Project acronym:	**HEATSTACK**
Project full title:	**Production Ready Heat Exchangers and Fuel Cell Stacks for Fuel Cell mCHP**
Grant agreement no:	**700564**

Deliverable D5.2 - Build of 5 SOC stacks using new production line

Version: 1.3

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Dissemination Level		
PU	Public	☒
PP	Restricted to other programme participants (including the Commission Services)	☐
CO	Confidential, only for members of the consortium (including the Commission Services)	☐

Version History

Version	Date	Author	Organisation	Description
1.0	04.06.2019	Frank Mittmann	sunfire GmbH	First Draft
1.1	04.06.2019	Christian Walter	sunfire GmbH	Second Draft
1.1	07.06.2019	James Craven	PNO	Content & Quality Review
1.2	07.06.2019	Frank Mittmann	sunfire GmbH	Final Draft
1.3	02.07.2020	James Hughes	PNO	Addition of 3 statements, FCH logo and EC flag on this page.

Statement of originality:
This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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Acknowledgment:
This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under Grant Agreement No. 700564. This Joint Undertaking receives support from the European Union’s Horizon 2020 research and innovation programme, and from Hydrogen Europe and Hydrogen Europe Research.

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Glossary

Table 1: Glossary

Abbreviation	Meaning
MEA	membrane electrolyte assembly
SFFC	Sunfire Fuel Cells GmbH
SOC	solid oxide cell
slph	standard litres per hour
µCHP	micro combined heat and power
WP	work package

1 Introduction

Sunfire GmbH is a leading manufacturer of Solid Oxide Cell (SOC) stacks, modules and systems with a current production capacity for prototypes and smaller series in Dresden, Germany. Sunfire seeks to expand this capacity towards series production within the HEATSTACK project. For doing that, several processes have to be automated. One of those processes is the application of the sealant glass. Within HEATSTACK, to achieve targets for volume production, Sunfire will develop the manufacturing process from a manual bonding workplace for the pre-assembly and the final assembly to an automated pilot production line for glass seals. This will reduce the process time to produce and apply the sealing and thus decrease the costs of the final SOC-stack.

The preceding deliverables, D3.1, D3.2 and D3.3 covered the development of a printing process for glass seals at Sunfire SOFC stacks. Within the present deliverable D5.2, a total of 5 Sunfire SOC stacks are to be built using the new technology. Subsequently, these stacks shall be integrated into µCHP systems.

2 Technical Section: Build of 5 SOC stacks

The 5 SOC 30-cell stacks were produced in the time period from March to June 2019. The production procedure was following the descriptions of D3.2 report. The printing quality / glass heights fulfilled the expectations and there were no plates rejected due to height measurement. However, the process stability of the spacer placing/adhesion is still not optimal, making it necessary to manually rework ~5% of the plates printed. This issue is subject to further optimizations. Table 2 shows an overview on the main production data of the 5 fabricated stacks.

Table 2: Overview on stack production data

Stack ID	Fabrication date	I-V-curve	Electrochemical characterization	Mechanical leakage test @ 10mbar	Remarks
5820	14.03.2019	ok	ok	2,0 slph	Delivery pending
5821	14.03.2019	ok	ok	1,3 slph	Delivered to SFFC
5882	04.05.2019	ok	ok	0,1 slph	Delivery pending
5949	01.06.2019	ok	ok	0,8 slph	Delivery pending
5950	01.06.2019	not ok	not ok	35 slph	Post-Mortem Analysis planned

The Current-Voltage-Curve (I-V-Curve) is a basic functional test, where SOC stacks are operated at a low current directly during joining process. The electrochemical characterization test measures the response of the open circuit voltage on a change of supply gases. Hereby, a steep decline of one block voltage indicates a leakage (e.g. of the glass seal or the MEA due to rupture) in the respective cell block. The mechanical leakage tests measures the loss flow at a defined internal pressure level. The current production limit is 10 slph for a 30 cell stack.

The data shows that 4 of the 5 stacks were produced successfully in terms of Sunfire production limits. The 5th stack failed all production tests and also showed visible traces of burned gas on the outside of the interconnect. By the time of this report, the cause for this failure is not clear yet. The stack will be undertaken a post-mortem-analysis in order to identify the failure cause and afterwards a replacement stack will be manufactured.

3 Conclusion and Outlook

Within this task, 5 SOC stacks were produced using the technology developed in HEATSTACK WP 3. Four of these stacks fulfilled all production tests, while one failed production and will be replaced by the time the cause is identified. Furthermore, minor issues in the spacer placing process were identified and are part of recent optimizations. Nevertheless, the outcome of this deliverable proofs the applicability of the new technology in a larger scale and serves as a basis for shifting the Sunfire stack production to the new process route. The SOC stacks are to be transferred to SFFC for integration in µCHP systems.