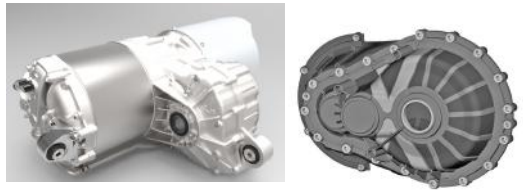
Shoulder to shoulder across borders: Light Vehicle 2025 Demonstrators

1

 # Body module
e.g. bonnet, door

Demo Leader:
Jean-Pierre Heijster, Automotive NL

2



 # e-Powertrain module
e.g. gearbox housing

Demo Leader:
Ioanna Koutla, Université de Liège

3

 # Suspension module
e.g. AM-consolidated parts

Demo Leader:
Jan Vandessande, Flanders Make

4

 # Hydrogen tanks
For fuel cells

Demo Leader:
Dr. Michael Effing, AMAC

✓ **We have chosen four demonstrators**

Project Partners

Co-Financers

Hydrogen Tank. Why?

- High demanding application for EV with Fuel Cell.
- Extreme pressures (700 bar). Requires carbon fibers.
- High volume production expected in 2020.
- Excellent capabilities for production and engineering in our Region EMR.

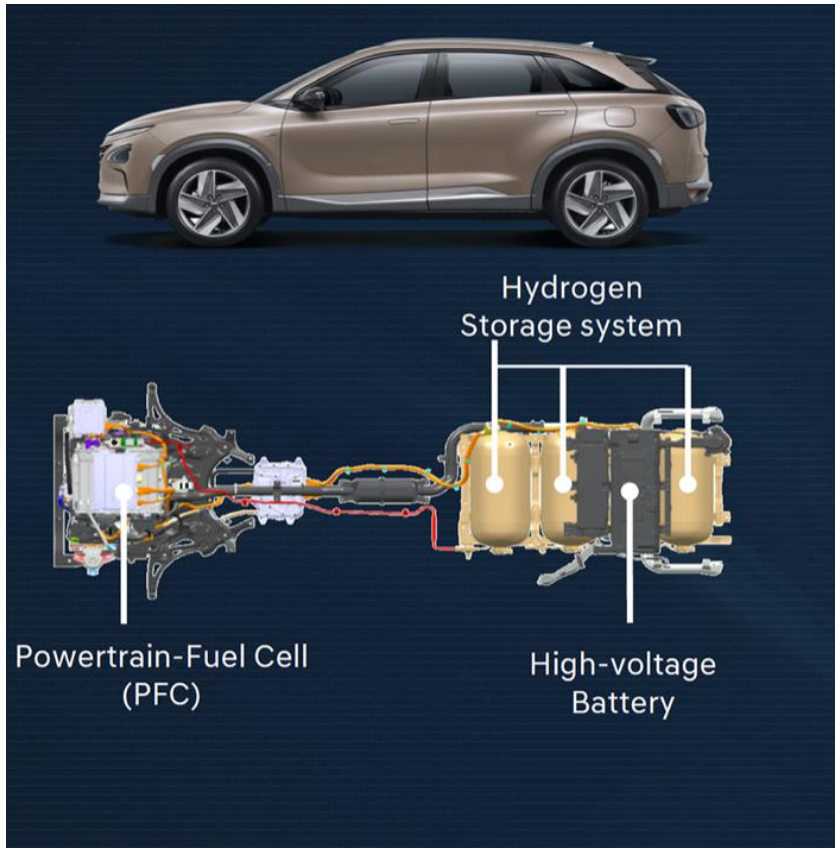
Fuel Cell technology application example

Hyundai Nexo 2020 FCEV

Application example: Hyundai Nexo FCEV

Characteristics:

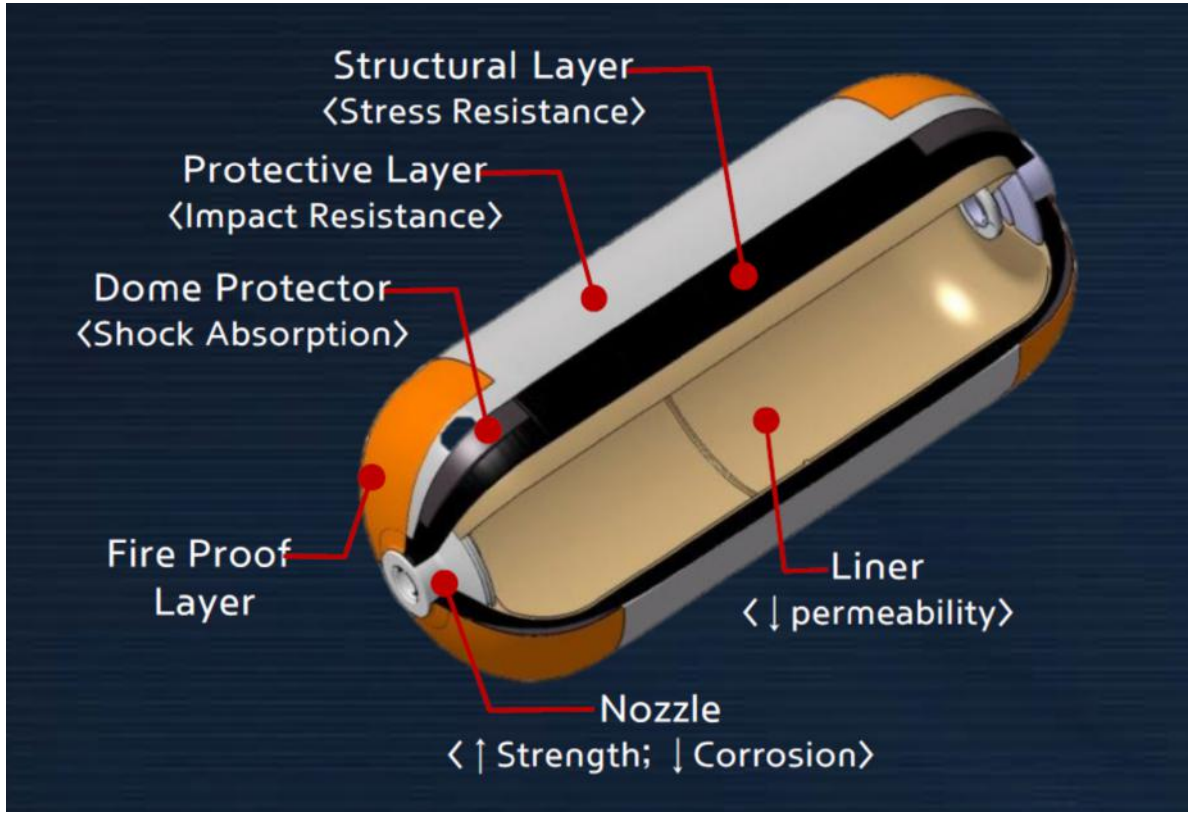
- Car model: Hyundai Nexo
- Hydrogen tank Type IV (700 bar)
- Lifetime: 15 years
- Number of tanks per vehicle: 3
- Volume: 52 liters
- Capacity: 2kg of Hydrogen



Source: SAE International

Application example: Hyundai Nexo FCEV

Construction of a Hydrogen tank



Source: SAE International

Objective of the Demo Project

Hydrogen technologies are in the early stage of market introduction. They store hydrogen at very high pressures of 700 bars for Fuel Cell driven EV (electric vehicles). The first generation is using thermoset filament winding with standard T700 carbon fiber.

The goal of this project is:

- to further reduce the weight by another 15%, using a new higher strength carbon fiber from Mitsubishi and secondly, we like to reduce the cost by using a high filament count of 30K versus a standard of 18K.

- Today liners are made in the traditional injection blow molding process with high volumen production. This causes a lot of extra cost for storage and handling.

Our overall target is to demonstrate 15-20% of weight savings and to lower the cost by 20%.

Partners

Name:	Mitsubishi Chemical
Key Contact:	Denis Boahene
Webpage:	eu.mitsubishi-chemical.com
Email:	denis.boahene@mccfc.eu
Main Responsibility:	Material Supplier

Name:	Plastic Omnium
Key Contact:	Axel Seifert
Webpage:	www.plasticomnium.com
Email:	axel.seifert@plasticomnium.com
Main Responsability:	Prototyping and Testing

Partners

Name: Automation & Manufacturing Services
Key Contact: Johan Portangent
Webpage: www.ams-innovation.com
Email: johan.potargent@amsbelgium.com
Main Responsibiliy: Manufacturing

Name: 2C-Composites
Key Contact: Thomas Bäumer
Webpage: www.2c-composites.de
Email: t.baeumer@2c-composites.de
Main Responsibility: Engineering

Partners

Name: Conbility
Key Contact: Kamran Samaie
Webpage: www.conbility.de
Email: kamran.samaie@conbility.com
Main Responsibility: Costing Study

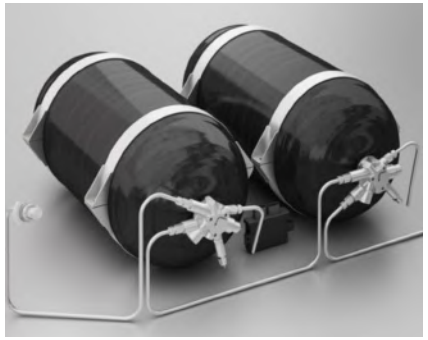
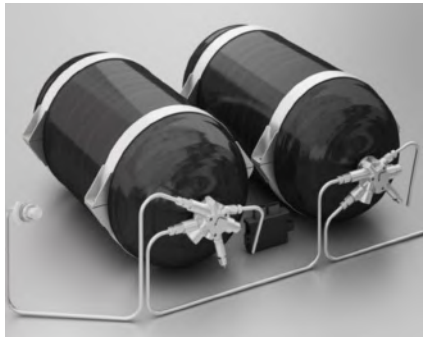
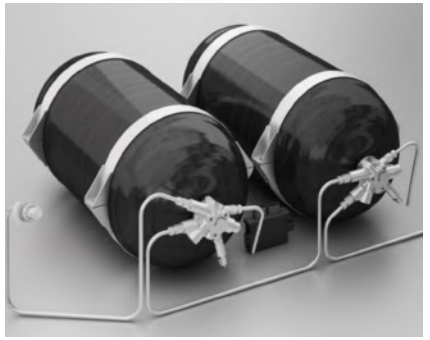
Partners and External Service Providers

Engineering	Raw Material	Equipment/Tooling	Tier 1/Tier 2	OEM	Others
• **PO/ B** • **2C-Composites/ D** • **AMS/ B**	• **Mitsubishi/ D**	• **PO/ B** • **2C-Composites/ D** • **AMS/ B**	• **PO/ B**	• **EGO/ D** • **Toyota/ B** • **Hyundai/ D** • **Ford/ D**	• **AZL/ D** • **Brightlands/ NL** • **Conbility/ D** • **University of Liège (LCA)**

Scope of the project

- A total of 10 hydrogen tanks type IV 52 liter (as for Hyundai Nexo)
- Two modifications on the liner → Blow molding vs Rotor molding
- Another liner modification is to be a 2-layer system made of different materials (PP, PA)
- Two different carbon fiber types, 10K vs the new 30K carbon fiber for hydrogen tanks applications
- Each composite pressure vessel (CPV) will be tested
- Two benchmarking studies are to be made
  - On the liner type
  - Thermoplastic vs Thermoset processing of a CPV

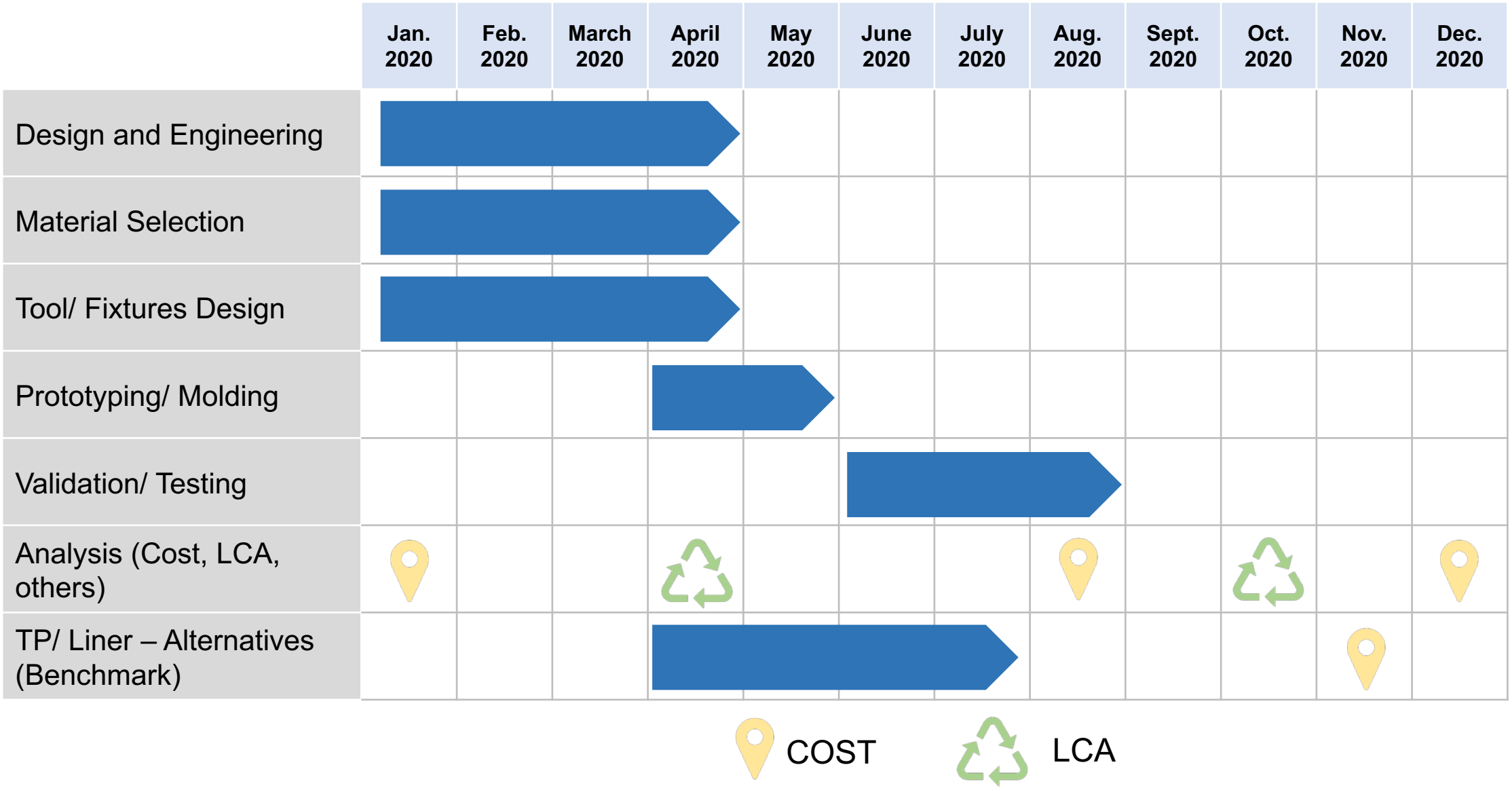
Expected deliverables

Source: Plastic Omnium

	Blow Molding Liner	Rotomolding Liner	Other Liner Modifications
CF 18 K (TRH50 18M)	2	2	1
CF 30 K New (TRH50 30M)	2	2	1
Total:	4	4	2

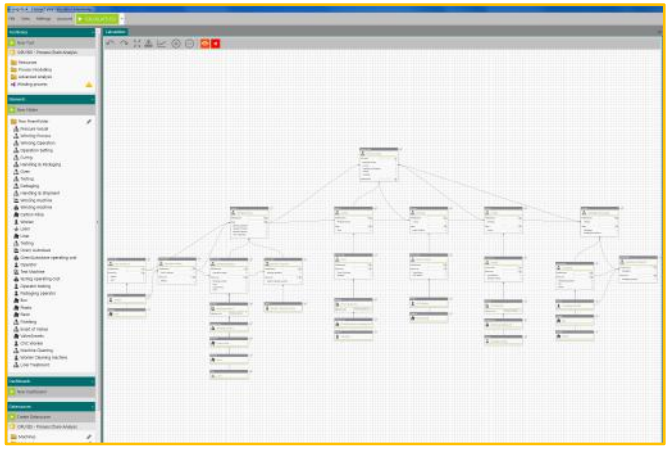
Schedule


Jan. 2020
Feb. 2020
March 2020
April 2020
May 2020
June 2020
July 2020
Aug. 2020
Sept. 2020
Oct. 2020
Nov. 2020
Dec. 2020
Design and Engineering
Material Selection
Tool/ Fixtures Design
Prototyping/ Molding
Validation/ Testing
Analysis (Cost, LCA, others)
TP/ Liner – Alternatives (Benchmark)
COST
LCA

Other Research

Cost modeling with OPLYSIS

OPLYSIS helps companies to evaluate, identify and implement cost-efficient lightweight production technologies



The intuitive drag & drop interface of our job costing software OPLYSIS® allows creating process chains in minutes.

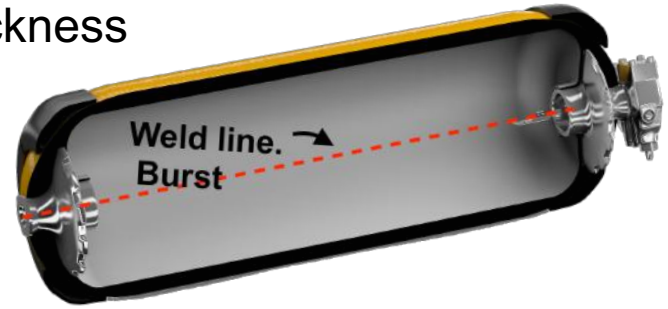
Link: http://conbility.de/geschaeftsbereiche/2-costing-software/?lang=en

Examine your current production with a multitude of analysis functions and find hidden costs in your processes.

Simulate alternate production scenarios by varying process elements or resources within seconds and use to e.g. assess investments.

Other Research

Liner Concept Blow molding vs Robomolding

Criteria	Blow moulding	Rob omoulding (Rotational Moulding)
Choice of Materials	PP, PE	All polymers (PP, PA, PE, etc)
In-line vs Off-line	Off line vs vessel production. 2-3 min per liner. This process creates stock	In line with vessel production. 20-30 min just in time 80ºC of mould. No stock
Shape (thickness)	Constant thickness (4-6 mm) 	No burst/ Weld line Various thicknesses
Investment for tool	High	1/3 low of blow mould tool

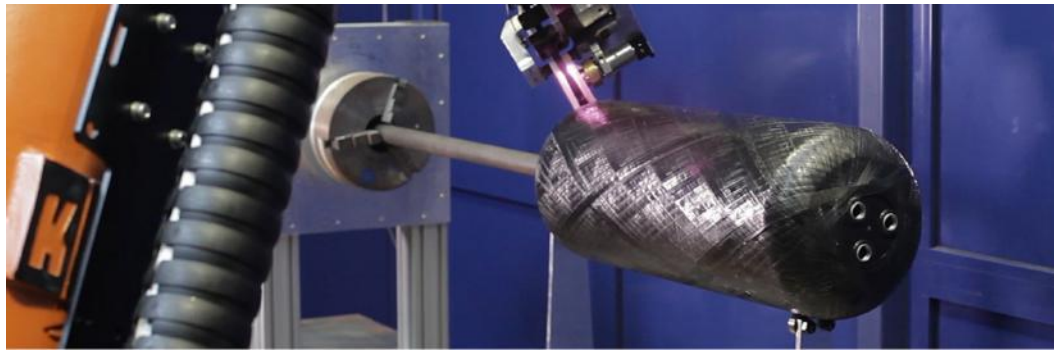
Other Research

- Benchmarking: Thermoset vs Thermoplastic Composite Winding

- Study: Tape vs Carbon Fiber / Resin

Links of interest:

- https://www.compositesworld.com/articles/thermoplastic-composite-pressure-vessels-for-fcvs
- https://www.compositesworld.com/articles/the-markets-pressure-vessels

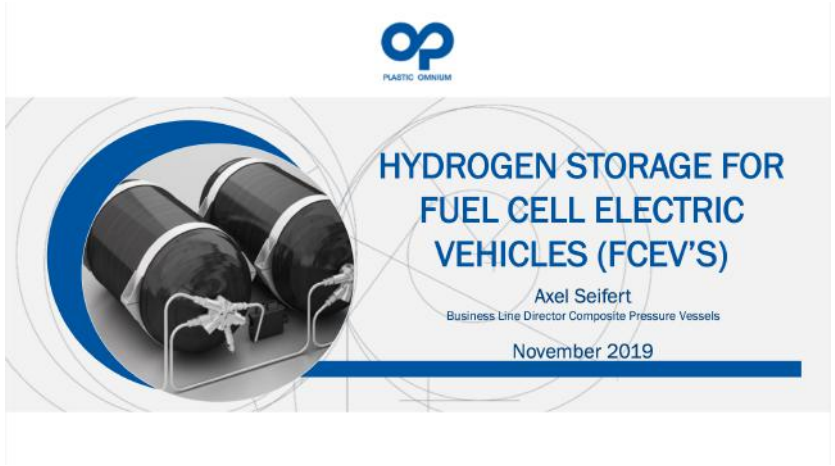


Source: Fraunhofer IPT

Literature

MMC CARBON FIBER FOR PRESSURE VESSEL
(MITSUBISHI CHEMICAL)

LINK: MCFE for WOF 26 Nov 2019.pdf



HYDROGEN STORAGE FOR FUEL CELL ELECTRIC VEHICLES (FCEV'S)
(PLASTIC OMNIUM)

LINK:PONE 15-11-2019.pdf