Public Abstract

Deliverable D5.1 System Testing Procedure

In the framework of the HEALTH-CODE project, two different technologies (H2/air and H2/O2) of PEMFC stacks are characterized and tested. The aim of this deliverable is to define tests protocol and EIS measurement techniques for the characterization of a PEM systems (µ-CHP and backup) in faulty conditions.
The most relevant faults for the studied technologies and applications are the following five:

- Major change in fuel composition
- Air starvation
- Fuel starvation
- Sulphur poisoning
- Water management: Flooding and Drying.

BACK UP system
The system is mainly composed of 2 units the electrolyser (P2G) and the PEMFC (G2P). The P2G converts energy from electrical power to gas, while the second one from gas to electrical power. When one unit is operating the second one is stopped.

EPS fuel cell system technical specifications

Electro Power System - Backup	
Commercial name	ElectroSelf™ 3 DOX
Application	Backup and grid balancing
Anode gas	Hydrogen
Cathode gas	Oxygen
Efficiency	50%
Auxiliary devices	Electrolyser, Battery (start-up units)

Validation test matrix at 120 A.

Operating Condition	Temperature [C]	H_2 Pressure [$mbar_g$]	O_2 Pressure [$mbar_g$]
Nominal	53	360	420
Drying	**60***	360	420
Flooding	**45***	360	420
H_2 Starv.	53	360	420
O_2 Starv.	53	360	420

Specifications are given by EPS in order to schedule the system installation and modifications to allow the HEALTH-CODE project tests

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µCHP system

The µCHP system from BPSE, Ballard Power Systems Europe (former Dantherm Power) is a µ-CHP for cogeneration of heat and electricity. The 46 cells PEM fuel cell stack is coupled with the natural gas reformer, heat integration and DC/AC inverter. The system is controlled via LabView interface. In order to acquire EIS spectra on the system
a brand-new DC/AC inverter was built by Micropi and coupled with the system.

BALLARD fuel cell system technical specifications

BPSE -µCHP	
Commercial name	µ-CHP LSN1
Application	Cogeneration of heat and electricity
Anode gas	Reformate
Cathode gas	Air
Efficiency	32%
Auxiliary devices	Reformer, heat integration, DC/AC inverter

Validation test matrix

Operating Condition	**CURRENT [A]**	**AIR λ**
NOMINAL	15 – 25 – 35	2
FLOODING	35	2
AIR STARVATION	35	1.9 – 1.8 – 1.7 – 1.6 – 1.5 – 1.4
CO CONTAMINATION	35	2