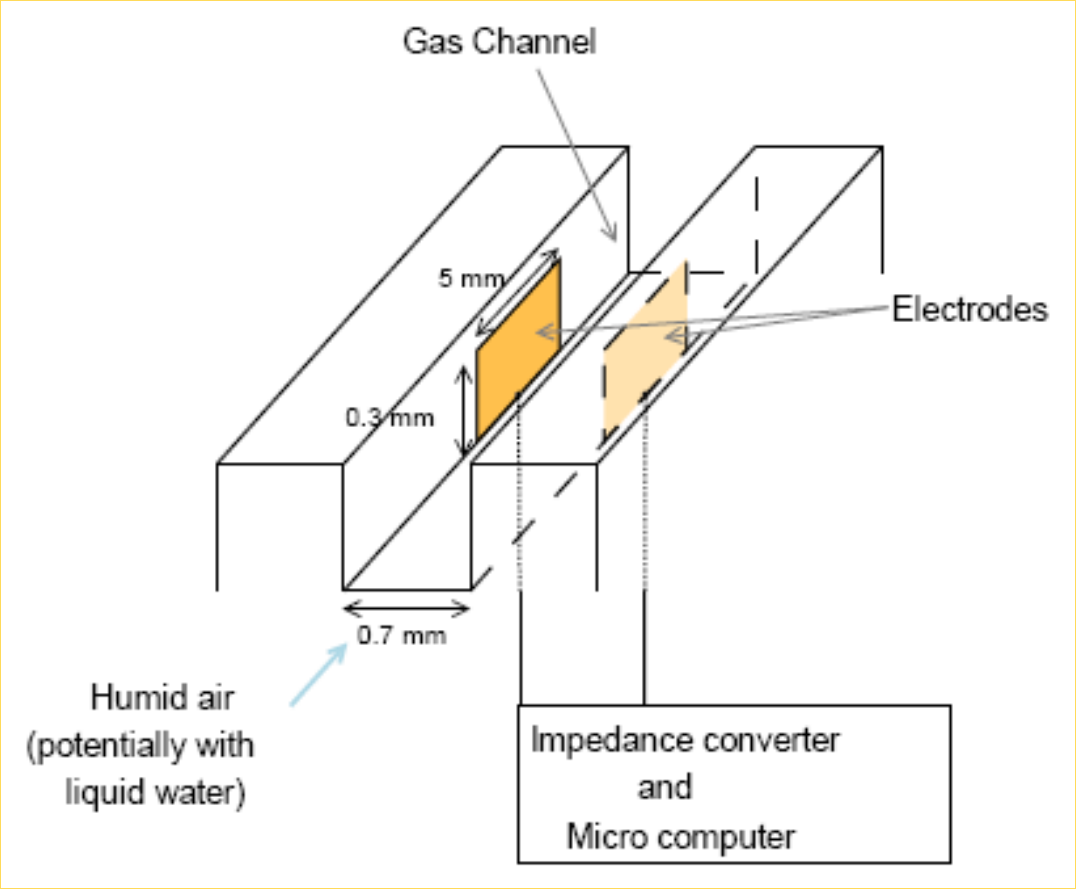
Need of a sensor to detect water droplets

→ Understanding the formation phenomenon

→ Consequences on performance

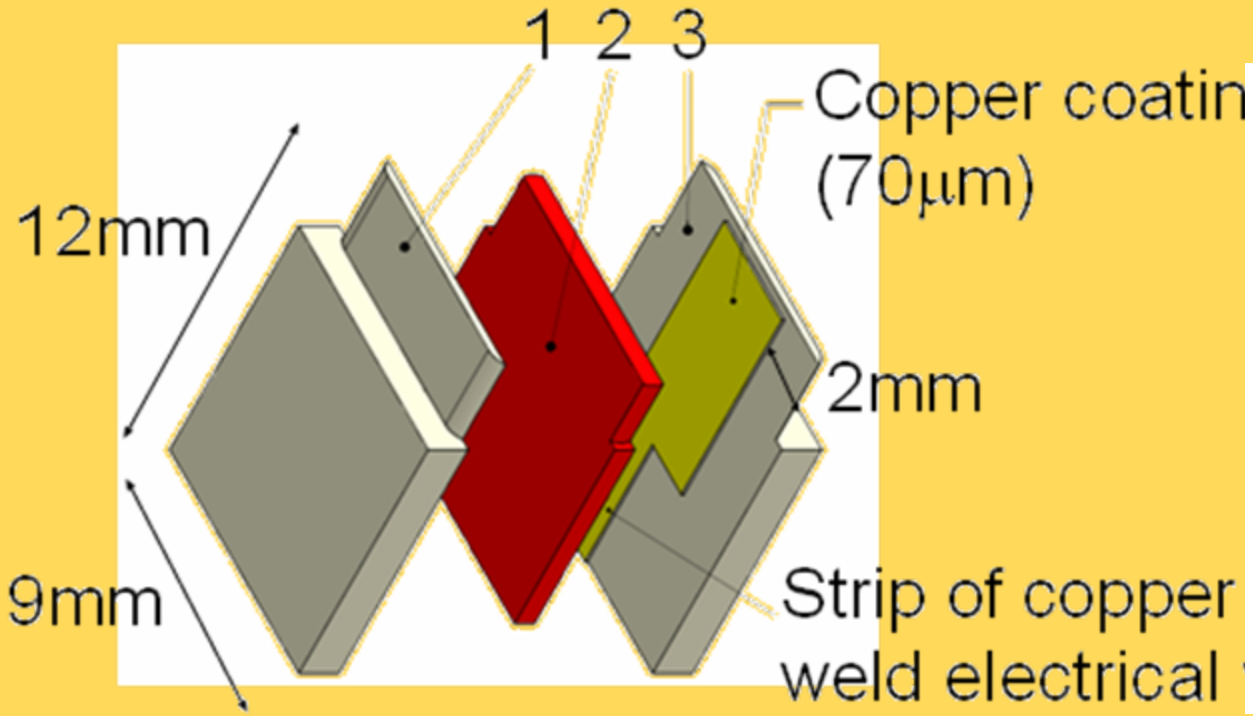
A sensor for the detection of water droplets

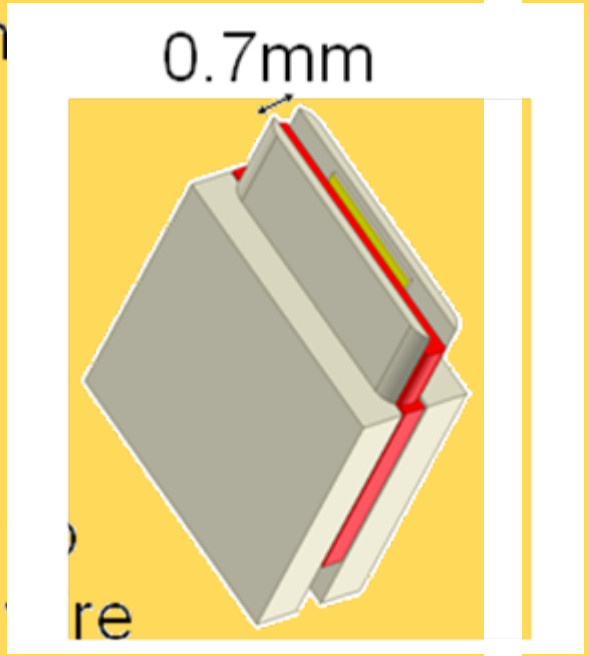
- Alternating current supply
- Acquisition of response signal
- Impedance measurement



Aim: Distinguish liquid from gaseous water.

Manufacture of the sensor

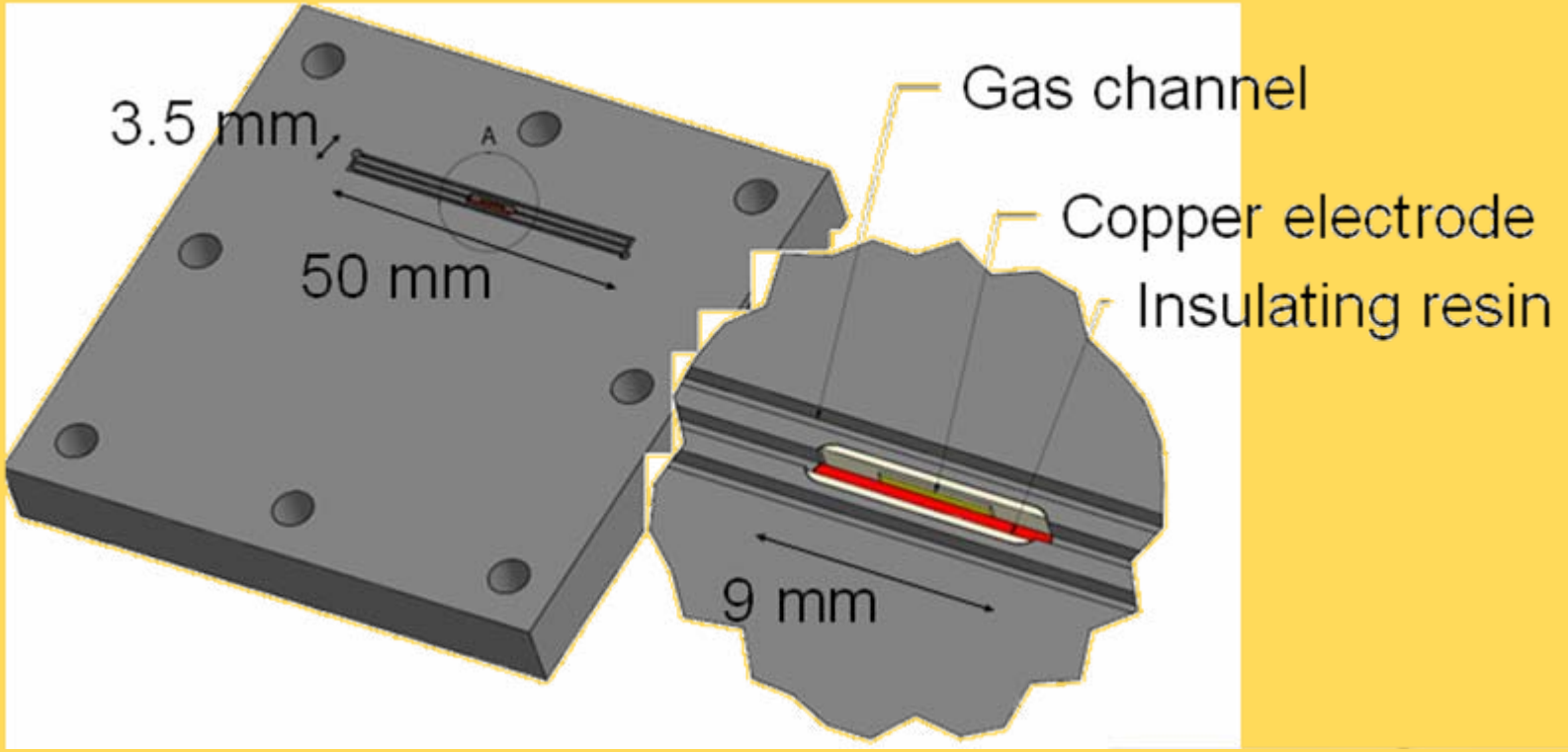




1 and 3 : Electrodes made out of printed circuit board

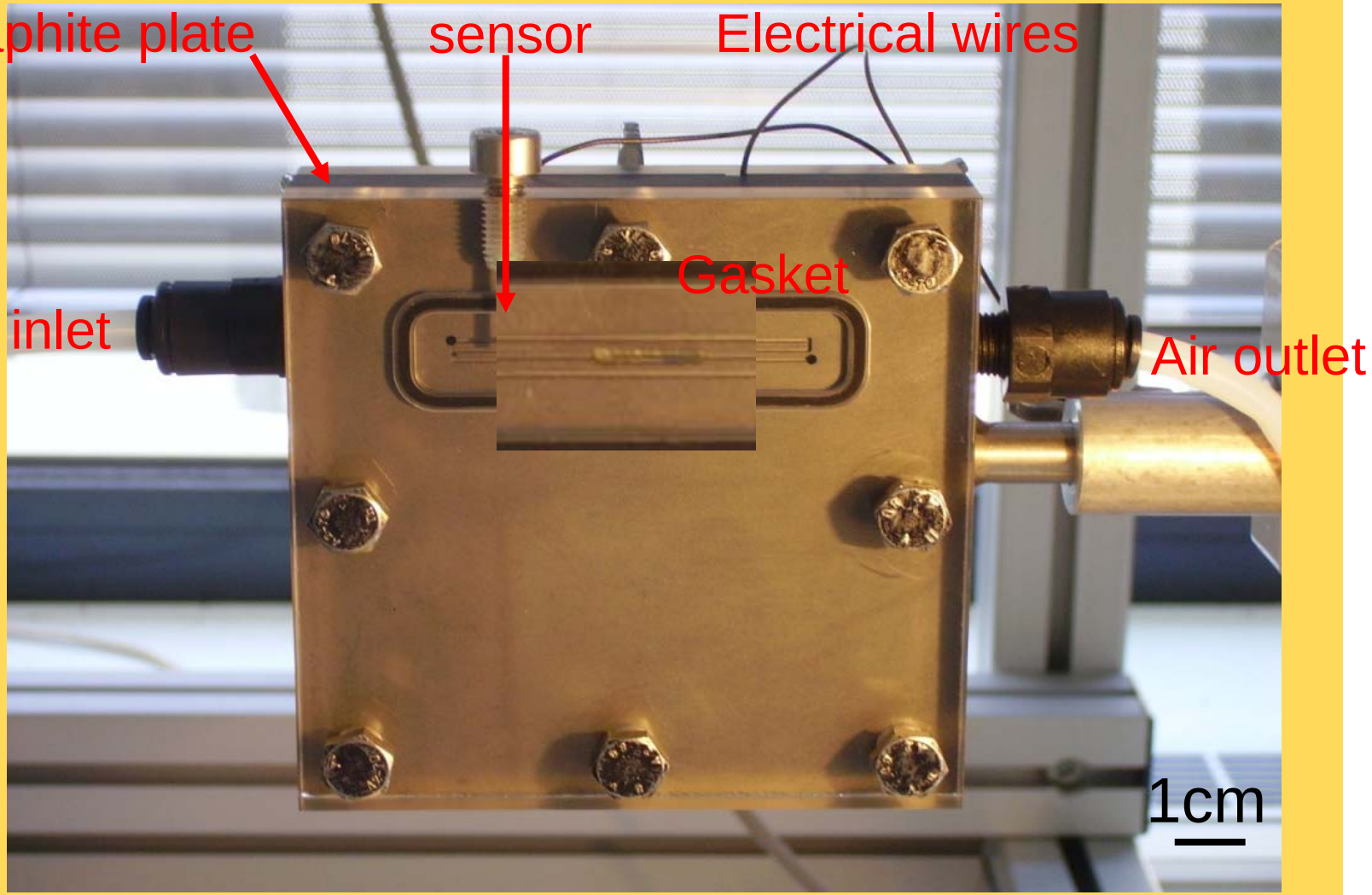
2 : Electrical insulation

Insertion into the graphite plate

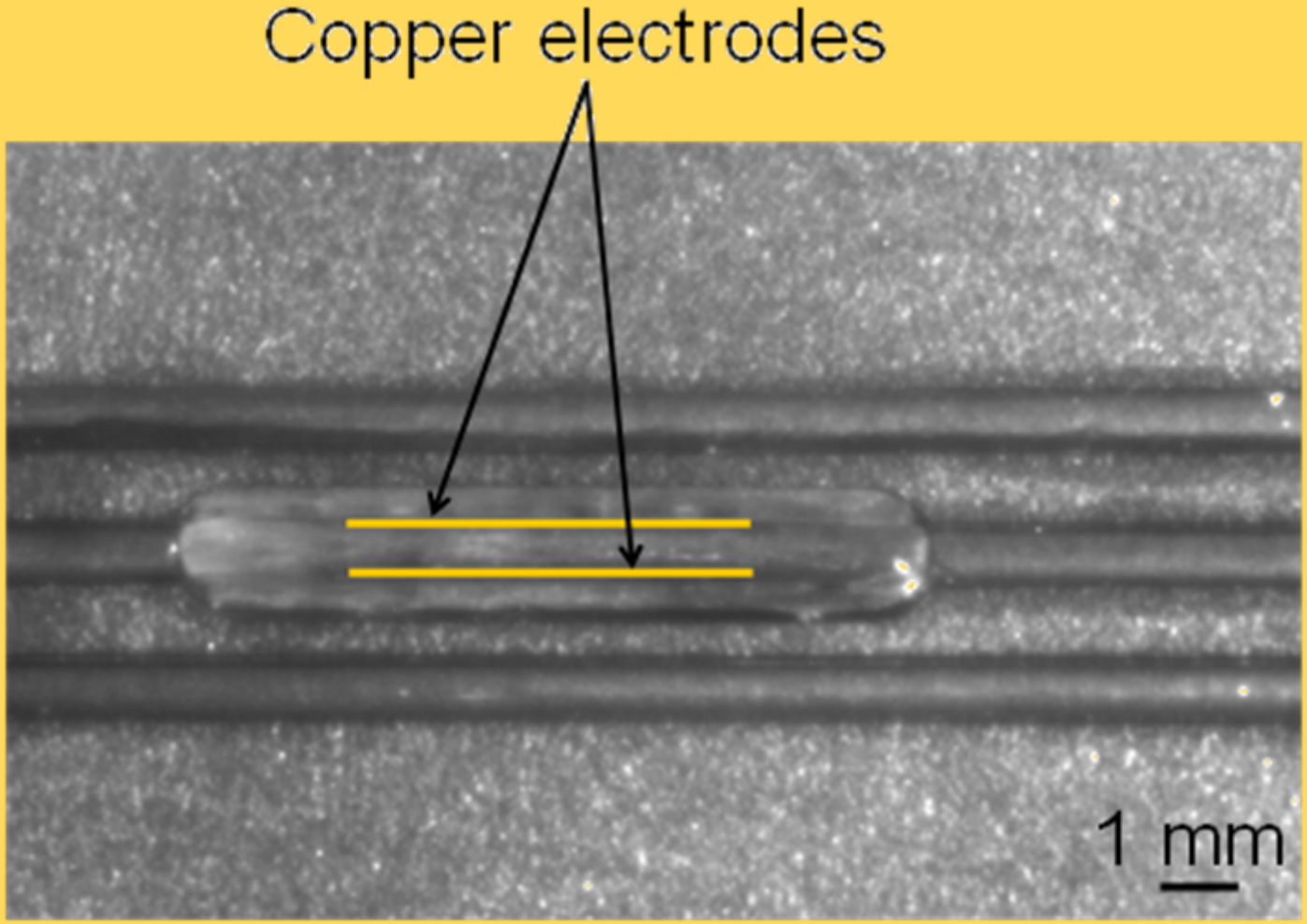


Home-made assembly replacing the milled channel section.

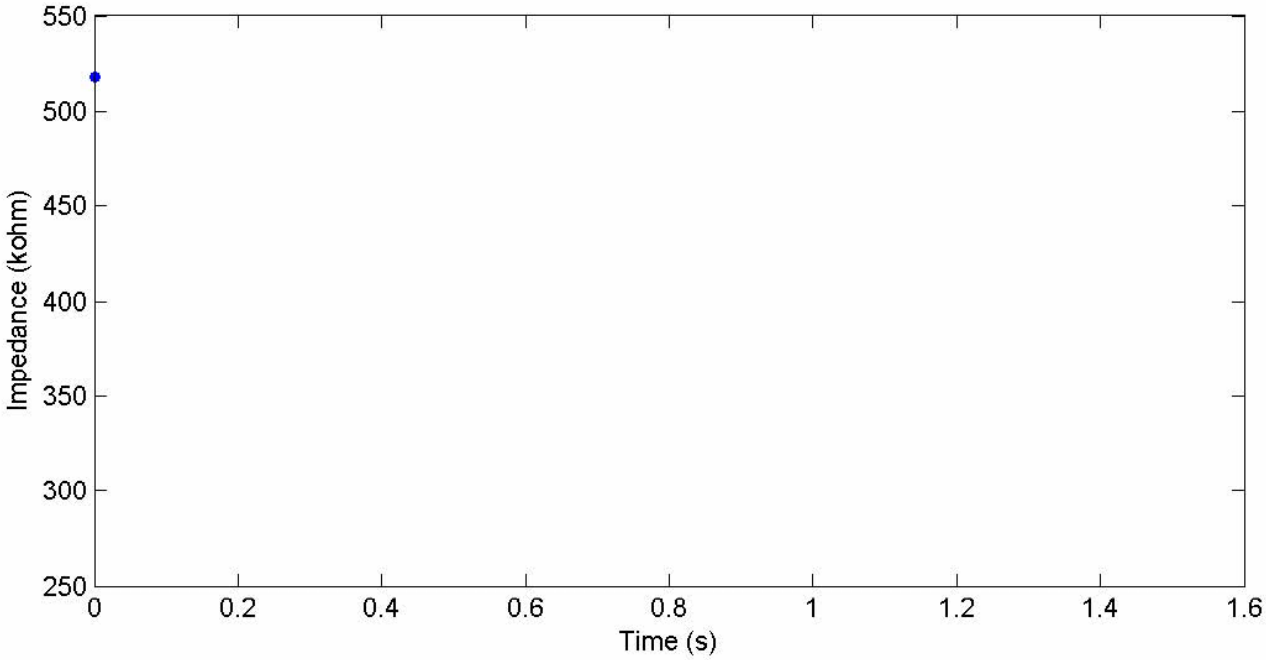
Experimental set-up for sensor test

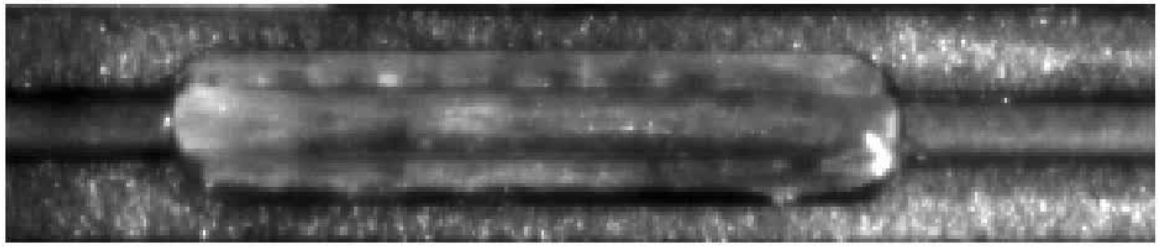


Zoom with digital camera

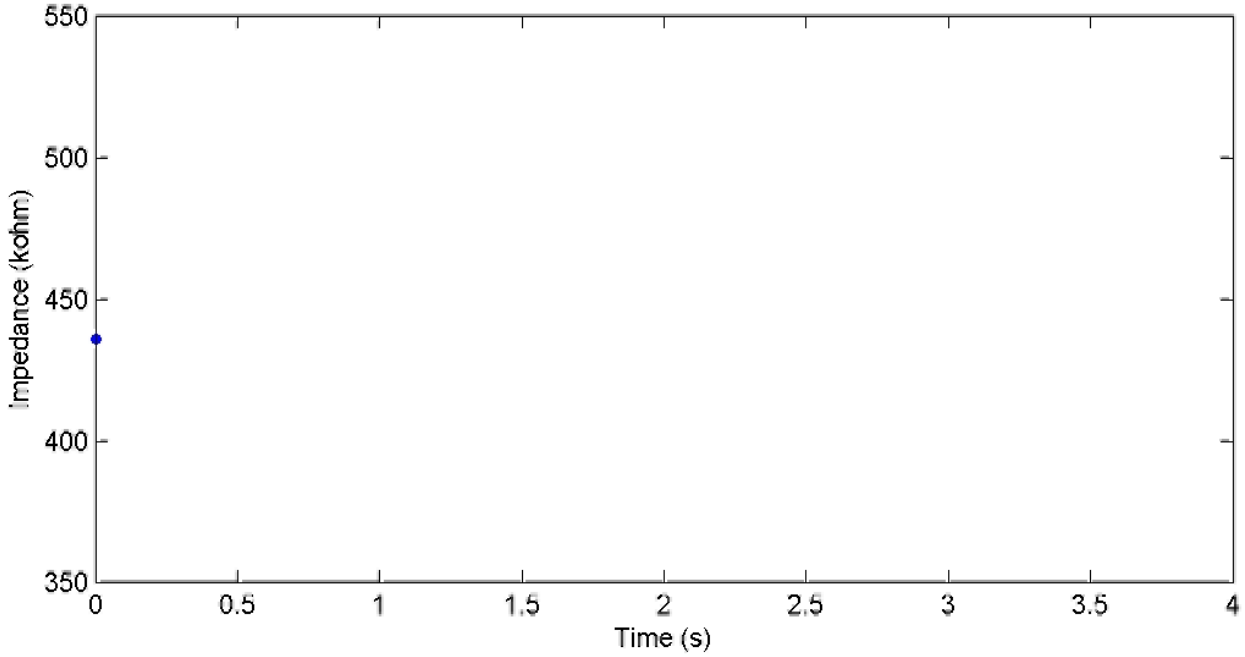


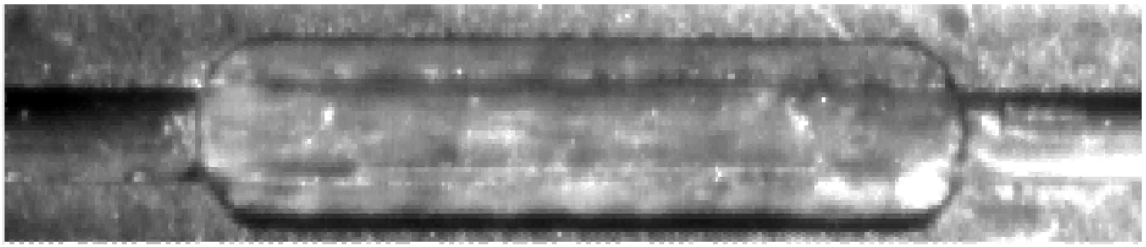
Example of a passing droplet



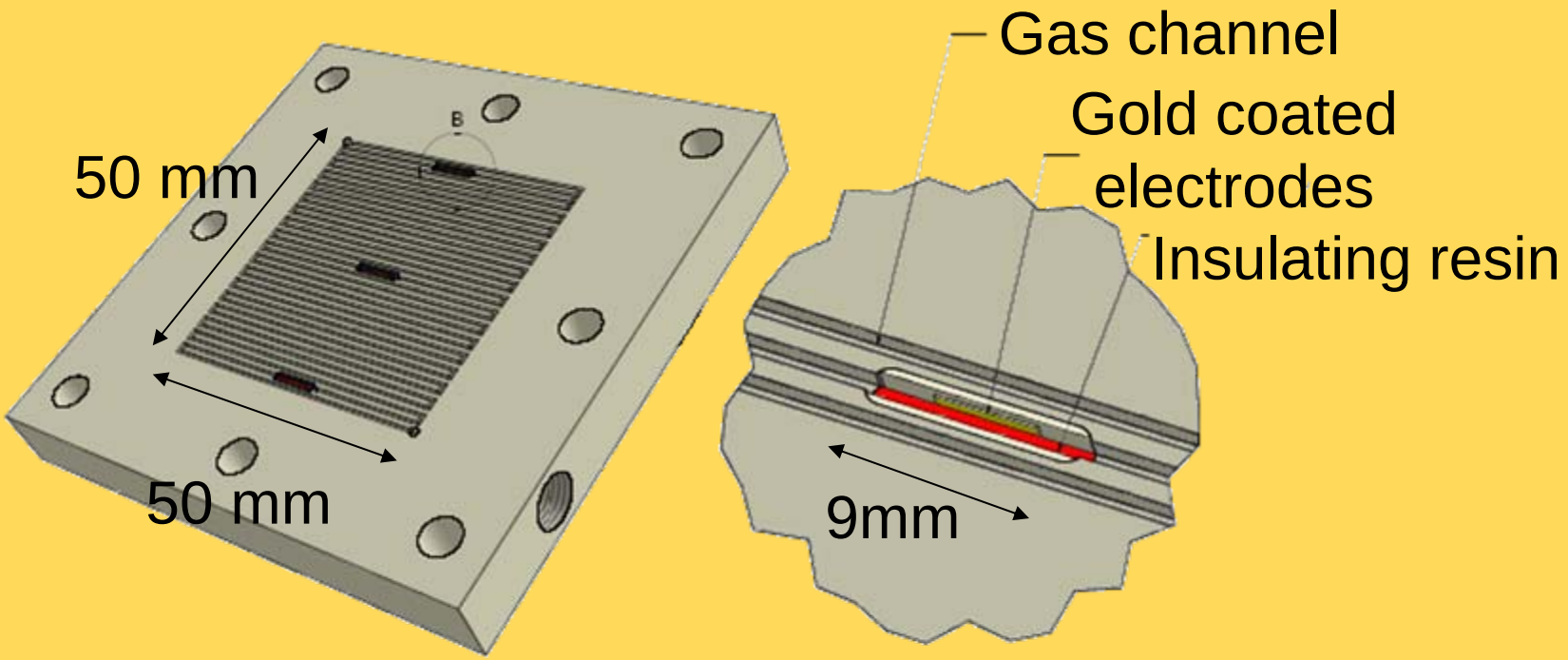


Example of smaller droplets



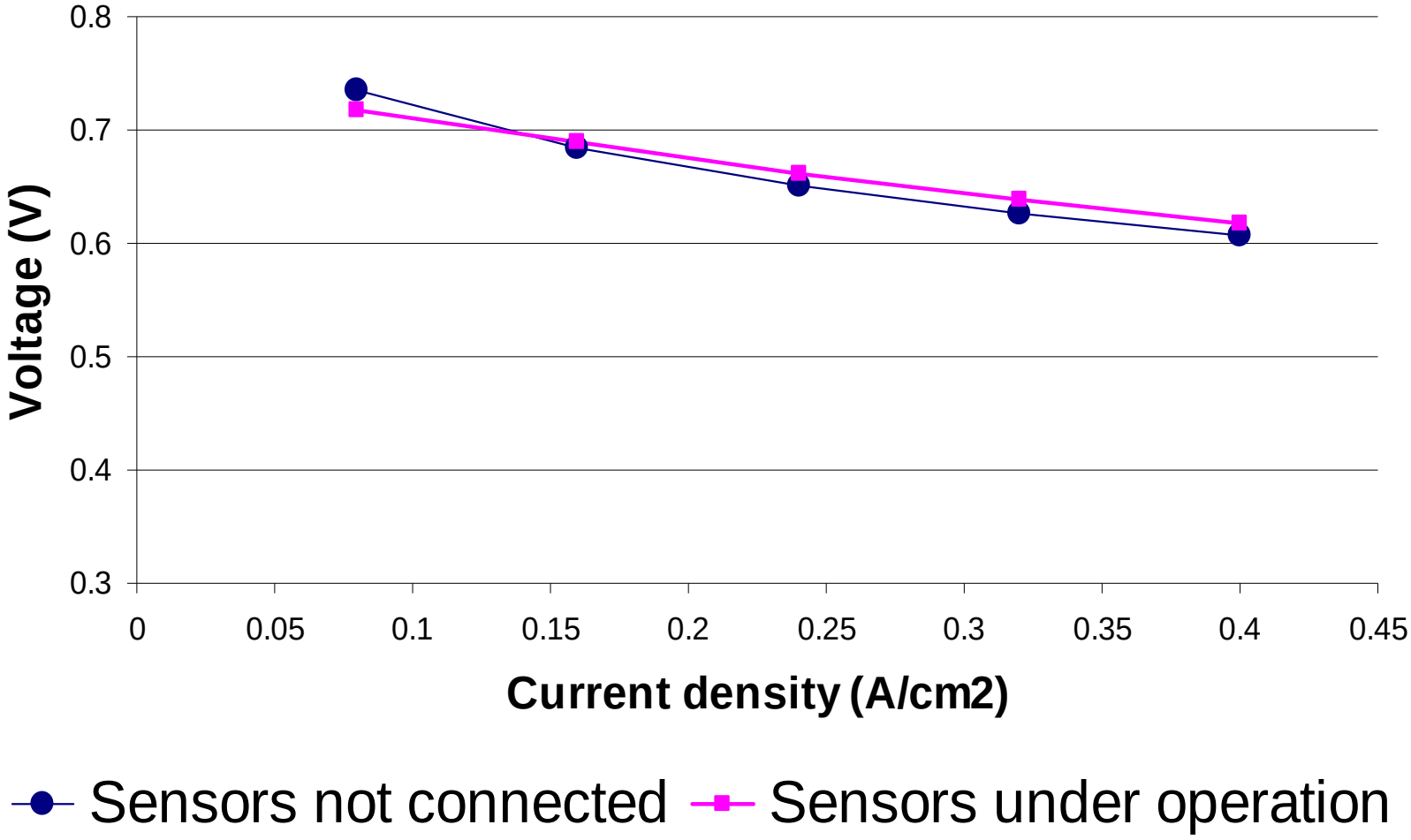


Monitoring the cathode plate

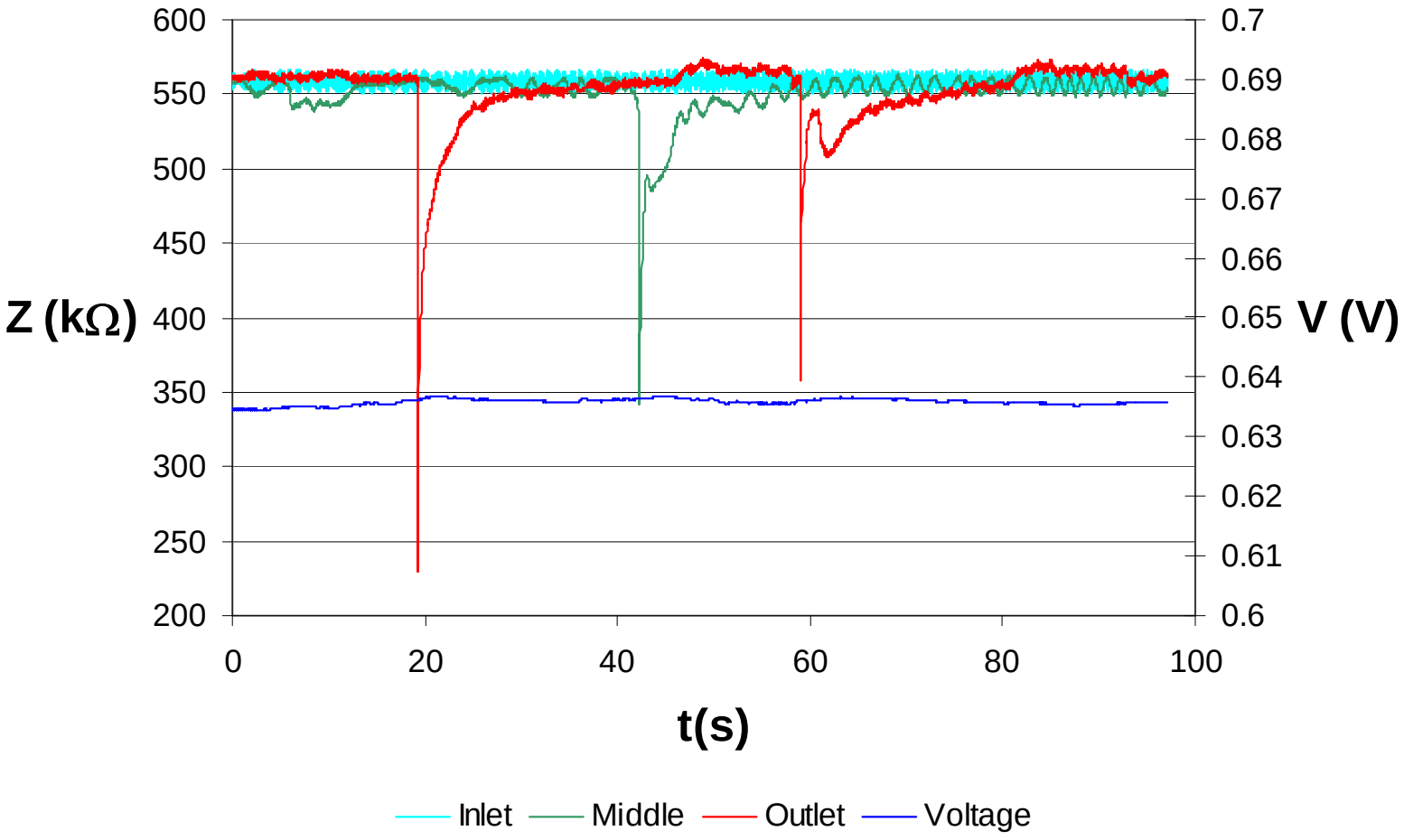


Tests in the same set-up and in a real fuel cell.

First polarisation curves



Droplets detection



Conclusion

Tests with **humid air**

→Feasibility

→Rapidity

→Sensitivity

Preliminary tests in a **working cell**

→No influence on cell performance

→Droplets detection

Validation of the method

Prospects

Next experiments:

Investigation of the monitored cell

Control of inlet parameters

In the longer term:

Understand and predict flooding

Optimize stacks conception

Creation of a new diagnostic tool.