TEST LINE #1

High-temperature electrolysis

Technical data sheet

July 2025

H2shift

Test Line 1: High-temperature electrolysis

The test line 1 focused on high temperature electrolysis is currently able to electrochemically characterise three types of samples: small scale button cells, large-area cells or single repeating units, and stacks. The following tables present the technical details of the test benches associated with each sample type.

Small-scale test station for button cells: from 0 to 10 W

Operating conditions		**Notes**
Temperature	*Value*	
Maximum process temperature [°C]	900	
Miniumum process temperature [°C]	500	
Pressure	*Value*	
Maximum process pressure [bar(a)]	1	
Miniumum process pressure [bar(a)]	1	
Chamber layout, hardware configuration, samples, and similar		**Notes**
Heated chamber layout and dimensions	*Value*	
Heating method [direct/indirect]	Indirect	
Heating source	Electric	Electric tubular furnace with heating elements, 1,5 kW
Samples and hardware	*Value*	
Sample type	Button cell	20 mm diameter button cell with a ≤ 14 mm diameter oxygen electrode. If electrolyte-supported cell, both electrodes must be ≤ 14 mm.
Hardware	Probostat® set-up	Allow dual atmospheres, internal temperature measurement, 4 wires electrical connection. Alumina tube to hold the sample with compression system
Sensors	*Value*	
Thermocouples	1	Located inside the fuel chamber, beside the cell
Fluids		**Notes**
Gases (inlet)	*Value*	
H2 [NmL/min]	0-50	Massflow controller, near ambient pressure
Ar-5%H2 [NmL/min]	0-50	Massflow controller, near ambient pressure
CO2 [NmL/min]	0-200	Massflow controller, near ambient pressure
Ar [NmL/min]	0-50	Massflow controller, near ambient pressure
Synthetic air [NmL/min]	0-500	Massflow controller, near ambient pressure
O2 [NmL/min]	0-500	Massflow controller, near ambient pressure
Water (inlet)	*Value*	
Steam generator	Yes	
Flow [g/h – NL/min steam]	5 - 100	
Water supply	2 x 1 L tank	Nitrogen pressurized (2 bar tank), manual refilling
Heating [yes/no]	Yes	Heated lines up to furnace inlet
Gas analysis		**Notes**
Instruments	*Value*	
Gas chromatography	Yes	Micro gas chromatograph
Electrochemical characterization		**Notes**
Instruments		
Power supply	Current: 0-5 A Voltage: 0-30 V	
Electronic load	300 W, 150V	
Potentiostat for Electrochemical Impedance Spectroscopy	Yes	
Control and acquisition system		**Notes**
Control system	*Value*	
Programmable control system [yes/no]	Yes	Control system allows programmable cycles, can be modified
Remote control [yes/no]	Yes	Control system installed on local PC, possible remote control

Medium-scale test station for large-area cells and short-stacks: from 0 to 1500 W

Operating conditions		**Notes**
Temperature	*Value*	
Maximum process temperature [°C]	900	
Miniumum process temperature [°C]	500	
Pressure	*Value*	
Maximum process pressure [bar(a)]	1	
Miniumum process pressure [bar(a)]	1	
Maximum differential pressure between the chambers	TBD	
Chamber layout, hardware configuration, samples, and similar		**Notes**
Heated chamber layout and dimensions	*Value*	

Heating method [direct/indirect]	Indirect	
Heating source	Electric	Electric cubic furnace with heating elements, 2,4 kW
Gas pre-heating	Yes	Coils inside the furnace chamber
Samples and hardware	*Value*	
Sample type	Large-area cell, single repeating unit, short stack	Cell up to 100x100 mm^2, SRU and short stack up to 120x120 mm^2.
Hardware	In-house design	Allow dual atmospheres. Compression system by means of a top plate pulled down with 4 rods and springs located out of the hot zone.
Sensors	*Value*	
Thermocouple	8	Can be installed all around the cell/short-stack.
Fluids		**Notes**
Gases (inlet)	*Value*	
H2 [NL/min]	0-30	Massflow controller, near ambient pressure
CO2 [NL/min]	0-30	Massflow controller, near ambient pressure
N2 [NL/min]	0-15	Massflow controller, near ambient pressure
Synthetic air [NL/min]	0-50	Massflow controller, near ambient pressure
Compressed air [NL/min]	0-50	Massflow controller, near ambient pressure – Quality 1:4:1 (ISO 8573-2010)
Water (inlet)	*Value*	
Steam generator [Yes/No]	Yes	
Flow [g/h – NL/min steam]	1.2 -2.5	
Water supply	Continuous	
Heating [yes/no]	Yes	Heated lines up to furnace inlet
Gas/steam output	*Value*	
Water condensation [Yes/No]	Yes	Lab water condenser (ambient temperature)
Flow measurement [Yes/No]	No	
Temperature measurement [Yes/No]	No	
Gas analysis		**Notes**
Instruments	*Value*	
Gas chromatography	Yes	Micro gas chromatograph
Electrochemical characterization		**Notes**
Instruments		
Power supply	I: 0-170 A U: 0-80 V	
Electronic load	100V/50A/600 W	
Potentiostat for Electrochemical Impedance Spectroscopy	No	
Individual voltage probe	Yes	
Control and acquisition system		**Notes**
Control system	*Value*	
Programmable control system [yes/no]	Yes	Control system allows programmable cycles, can be modified
Remote control [yes/no]	Yes	Control system installed on local PC, possible remote control

Large-scale test station for stacks: from 100 to 5000 W

Operating conditions		**Notes**
Temperature	*Value*	
Maximum process temperature [°C]	900	
Miniumum process temperature [°C]	500	
Pressure	*Value*	
Maximum process pressure [bar(a)]	1	
Miniumum process pressure [bar(a)]	1	
Maximum differential pressure between the chambers	TBD	
Chamber layout, hardware configuration, samples, and similar		**Notes**
Heated chamber layout and dimensions	*Value*	
Heating method [direct/indirect]	Indirect	
Heating source	Electric	Electric cubic furnace with heating elements, 3,6 kW
Gas pre-heating	Yes	Coils inside the furnace chamber
Samples and hardware	*Value*	
Sample type	Stack	Stack up to 320x190x200 mm^2.
Hardware	In-house design	Allow dual atmospheres. Compression system by means of a top plate pulled down with 4 rods and springs located out of the hot zone.
Sensors	*Value*	
Thermocouple	8	Can be installed all around the cell/short-stack.
Pressure sensor	4	Fuel and air inlets, fuel and air outlets
Fluids		**Notes**
Gases (inlet)	*Value*	
H2 [NL/min]	0-30	Massflow controller, near ambient pressure
N2 [NL/min]	0-15	Massflow controller, near ambient pressure
Synthetic air [NL/min]	0-250	Massflow controller, near ambient pressure
Compressed air [NL/min]	0-250	Massflow controller, near ambient pressure – Quality 1:4:1 (ISO 8573-2010)

Water (inlet)	*Value*	
Steam generator	Yes	
Flow [g/h – NL/min steam]	3 - 62	
Water supply	Continuous	
Heating [Yes/No]	Yes	
Gas/steam output	Value	
Water condensation [Yes/No]	Yes	Lab water condenser (ambient temperature)
Flow measurement [Yes/No]	Yes	After water condensation
Temperature measurement [Yes/No]	Yes	
Gas analysis		**Notes**
Instruments	*Value*	
Gas chromatography	Yes	Micro gas chromatograph
Electrochemical characterization		**Notes**
Instruments		
Reversible power supply	Current: 0-170 A Voltage: 0-80 V	Up to 5 kW
Potentiostat for Electrochemical Impedance Spectroscopy	No	
Individual voltage probe	Yes	
Control and acquisition system		**Notes**
Control system	*Value*	
Programmable control system [yes/no]	Yes	Control system allows programmable cycles, can be modified
Remote control [yes/no]	Yes	Control system installed on local PC, possible remote control

Large-scale test station for stacks: up to 25 kW

Operating conditions		**Notes**
Temperature	*Value*	
Maximum process temperature [°C]	950	
Miniumum process temperature [°C]	500	
Pressure	*Value*	
Maximum process pressure [bar(a)]	1	
Miniumum process pressure [bar(a)]	1	
Maximum differential pressure between the chambers	TBD	
Chamber layout, hardware configuration, samples, and similar		**Notes**
Heated chamber layout and dimensions	*Value*	
Heating method [direct/indirect]	Indirect	
Heating source	Electric	
Gas pre-heating	Yes	750 °C
Samples and hardware	*Value*	
Sample type	Stack	700x530x530 (±20) mm
Hardware	SCADA	WinCC
Sensors	*Value*	
Thermocouple	8	Can be installed all around the cell/stack.
Pressure sensor	4	0-0,1 bar. Fuel and air inlets, fuel and air outlets
Fluids		**Notes**
Gases (inlet)	*Value*	
H2 [NL/min]	0-30	Massflow controller, near ambient pressure
N2 [NL/min]	0-100	Massflow controller, near ambient pressure
Synthetic air [NL/min]	0-250	Massflow controller, near ambient pressure
Compressed air [NL/min]	0-250	Massflow controller, near ambient pressure – Quality 1:4:1 (ISO 8573-2010)
Water (inlet)	*Value*	
Steam generator	Yes	Power 6 kW
Flow [kg/h – NL/min steam]	6 - 124	
Water supply	Continuous	
Heating [Yes/No]	Yes	Heated lines up to furnace inlet
Gas/steam output	Value	
Water condensation [Yes/No]	Yes	
Flow measurement [Yes/No]	Yes	
Temperature measurement [Yes/No]	Yes	
Gas analysis		**Notes**
Instruments	*Value*	
Gas chromatography	Yes	Micro gas chromatograph
Electrochemical characterization		**Notes**
Instruments		
Reversible power supply	Yes	I: 0 to 160 A , U: 3 to 400 V
Potentiostat for Electrochemical Impedance Spectroscopy	No	

Individual voltage probe	Yes	10 single cell/cluster voltage measurement of 4V
Control and acquisition system		**Notes**
Control system	*Value*	
Programmable control system [yes/no]	Yes	Control system allows programmable cycles, can be modified
Remote control [yes/no]	Yes	Control system installed on local PC, possible remote control