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FROM BASIC TO APPLIED RESEARCH TOWARDS DURABLE AND RELIABLE FUEL CELLS

Focus on accelerated stress tests, degradation phenomena, fault modelling, advanced monitoring, diagnostics, prognostics and control of SOC and PEMFC

Workshop jointly organized by H2020 Projects AD ASTRA and RUBY

5 July 2022 – Lucerne (CH) – European Fuel Cell Forum 2022

venue:	University of Lucerne Frohburgstrasse, Lucerne (CH) Conference Room n. 5
	www.efcf.com/2022/conference/highlights/venue
registration deadline:	17 June 2022
registration:	www.rubyproject.eu/dissemination/workshop1/#registration
info:	workshop@rubyproject.eu

RUBY Project **RUBY** Robust and reliable general management tool for performance and durability improvement of fuel cell stationary units

Improving FCs performance from basic phenomena to management

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5TH JULY 2022 - LUCERNE (CH)

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Current Needs and Solutions

RUBY







Low costs: production, operation, maintenance

Reliability, durability and availability

- use innovative materials;
- improve stack and system performance;
- reduce fault/failure occurrence;
- avoid detrimental operations;
- keep functionality in abnormal states.

Production, operation and maintenance costs

- reduce materials amount and cost;
- improve production process efficiency;
- reduce quality test costs;
- improve overall system efficiency and cost;
- enhance predictive maintenance.

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EU JU Framework State-of-the-Art 1/2





SOFC		PEMFC		
GENIUS	<u>Simple stack and system (</u> CHP): focus on <u>BoP</u> <u>diagnosis</u> conventional_techniques	D-CODE	LT and HT backup systems: focus on <u>faults</u> <u>diagnosis with EIS</u>	
DESIGN	Cell & stack with <u>statistical approaches</u>	PUMA-MIND	Multi-scale modelling for stack diagnosis	
DIAMOND	Integrated stack modules: focus on <u>stack and BoP</u> <u>diagnosis</u> and control with conventional techniques	SAPPHIRE	LT technologies: focus on <u>lifetime improvement</u>	
			<u>On-board EIS</u> technique for both CHP and backup systems: focus on 5 faults (air and fuel starvation, flooding and dehydration, sulphur poisoning) and lifetime inference.	
INSIGHT	<u>On-board EIS, THD, PRBS</u> techniques for CHP systems: focus on 3 faults <u>degradation and</u> <u>lifetime</u>	HEALTH-CODE		
REACTT	On-board EIS for SOEC/rSOC	L	1	

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EU JU Framework State-of-the-Art 2/2

Improved, Integrated and Holistic approach for Monitoring, Diagnostic, Prognostic and Control Strategies

Past & on-going projects

	MONITORING	DIAGNOSIS	PROGNOSIS	CONTROL	HW DESIGN	FULL INTEGRATION	ONFIELD TESTING
SOFC	GENIUS INSIGHT SOSLEM DIAMOND	GENIUS DIAM (AD AS INSIGHT	STRA INSIGHT		INSIGHT	UNCOVERED	ENE.FIELD PACE
PEMFC	D-CODE HEALTH-CODE	D-CODE HEALTH- CODE	SAPPHIRE HEALTH- CODE	UNCOVERED	D-CODE HEALTH- CODE	UNCOVERED	UNCOVERED





Funded by the EU Fuel Cell and Hydrogen 2 Joint Undertaking (now Clean Hydrogen Partnership) -H2020 Programme Grant Agreement Number 875047 Clean Hydrogen Partnership





Reliability, durability and availability

As the systems become more **complex** and the **performance objectives** increase, a better **integration** of modeling, control and experiments is **mandatory**. This is a critical step towards system deployment.

A multidisciplinary view is required to merge:

<u>Experiments</u> New way of performing characterization and identification via, e.g., statistics (DOE).

<u>Models</u> New approaches are required and are brought from other areas (e.g. planes, cars).

Testing Software-/Hardware-In-the-Loop (SIL/HIL).

<u>Methodologies</u> Mathematics, Statistics, Numerics are available.







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