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# Clean Hydrogen Project BRAVA No. 101101409

## WP4 - Deliverable D4.2 & D4.3

**4.2: Report on Ionomers:** *1st status report on ionomer R&D activities and samples, incl. first material selection*

**4.3: Report on Membranes:** *1st status report on membrane R&D activities and samples, incl. first selection*

M12 – SEN



## Deliverable Details

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<b>Final approval</b>	Dirk Kastell

## Change History

<b>Version</b>	<b>Date</b>	<b>Changes</b>	<b>Done by</b>	<b>Approved by</b>
V1		First Version	Solvay / CNRS	
V2	08.11.2023	Second Version	Solvay / CNRS	Airbus



## List of Acronyms and Abbreviations D4.3

<b>Abbr.</b>	<b>Description</b>	<b>Abbr.</b>	<b>Description</b>
AST	Accelerated stress test	OCV	Open circuit voltage
BOT	Beginning of test	PAI	Polyamideimide
BPP	Bipolar plate	PFSA	Perfluorosulfonic acid
CCM	Catalytic coated membrane	PEM	Proton exchange membrane
CL	Catalyst layer(s)	PEMFC	Proton exchange membrane fuel cell
EOL	End of Life	RSP	Radical scavenger product
FC	Fuel cell	SoA	State of the art
FER	Fluoride emission rate	SEM	Scanning electron microscopy
ICP-MS	Inductively coupled plasma mass spectrometry	TEM	Transmission electron microscopy
MEA	Membrane electrode assembly		



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# 1. Executive Public Summary

## Combined report on ionomers and membranes

### D4.2 Report on Ionomers

The purpose of this deliverable report 4.2 “Ionomers report 1” is to recap ionomer R&D activities and related Solvay materials we are developing for the proton exchange membrane (PEM) design and binders for electrodes in alignment with the performance and durability requirements for the BRAVA project.

This report also includes the first materials selection and materials transactions with all the WP4 partners. Via a Solvay sub-contractor, a reference 15  $\mu\text{m}$  Proton Exchange Membrane has been defined (with WP4 partners) and produced by our sub-contractor (by a scalable roll-to-roll process) based on Solvay ionomer and additive with the combination of a classical ePTFE (expanded PTFE) reinforcement technology.

The first generation of Catalyst Coated Membrane within the WP4 will be prepared using this reference PEM.

### D4.3 Report on Membranes

This deliverable report (D4.3.) presents the progress at CNRS in reinforcement preparation and membrane development tailored for aviation fuel cell applications in the BRAVA project, and addresses the unique requirements and challenges associated with providing efficient and reliable power generation for aviation purposes.

The work carried out at CNRS spans from the start of the project (M1) to its current status at Month 11 (M11). The efforts undertaken encompass the establishment of durability standards for the proton exchange membrane, exploration and integration of cutting-edge materials and production methods, particularly the utilization of electrospinning techniques, as well as comprehensive assessments to determine the membrane's suitability for integration into aircraft fuel cell systems.

A particular highlight of the period is the development of a novel nanofiber reinforced ionomer membrane that displays high E-modulus and lower hydrogen crossover than the reference ePTFE reinforced ionomer membrane of greater thickness.



## 10. Acknowledgments

The author(s) would like to thank the partners in the project for their valuable comments on previous drafts and for performing the review.

### Project partners:

#	Partner short name	Partner Full Name
1	A-D	AIRBUS OPERATIONS GMBH
2	A-E	AIRBUS OPERATIONS SL
3	AER	AEROSTACK GMBH
4	CNRS	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE
4.1	UM	UNIVERSITÉ DE MONTPELLIER
5	HER	HERAEUS DEUTSCHLAND GMBH & CO KG
6	LTS	LIEBHERR AEROSPACE TOULOUSE SAS
7	MAD	MADIT METAL S.L.
8	MOR	MORPHEUS DESIGNS S.L.
9	NLR	STICHTING KONINKLIJK NEDERLANDS LUCHT – EN RUIMTEVAARTCENTRUM
10	SOL	SOLVAY SPECIALTY POLYMERS ITALY SPA
10.1	RHOP	RHODIA OPERATIONS
10.2	RHLA	RHODIA LABORATOIRE DU FUTUR
11	TUB	TECHNISCHE UNIVERSITÄT BERLIN

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