FIT-4-AMANDA

Future European Fuel Cell Technology: Fit for Automatic Manufacturing and Assembly

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Publishable Executive Summary

The evaluation of the power characteristics and the operational stability at different load points of a newly designed and developed fuel cell is essential for the comprehensive assessment of the stack performance. In order to save costs and having results at an early stage, single-cell and short-stack tests with the target design are common in the fuel-cell sector for these characterisations. Therefore, this approach was naturally also the procedure of choice in the Fit-4-AMandA project[1] and has been carried out. As the partner responsible for a validation and long-term characterisation in T3.3 of the WP3, the TUC with its scientific competence and comprehensive laboratory equipment is a guarantor for the careful implementation of these activities on a high level. The testing set up, the conducted procedures and the gained results are described in this confidential report.

After a break-in procedure and initial diagnostics at Beginning of Life (BoL), a PM400 single cell (a single cell with an active area of approximately 400 cm^2), which was provided by PM, undergoes a long-term test lasting 1000 h. Polarisation curves (IV), cyclic voltammetry (CV), linear sweep voltammetry (LSV), and electrochemical impedance spectroscopy (EIS) are used as diagnostics methods at Beginning of Test (BoT) and afterwards regularly at 50-100 h intervals. The hysteresis of the polarisation curve is examined. The voltage-decay rate is calculated. The changes in electrochemical active surface area of the PM400 single cell are studied.

The results of the characterisation of the PM400 single cell are compared with the performance-test result of the 25-cm^2 single cells provided by IRD. Both formats are utilising the 7-layer-MEA from IRD, which is used in the Mass-manufacturing machine (MMM) developed in the scope of the project Fit-4-AMandA.

[1] Future European Fuel Cell Technology: Fit for Automatic Manufacturing and Assembly – Fit-4-AMandA (EU project, duration 01 Mar 2017 – 31 Dec 2020, 45 months). Funding Programme H2020-JTI-FCH-2016-1, Grant Agreement #735606.

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Project partners:

#	Partner	Partner Full Name
1	UNR	Uniresearch BV
2	PM	Proton Motor Fuel Cell GmbH
3	IRD	IRD Fuel Cells A/S
4	Aumann	Aumann Limbach-Oberfrohna GmbH
5	Fraunhofer	Fraunhofer-Gesellschaft zur Foerderung der angewandten Forschung e.V.
6	TUC	Technische Universitaet Chemnitz
7	UPS	UPS Europe SA

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1. Appendix – Polarization curve set points

Table 1: Polarization curve set point – based on the DOE protocol. Error! Bookmark not defined.

Set point no.	Current density (mA/cm²)	Recommended dwell time (s)	Recommended data acquisition time (s)
1	0	50	≥ 30
2	10	50	≥ 30
3	20	50	≥ 30
4	40	50	≥ 30
5	60	50	≥ 30
6	80	50	≥ 30
7	100	50	≥ 30
8	200	150	≥ 30
9	300	150	≥ 30
10	400	150	≥ 30
11	500	150	≥ 30
12	600	150	≥ 30
13	700	150	≥ 30
14	800	150	≥ 30
15	900	150	≥ 30
16	1000	150	≥ 30
17	1100	150	≥ 30
18	1200	150	≥ 30
19	1300	150	≥ 30
20	1400	150	≥ 30
21	1500	150	≥ 30
22	1600	150	≥ 30
23	1700	150	≥ 30
24	1800	150	≥ 30
25	1900	150	≥ 30
26	2000	150	≥ 30
27	1900	150	≥ 30
28	1800	150	≥ 30
29	1700	150	≥ 30
30	1600	150	≥ 30
31	1500	150	≥ 30
32	1400	150	≥ 30
33	1300	150	≥ 30
34	1200	150	≥ 30
35	1100	150	≥ 30
36	1000	150	≥ 30
37	900	150	≥ 30
38	800	150	≥ 30
39	700	150	≥ 30
40	600	150	≥ 30
41	500	150	≥ 30
42	400	150	≥ 30
43	300	150	≥ 30
44	200	150	≥ 30
45	100	50	≥ 30
46	80	50	≥ 30
47	60	50	≥ 30
48	40	50	≥ 30
49	20	50	≥ 30
50	10	50	≥ 30
51	0	50	≥ 30

Table 2: Polarization curve set point – based on the EU protocol. Error! Bookmark not defined.

Set point no.	Current density (mA/cm²)	Recommended dwell time (s)	Recommended data acquisition time (s)
1	0	50	≥ 30
2	20	50	≥ 30
3	40	50	≥ 30
4	60	50	≥ 30
5	80	50	≥ 30
6	100	50	≥ 30
7	200	150	≥ 30
8	300	150	≥ 30
9	400	150	≥ 30
10	600	150	≥ 30
11	800	150	≥ 30
12	1000	150	≥ 30
13	1200	150	≥ 30
14	1400	150	≥ 30
15	1600	150	≥ 30
16	1800	150	≥ 30
17	2000	150	≥ 30
18	1800	150	≥ 30
19	1600	150	≥ 30
20	1400	150	≥ 30
21	1200	150	≥ 30
22	1000	150	≥ 30
23	800	150	≥ 30
24	600	150	≥ 30
25	400	150	≥ 30
26	300	150	≥ 30
27	200	150	≥ 30
28	100	50	≥ 30
29	80	50	≥ 30
30	60	50	≥ 30
31	40	50	≥ 30
32	20	50	≥ 30
33	0	50	≥ 30