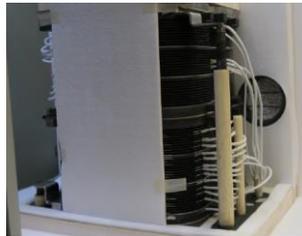
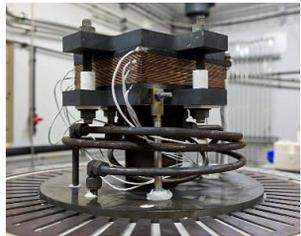


Multimegawatt high-temperature electrolyser to generate green hydrogen for production of high-quality biofuels

Stacks performance and durability



WP2 Objectives



Work Package 2 is focused on stack testing in laboratory environment, benchmarking different stack technologies, and achieving a 25,000 h operating time milestone. It aims at:

- Evaluate performance, robustness and degradation
- Test and benchmark different stacks in representative conditions

Harmonized testing protocol

The protocol includes the recording of performance maps, load-point and thermal cycles, as well as steady-state steps to assess degradation and therefore the expected lifetime of different Solid Oxide Electrolysis (SOE) stack technologies operated exclusively in electrolysis mode.

The corresponding deliverable « D2.1 Definition of testing protocols » is publicly available on project website: <https://multiplhy-project.eu>

Stacks description

- CEA cathode-supported stack (CSS): 25-cell stack, 100 cm² active area electrode support cells, cross-flow design
- Sunfire electrolyte-supported stack (ESS): 30-cell stack, 128 cm² active area electrolyte support cells, co-flow design, 2 stacks piled-up

Results analysis

ESS and CSS stacks were tested 8,200 and 6,800 hours.

• **Performance:** as expected, CSS stack could reach higher current densities at lower T compared to ESS stack.

• **Durability:** both stacks were operated at the thermoneutral voltage with a steam conversion of 70%. To maintain performances, the stack temperature was increased to compensate the degradation.

With this operation strategy, **no Hydrogen production loss** occurred over the whole testing duration.

The extent of performance degradation decreases with higher T.

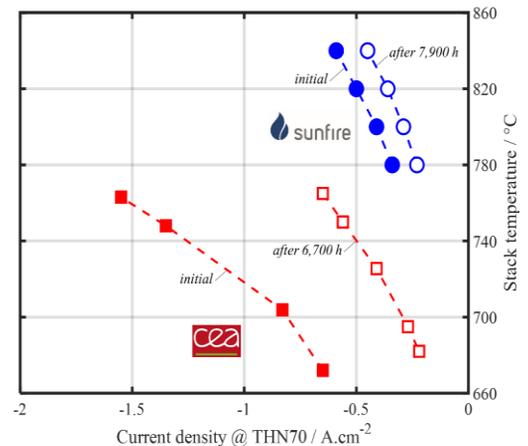


Fig.2: Initial and final performance maps recorded on both stack technologies. THN70 relates to operation at the thermoneutral voltage and at 70% steam conversion.

Overview of test sequences

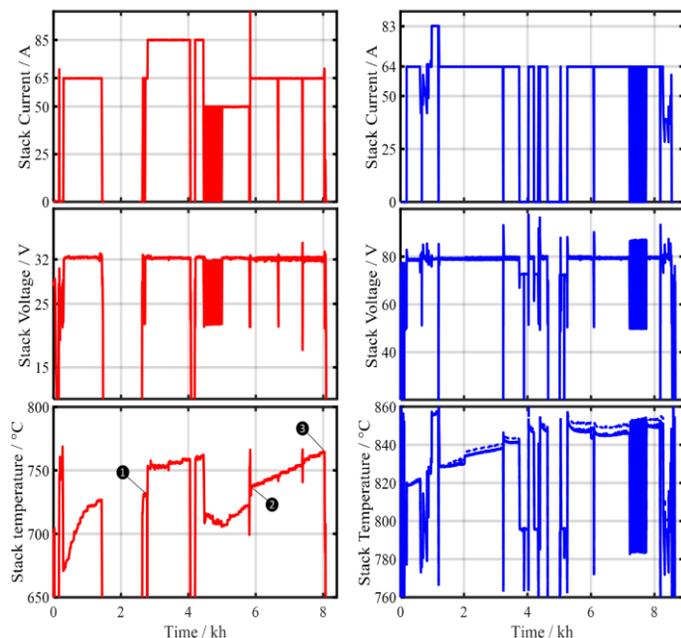


Fig.1: Time evolutions for stack current and voltage for the cathode-supported stack (red, left) and the two electrolyte-supported stacks (blue, right). The maximum temperature of both stacks piled-up is shown (solid and dotted blue curves).