IEA ANNEX 30

MEGASTACK Workshop on cost targets and cost reduction strategies for PEM electrolysers

Agenda

- Megastack project introduction
- Motivation and objective of workshop

MEGASTACK Main Objectives

- Develop a cost efficient stack design for MW sized PEM electrolyser.
- Construct and demonstrate a prototype of this stack design which will demonstrate:
  - Efficiency of at least 75% (LHV) @ 1.2 Acm^{-2}
  - Stack capital cost below € 2,500 / Nm^3h^{-1}

ITM POWER Energy Storage | Clean Fuel

Fraunhofer ISE

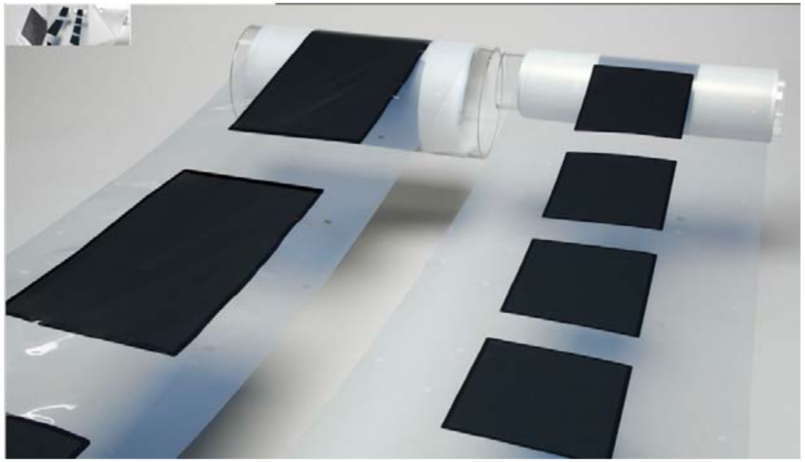
SINTEF

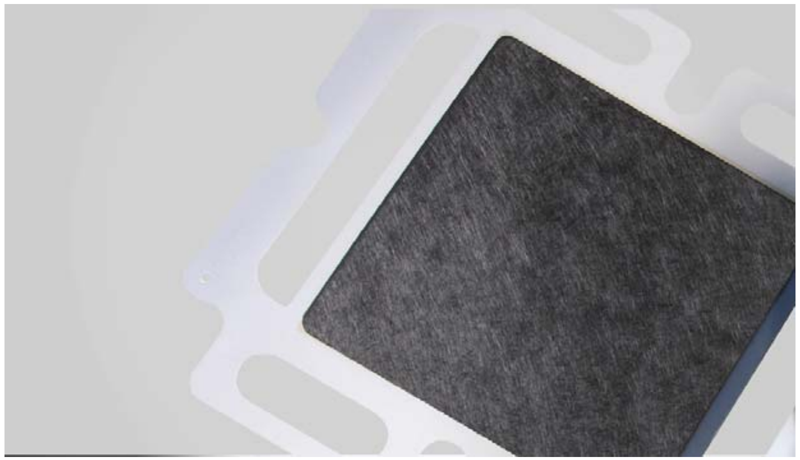
cea

Approach – MEAs

- Large scale (> 1000 cm^2)

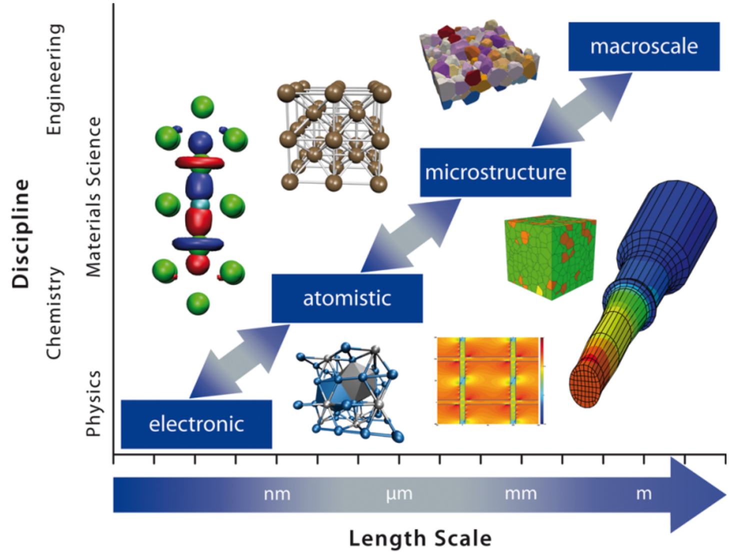
- Roll to roll manufacturing
  - Reduced manufacturing costs
- Inexpensive and robust rim materials
  - Reduction in ionomer usage in non-active cell areas.
  - reduction of the probability of failures in the MEA and an increased stack lifetime

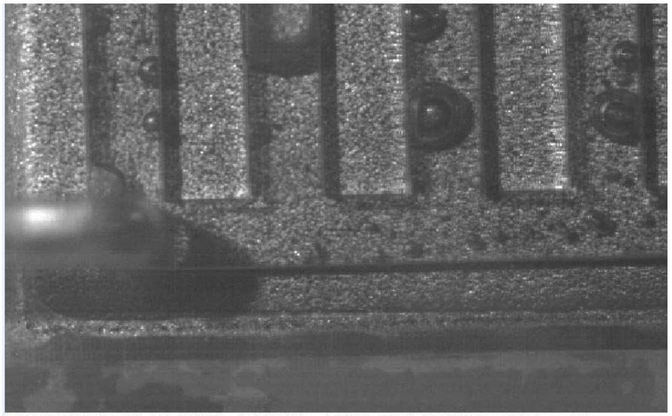




Approach – multiscale/multiphysics design tools

- Improved stack design through increased understanding of internal heat and mass transport processes.
- Temperature, pressure and other mechanical stresses are reduced, reducing degradation
- Increase of electrolyser current density and reduction of pressure drops.

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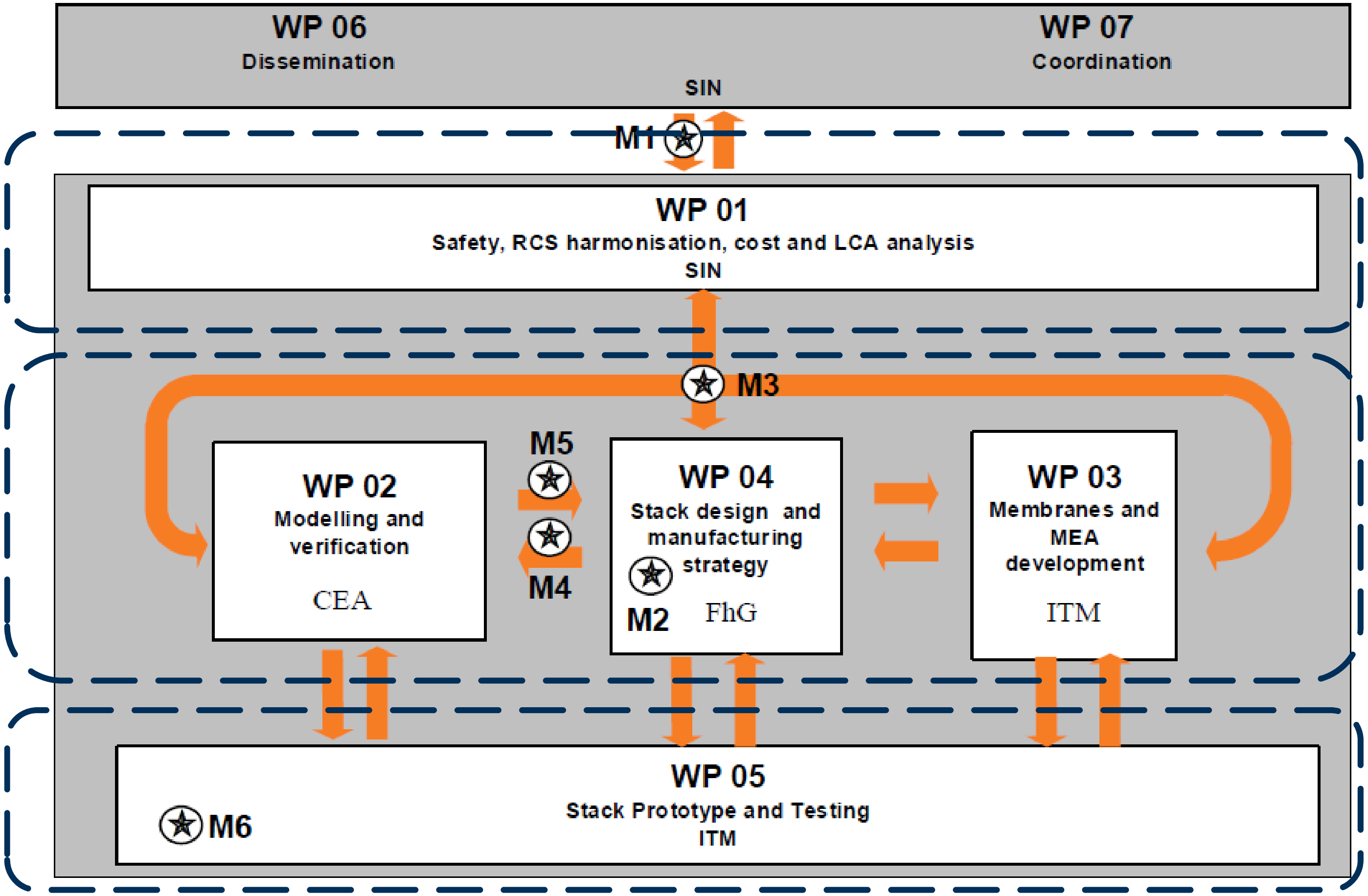
Approach - LEAN stack design

- Increase of cell area
- 50% Reduction cell part count

- Ease of manufacture and assembly & Increased quality control measures
  - Reduced risk of manufacturing errors and subsequent premature failures
- Externalisation of stack non-core functions
  - Reduction of stack components
  - Lower costs of maintenance and replacement

Work package interdependencies



Cost and performance evaluation
Market and external interaction

Integrated stack design, component and single cell testing. Modelling

Stack construction, testing and verification

Workshop motivation

- Get an update on the cost targets and cost reduction potential of PEM electrolysers for various markets.
  - OPEX vs CAPEX, where can costs be reduced?
- What are the proper market conditions? (feed in tarrifs, capacity market, electriciy tax).
- What is missing on the side of rules, codes and regulations?
- What are the main bottlenecks? Where should R&D efforts be targeted?
- Review of the KPIs for electrolysers in the FCH JU MAWP. How are these KPIs in accordance with targets set in other areas and with expectations from other stakeholders.
- Give feedback to the FCH-JU
  - Key performance indicators (technical and economic)

Workshop motivation

- Session 1
  - Discussion of the different market and application areas for (PEM) electrolysis and derived cost targets for various applications.

- Session 2
  - Industry will present possible pathways/strategies to achieve cost targets and cost reduction strategies.

First session

15:00	Magnus Thomassen	SINTEF / Norway (Moderation and introduction to the project)
15:10	Jong Hyun Jang	KIST / Republic of Korea
15:30	Oliver Ehret	NOW / Germany
15:50	Mamoru Jo	NEDO / Japan
16:10	Bryan Pivovar	NREL / United States of America
16:20	Franz Lehner	E4Tech / Switzerland (on behalf of JU FCH)
16:40	Discussion	

What are proper market conditions and legal framework to be competitive on the market (feed in tariffs, capacity market, electricity taxes)?

Review of the KPIs for electrolysis in the FCH JU Multi-Annual Work Programme: Are these European KPIs in accordance with targets set in other areas and with expectations from other stakeholders?

Second session

09:00	Tom Smolinka	Fraunhofer ISE / Germany (Moderation and summary of the 1st session)
09:10	Pascal Pewinski	ArevaH2Gen / France
09:30	Everett B. Anderson	Proton OnSite / United States of America
09:50	Manfred Waidhas	Siemens / Germany
10:10	Frederic A L. Marchal	ITM Power / Great Britain
10:30	Discussion	

What are acceptable cost targets for PEM electrolysers in energy applications?
What are main bottlenecks to achieve these cost targets?
What are the most important actions that need to be taken to achieve these targets?
Review of the KPIs for electrolysis in the FCH JU Multi-Annual Work Programm

FCH JU MAWP – specific objectives

- Programme to be implemented in the FCH 2 JU during the period 2014-2020 will in particular contribute to the following ***techno-economic objectives***.

- Techno-economic objective 3: increase the energy efficiency of production of hydrogen mainly from water electrolysis and renewable sources while reducing operating and capital costs, so that the combined system of the hydrogen production and the conversion using the fuel cell system is competitive with the alternatives available in the marketplace;

- Techno-economic objective 4: demonstrate on a large scale the feasibility of using hydrogen to support integration of renewable energy sources into the energy systems, including through its use as a competitive energy storage medium for electricity produced from renewable energy sources;

FCH JU MAWP – Electrolysis KPIs

Table 3.1.1.2 State-of-the-art and future targets for Hydrogen production from renewable electricity for energy storage and grid balancing

		State-of-the-art	2017	2020	2023
KPI 1	H2 production electrolysis, energy consumption (kWh/kg) @ rated power	57-60 @100kg/d	55 @500kg/d	52 @1000+kg/d	50 @1000+kg/d
KPI 2	H2 production electrolysis, CAPEX @ rated power including ancillary equipements and comissioning	8.0 M€/(t/d)	3,7 M€/(t/d)	2.0 M€/(t/d)	1.5 M€/(t/d)
KPI 3	H2 production electrolysis, efficiency degradation @ rated power and considering 8000 H operations / year	2% - 4% / year	2% / year	1,5% / year	<1% / year
KPI 4	H2 production electrolysis, flexibility with a degradation < 2% year (refer to KPI 3)	5% - 100% of nominal power	5% - 150% of nominal power	0% - 200% of nominal power	0% - 300% of nominal power
KPI 5	H2 production electrolysis, hot start from min to max power (refer to KPI 4)	1 minute	10 sec	2 sec	< 1 sec
	H2 production electrolysis, cold start	5 minutes	2 minutes	30 sec	10 sec