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Report title Workshop and partnering event for dissemination to stakeholders	Deliverable No 6.4
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Summary <p>On July 5th 2022, as an official side event of the 15th European SOFC & SOE Forum held in Lucerne, the AD ASTRA & RUBY jointly organized workshop was held, bringing together projects partners, researchers and industries representatives to present and discuss the achievements of both projects regarding the main topics.</p>	
Key words	



TABLE OF CONTENTS

1. FROM BASIC TO APPLIED RESEARCH TOWARDS DURABLE AND RELIABLE FUEL CELLS: Workshop jointly organized by H2020 Projects AD ASTRA and RUBY	4
1.1. Workshop Agenda and Attendants	5



1. FROM BASIC TO APPLIED RESEARCH TOWARDS DURABLE AND RELIABLE FUEL CELLS: WORKSHOP JOINTLY ORGANIZED BY H2020 PROJECTS AD ASTRA AND RUBY

The workshop gathered scientists and engineers from EU research and industry communities active on the broad area of Fuel Cell lifetime enhancement and advanced management. The speakers described the achievements on stress tests analysis and degradation of high temperature Solid Oxide Cells together with the work undergoing in the field of monitoring, diagnostics, prognostics and control of both SOFCs and PEMFCs.

The partners of the projects AD ASTRA and RUBY shared the results of their efforts, connecting degradation phenomena, fault root causes and mathematical framework that serves for improved stack and balance of plant management. The event addressed in a holistic framework the main topics that can lead to more performing stacks and competitive Fuel Cell Systems. A comprehensive overview and the potential of the project's outcomes were offered to the interested stakeholders and users from academia, industry and research. Emphasis was given to methodological approaches that can help achieving reliable performance of both stacks and BoP components, providing a comprehensive vision on the improvement of efficiency, performance, reliability, lifetime and maintenance of SOFC and PEMFC.

A talk from the affine project REACTT, presented as a special guest, was also given to encompass the preliminary achievements dealing with advanced diagnostics and control towards increased lifetime of solid oxide cells.

Contributions from the AD ASTRA project addressed the building of Accelerated Stress Test protocols for quantitative identification and prediction of critical degradation mechanisms, correlating them with overall performance variables in Solid Oxide Fuel Cell/Electrolyser and stack components. The experimental data have been exploited to build models to predict Remaining Useful Life based on operating profile in real-time. Final protocols will address realistic failure modes of critical SOC components (fuel electrode, oxygen electrode and interconnect) in two application profiles, namely: power-to-X and CHP.

Presentations from the RUBY project highlighted the aim of developing, integrating, engineering and testing a comprehensive and generalized Monitoring, Diagnostic, Prognostic and Control (MDPC) tool capable of improving efficiency, reliability and durability of SOFC and PEMFC systems for stationary applications. The tool relies on advanced techniques such as Electrochemical Impedance Spectroscopy and dedicated hardware and will be embedded in backup and μ -CHP Fuel Cell Systems for on-line validation in relevant operational environment.

The intertwined connection between the understanding and prediction of SOC component and stack degradation with its effective management during on-field application of real modules strongly emerged as the main outcome of this workshop jointly organized by the AD ASTRA and RUBY projects.

As the former depicted and highlighted the complexity of the physicochemical mechanisms and its attempt to exploit their understanding for artificially accelerate them, the latter stressed out the impact that such complex phenomena have in the real life application, where the monitoring, fault detection and proper automatized intervention for degradation mitigation is undoubtedly one of the key factors for achieving a full market penetration of these hydrogen electrochemical conversion technologies.

The AD ASTRA & RUBY jointly organized workshop was held On July 5th 2022, as an official side event of the 15th European SOFC & SOE Forum 2022, held in Lucerne on 5-8 July 2022.

1.1. Workshop Agenda and Attendants

The agenda of the workshop is presented hereafter:

9:00-9:05	Welcome	D. Pumiglia (ENEA) - C. Pianese (UNISA)
9:05-9:15	Improving FCs performance from basic phenomena to management	S. J. McPhail - C. Pianese (UNISA)- D. Pumiglia (ENEA)
9:15-9:25	Description of project AD ASTRA	D. Pumiglia (ENEA)
9:25-9:35	Description of project RUBY	P. Polverino (UNISA)
9:35-9:55	How cells and metal interconnects respond to operating parameters up to 40 kh	P. Piccardo (UNIGE)
9:55-10:15	Degradation assessment in solid oxide cell operated in electrolysis mode	A. Leon (EIFER)
10:15-10:25	Q&A	
10:25-10:40	Coffee break & networking	
10:40-11:00	Online total harmonic distortion analysis for rSOC diagnostic: Illustration for reactants depletion	H. Moussaou (EPFL)
11:00-11:20	AST: The effect of pressure on the interconnect ageing	R. Spotorno (UNIGE)
11:20-11:40	SOFC degradation studies through a multiscale modelling approach	F. Bianchi (UNIGE)
11:40-12:00	Development of mathematical transfer functions for AST design	P. Polverino (UNISA)
12:00-12:20	Modeling the impact of electrode degradations on the SOC response	E. Da Silva (CEA)
12:20-12:30	Q&A	
12:30-13:30	Lunch at the Canteen of the University of Lucerne	
13:30-13:50	Robust diagnosis of PEMFC based on Artificial Intelligence and EIS	D. Chanal (UBFC)
13:50-14:10	Data-driven and model-based diagnosis of SOFC cells and stacks	D. Juricic (IJS)
14:10-14:30	Data-driven and model-based diagnosis of PEMFC & SOFC Balance of Plants	A. Pandolfi (UNISA)
14:30-14:50	Validation of performance of RUBY-tool for SOFC μ -CHP	A. Nieminen (VTT)
14:50-15:00	Q&A	
15:00-15:20	Coffee break & networking	
15:20-15:40	Enforcing optimal operation of Fuel Cell systems despite degradation via real-time optimization	T. De Avila Ferreira (HES-SO)
15:40-16:00	Degradation-aware energy management of fuel cell-based VPPs	M. Sorrentino (UNISA)
16:00-16:20	EU project REACTT-Advanced Field Diagnostics of SOEC & rSOC	D. Juricic (IJS)
16:20-16:40	Hardware for on-field EIS: state of the art, solutions and issues	G. Spagnuolo (UNISA)
16:40-16:50	Q&A	
16:50-17:00	Feedback from Q&A sessions, discussion – Closure	D. Pumiglia (ENEA) - C. Pianese (UNISA)

The confirmed attendants to the workshop were 29, as indicated in the following table from the original participant list.

The presentations from the workshop will be publicly available and can be requested through the project website <https://www.ad-astra.eu/>.

n.	Surname	Name	Organization	Type	Country
1	Adinolfi	Ennio Andrea	University of Salerno	Research	Italy
2	Bianchi	Fiammetta	University of Genova	Research	Italy
3	Chanal	Damien	UBCF	Research	France
4	Cheikh	Abderazek	FEMTO-ST Institute, FCLAB	Research	France
5	Da Rosa Silva	Eduardo	CEA	Research	France
6	De Avila Ferreira	Tafarel	Hes-so	Research	Switzerland
7	Galiano	Francesco	Bitron S.p.A	Industry	Italy

8	Geipel	Christian	SUNFIRE	Industry	Germany
9	Juricic	Dani	Institute Jozef Stefan	Research	Slovenia
10	Laurencin	J�rome	CEA	Research	France
11	Leon	Aline	European Institute for Energy Research	Research	Germany
12	Malkow	Thomas	EC, JRC	Research	The Netherlands
13	Maritato	Luigi	University of Salerno	Research	Italy
14	McPhail	Stephen J.	KIWA	Other Private	Italy
15	Moussaoui	Hamza	EPFL	Research	Switzerland
16	Nieminen	Aki	VTT	Research	Finland
17	Pandolfi	Alfonso	University of Salerno	Research	Italy
18	Pianese	Cesare	University of Salerno	Research	Italy
19	Polverino	Pierpaolo	University of Salerno	Research	Italy
20	Pumiglia	Davide	ENEA	Research	Italy
21	Spagnuolo	Giovanni	University of Salerno	Research	Italy
22	Spotorno	Roberto	University of Genova	Research	Italy
23	Sun	Xiufu	DTU	Research	Denmark
24	Tanzi	Carlo	Bitron S.p.A	Industry	Italy
25	Tremblay	Marie-lise	Hydro-Qu�bec	Research	Canada
26	Yu	Hangyu	EPFL	Research	Switzerland
27	Cigolotti	Viviana	ENEA	Research	Italy
28	Piccardo	Paolo	University of Genova	Research	Italy
29	Monforti	Andrea	ENEA	Research	Italy

A group photo of part of the attendants and presenting authors is reported below, taken at the end of the workshop.

