PEMTASTIC

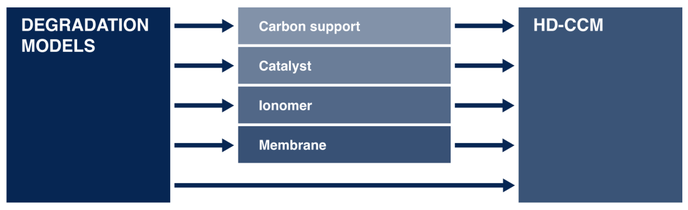
Clean Hydrogen Partnership

Co-funded by the European Union

ROBUST PEMFC MEA DERIVED FROM MODEL-BASED UNDERSTANDING OF DURABILITY LIMITATIONS FOR HEAVY DUTY APPLICATIONS

Objectives

The R&D project PEMTASTIC aims to meet the key technical challenges to increase durability of membrane-electrode assembly (MEAs) for heavy-duty (HD) applications. These challenges are approached with a combination of model-based design and the development of a durable CCM using innovative materials tailored for heavy duty operation at 105°C.

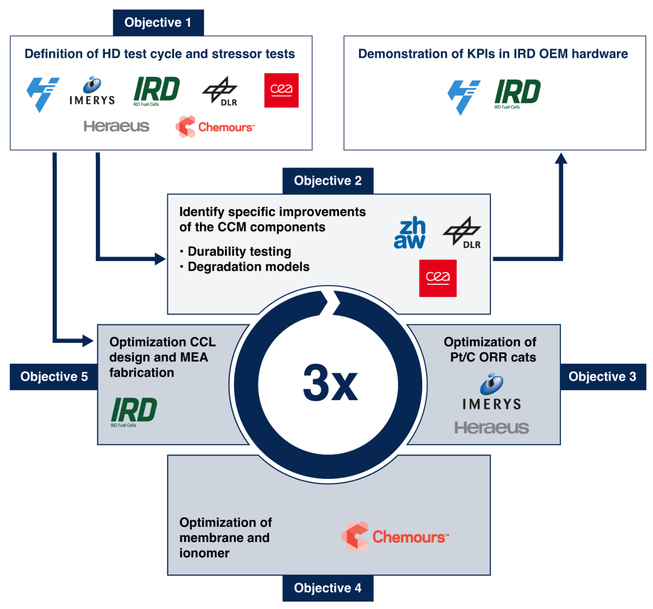


MODEL-BASED CCM DEVELOPMENT

Clean Hydrogen JU SRIA KPIs				
	SoA 2020[18]	Targets 2024	Targets 2030	PEMTASTIC targets
Durability / h	15.000	20.000	30.000	20.000
PGM loading / gkW^{-1}	0.4	<0.3	<0.25	0.3
Power density / Wcm^{-2}	1.0 @ 0.65V	> 1.2 @ 0.650V	> 1.2 @ 0.650V	1.2 @ 0.65V
Additional Project KPIs				
Operation temperature / °C	80-85			95-105 at low RH

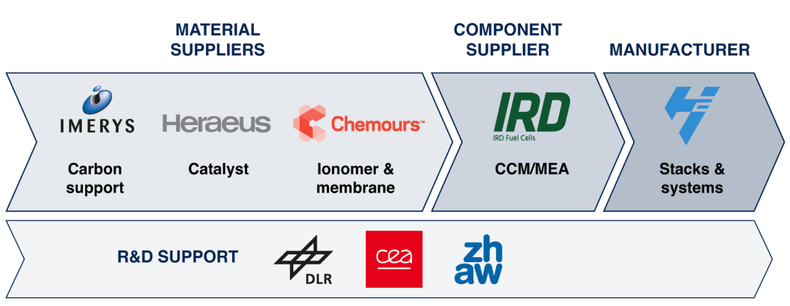
Methodology

- Definition of FC test protocols based on truck mission profiles
- Identification of relevant fuel cell operation stressors
- Extensive degradation tests in differential cells
- Assisting physical-chemical material characterization
- Micro- and mesoscale material modelling, 1D and 2D cell level modelling New materials: corrosion resistant supports, a novel catalyst deposition technique, prototype ionomers
- Iterative adaptation based on experimental input
- Validation at TRL4 in short stack.



Expertise

The consortium covers the full value chain from material development to stack and systems manufacturing.



Call topic: CLEANH2-2022-03-02
Type of Action: RIA
Duration: 01.02.2023 – 31.01.2026
GA Number: 101101433
CleanH2 Funding: 2.749 k€
Total budget: 3,685 k€

https://www.linkedin.com/showcase/pemtastic
http://pemtastic-project.eu/
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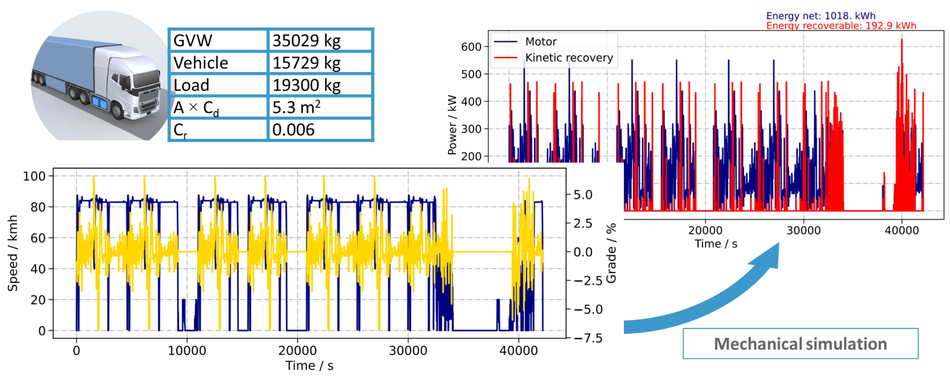
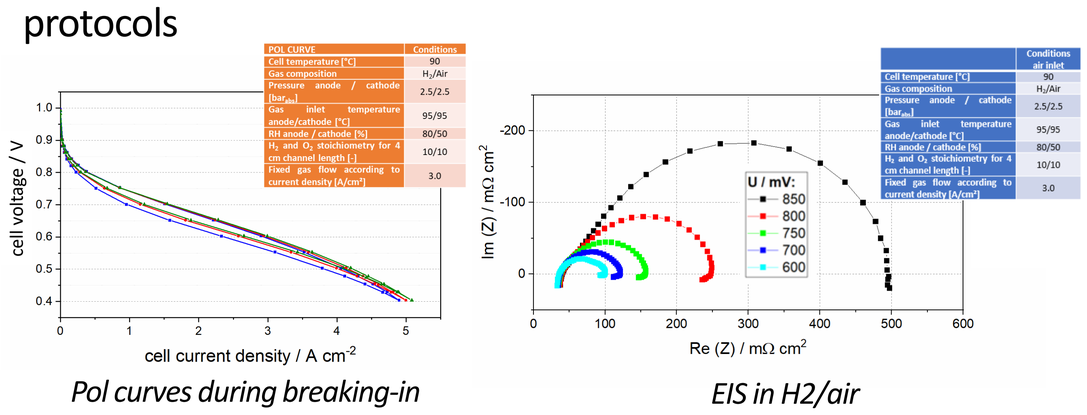
Selected results

Analysis of truck power requirements based on mission profiles



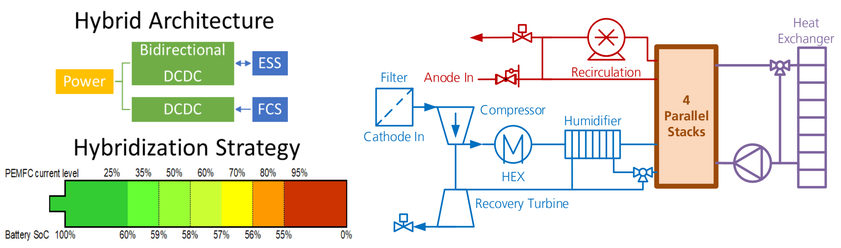
Characterization of reference MEA following PEMTASTIC testing protocols



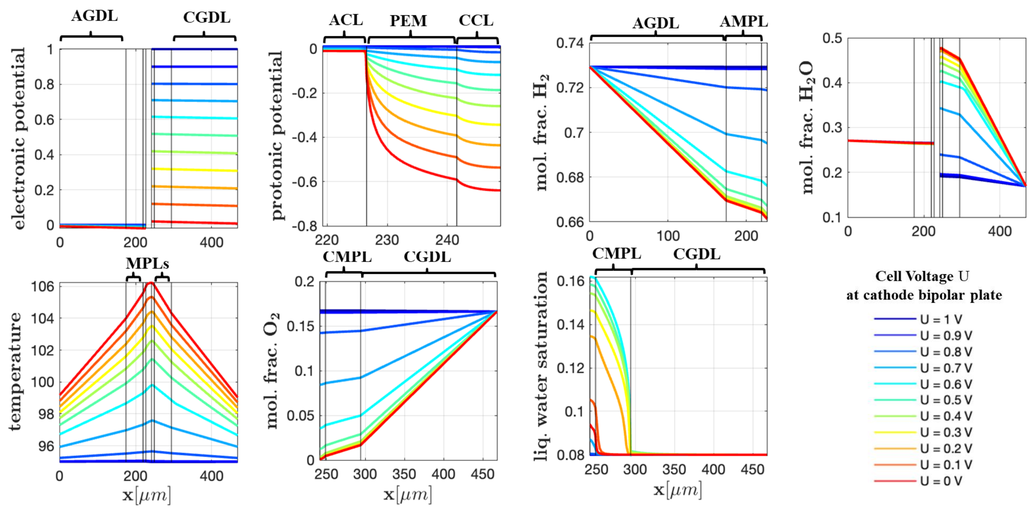
Pol curves during breaking-in

EIS in H2/air

Determination of fuel cell power profile for specific hybridization strategy



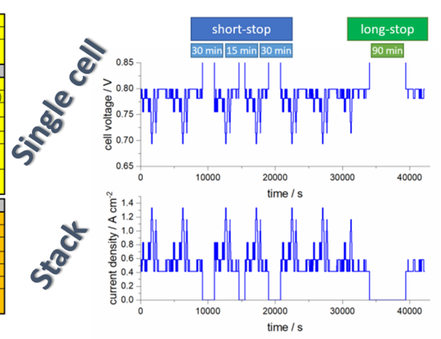
1D COMSOL preliminary simulations with operating conditions T = 95°C, P = 2.5 bar, RH = 80/50%, O_2 concentration = 20%



Potential profiles for charge, heat and mass

Definition of FC test protocols for heavy-duty applications

Proposed by	PEMTASTIC HD condtions	
Source	At air **inlet**	At air **outlet**
Comment		(calc by CEA)
Differential Cell		
Cell temperature [°C]	90	105
Gas composition	H2/air	H2/(N2+9%O2)
Outlet pressure anode / cathode [bar$_{abs}$]	2.5/2.5	2.6/2.2
Gas inlet temperature anode/cathode [°C]	Cell temperature + 5 °C	
RH anode / cathode [%]	80/50	35/60
H2 and O2 stoichiometry for 4 cm channel length [-]	10/10	
Fixed gas flow according to current density [A/cm²]	3.0	
Stack / technical single cell		
Coolant inlet temperature [°C]	90	
Gas composition	H2/air	
Inlet pressure anode / cathode [bar$_{abs}$]	2.6/2.5	
Gas inlet temperature anode/cathode [°C]	95	
RH anode / cathode [%]	50/35	
Stoichiometry integral cell / stack [-]	1.2/1.8	
Fixed gas flow according to current density [A/cm²]	0.2	



Available as Deliverable 1.3: Public report on definition of FC test protocols

The project is supported by the Clean Hydrogen Partnership and its members Hydrogen Europe and Hydrogen Europe Research.