

Next Steps

The key steps over the next months are to use the **scaled-up** electrospun reinforcement in the membrane casting line and qualify the membranes produced, and then **down-select** the final membrane construction as well as the catalyst layer ionomer for final CCMs. As one of the next intermediate project milestones comprises achieving the 1.2 W/cm² target at 0.6 V in a 20-cell stack (M36), CCMs for this short stack will be produced in the coming months using optimised ionomers in membranes and catalyst layers.

In parallel, definition of the **production process, quality methodology, bipolar plate production and stack assembling processes** must be finalised and the NM12 bipolar plates manufactured and validated.

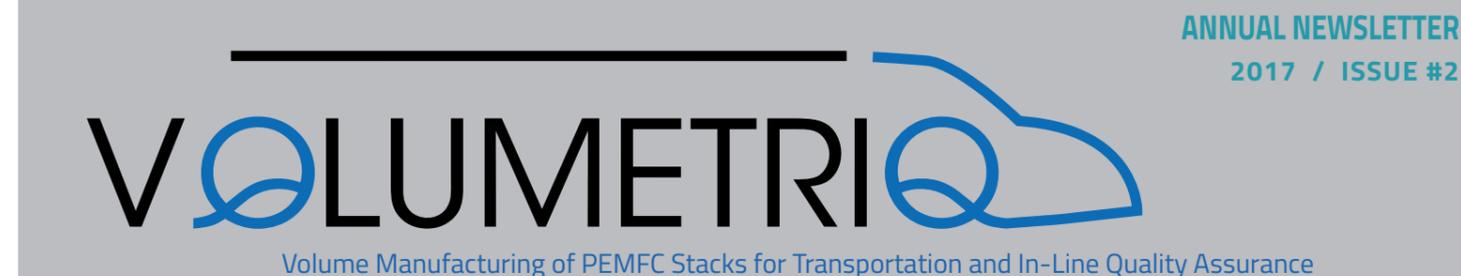
There is a lot of work ahead of us, but with 19 months of the contract yet to run, and a fully committed project team, **VOLUMETRIQ is on track to achieve its objective** of developing a European supply base for PEM fuel cell stacks and their key components with high volume manufacturing capability and embedded quality control.

Dissemination

VOLUMETRIQ presented at the European Fuel Cell Car Workshop - Orléans, France, 1-3 March 2017

This workshop was a unique occasion to share recent results and discuss scientific and technological advances made in the framework of FCH-JU funded research and demonstration projects in the area of Automotive Transport. VOLUMETRIQ contributed to the EFCW event through a poster presentation that is available on the project website.

VOLUMETRIQ has also disseminated results during year 2 at the **Fuel Cells Fundamentals and Developments conference**, Stuttgart, the **ISE Topical Meeting on Advances in Lithium and Hydrogen Electrochemical Systems for Energy Conversion and Storage**, Buenos Aires, and at the **CARISMA conference on progress in fuel cell materials and MEAs**, Newcastle.



Achievements - CCM supply

PBI membrane reinforcement scale-up ; CCM supply, important process of the stack assembly...

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Achievements - Milestones

MEA development, stack assembly, production process and milestone status ...

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Partners

VOLUMETRIQ involves 6 partners (industrials and academics) and 1 associate partner ...

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Next Steps - Dissemination

Scale-up and membrane down selection, EFCW2017 conference attendance ...

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This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 671465.

This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme.



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VOLUMETRIQ second year A year of promises and achievements

As the second year of VOLUMETRIQ draws to a close, we look back with some satisfaction at its achievements.

At the materials development level, the CNRS-developed PBI electrospun nanofibre membrane reinforcement has been scaled up and the first trials on feeding the scaled-up material into the coating line at JMFC were positive.

Importantly, current project MEAs that include Solvay's Aquivion EW 750 ionomer in catalyst coated membranes fabricated at JMFC, and a novel GDL developed by SGL in the INSPIRE project, led to the go/no-go power density milestone of VOLUMETRIQ being reached at M22, two months ahead of schedule.

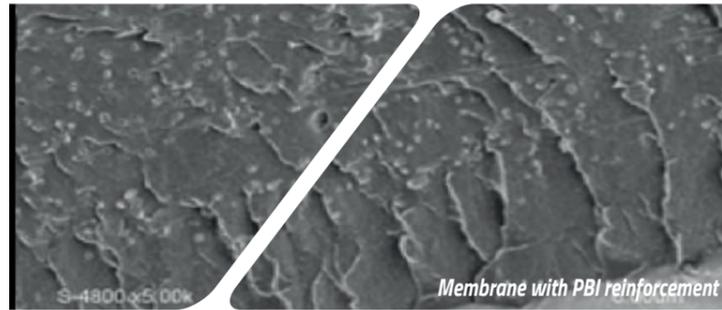
- PBI electrospun nanofibre membrane reinforcement scaled up and first trials in the coating line at JMFC
- Go/no-go power density milestone of VOLUMETRIQ reached at M22
- JMFC-produced Continuous Catalyst Coated membrane (CCM) rolls used in the EK automatic stack assembly line

In testing at EK and JMFC, these MEAs are reproducibly achieving more than 2 A/cm² at 0.6 V under the project's challenging conditions of 80 °C, 50/30% relative humidity at anode/cathode, 2.5 bars absolute pressure.

Essential for at-scale manufacturing, EK has identified CCM cutting and handling processes for high volume production that are compatible with their automatic stack assembly line, while recent months have also witnessed successful testing of the feasibility of feeding JMFC-produced continuous CCM rolls into the automatic stack assembly line.



Fuel cell stack assembly line



Membrane with PBI reinforcement

Achievements and Output

PBI Membrane Reinforcement Scale-up

One of the MEA component objectives in VOLUMETRIQ is to demonstrate the manufacturability of a thin, low EW, nanofibre reinforced membrane.

Following on from previous work in the FCH JU project MAESTRO that demonstrated the performance and durability benefits of a PBI nanofibre reinforced membrane, a continuous roll-to-roll electrospinning process has been developed to produce continuous webs of PBI reinforcement that meet the target material tensile strength and other physical property specifications.



Rolls up to 20 linear metres of electrospun PBI web were successfully scaled-up

PBI Reinforcement - Membrane Manufacturing Assessment



The scaled-up PBI web has also successfully completed the first web handling assessment on a high volume membrane manufacturing coating line at JMFC.

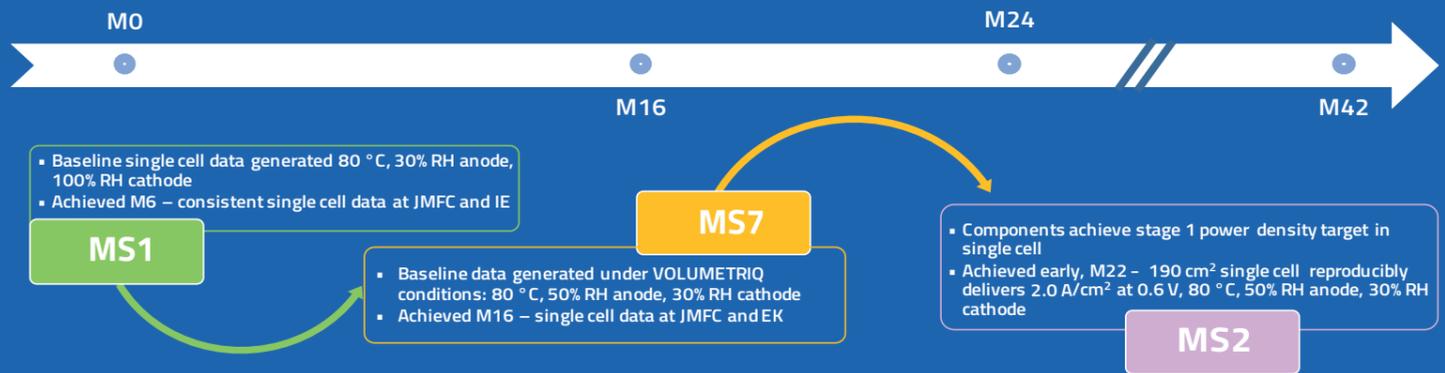
The next step will be to move on to the first trials of continuous membrane manufacture using the electrospun PBI web reinforcement.

PBI web scaled-up on high volume manufacturing coating line

Catalyst coated membrane (CCM) supply

Catalyst coated membrane (CCM) supply is an important process of the stack assembly due to high costs of the materials, and to minimise costs the highest utilisation rate possible is essential. CCMs are produced directly on rolls mainly, so that the further processing has to adapt to this design, ensuring a maximum output of the used material. Punching and cutting processes for CCM supply have been analysed over the past year, and the most promising technique identified. Furthermore, the feeding, processing and process linking have been analysed and adapted where appropriate, and a roll feed automated CCM supply unit was successfully integrated and tested in WP6 "Optimised CCM supply and stack assembly process" of VOLUMETRIQ

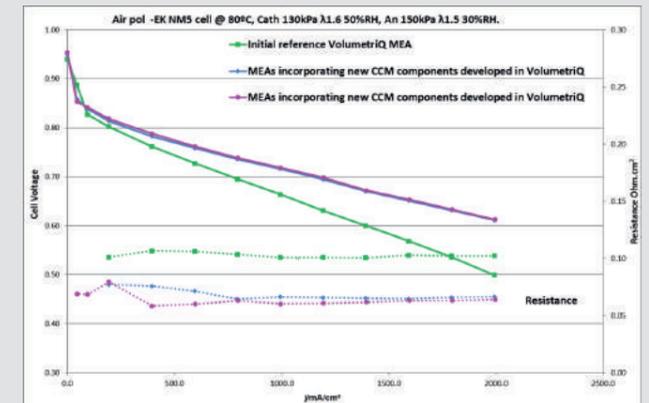
Milestones Status



MEA Development

The VOLUMETRIQ project is tasked with developing high volume, roll-to-roll compatible, manufacturing of advanced automotive MEA components.

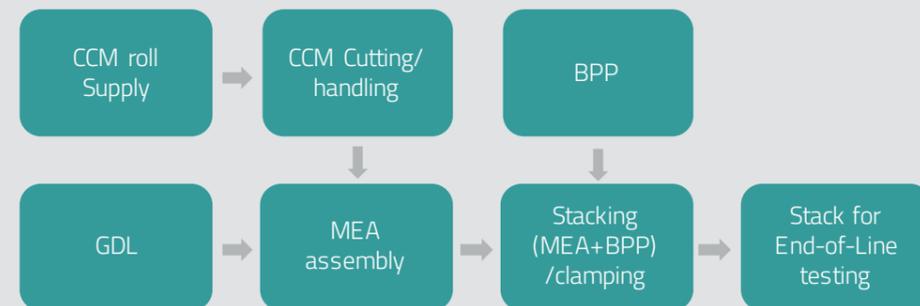
Using ElringKlinger's NM5 automotive cell hardware, new catalyst layer and membrane components have been developed and integrated to successfully meet the VOLUMETRIQ 0.6V@2A/cm² MS2 mid-term cell performance target.



VOLUMETRIQ 0.6 V @ 2 A/cm² MS2 mid-term target CCM

Parametric Sensitivity and Stack Manufacture

Process scheme of ElringKlinger's stack manufacturing line



ElringKlinger's 200 cell NM5 stack module - 46 kWel (voltage loss of < 10 μV/h over > 8000 h)