

Joint Technology & Concept Study

Trends and Design Factors for Hydrogen Pressure Vessels



Overview on Pressure Vessels

Types of Pressure Vessels

	<p>Type V</p> <ul style="list-style-type: none"> Complete fiber reinforced shell Only end fittings metallic or other
	<p>Type IV</p> <ul style="list-style-type: none"> Plastic liner (e.g. HDPE or PA) Complete fiber reinforced shell
	<p>Type III</p> <ul style="list-style-type: none"> 4130 Steel or 6061 Aluminum liner Complete fiber reinforced shell
	<p>Type II</p> <ul style="list-style-type: none"> 4130 Steel or 6061 Aluminum liner Partial fiber reinforced shell
	<p>Type 1</p> <ul style="list-style-type: none"> Complete 4130 steel or 6061 Aluminum vessel

Source: <https://www.infinitecomposites.com/composite-pressure-vessel-resources>

Small and large



Mobile and stationary applications



Project Objectives

Objectives:

- Provide market & industry insights.
- Share regulatory, standards & IP landscape info.
- Present latest design, materials & manufacturing state of the art.
- Create reference designs for evaluating KPIs.
- Design study for thermoset and thermoplastic composite pressure vessels
 - Cost
 - Weight
 - CO₂
 - Recyclability

Results:

- Discover trends in markets & technologies.
- Understand value chain: materials, equipment, components, testing & development services.
- Gain insights on design parameter impacts on KPIs using FEA analysis.
- Evaluate reference designs to assess material, liner design, manufacturing methods, boss design & integration influence on vessel performance, cost & CO₂ footprint.
- Network with potential partners & customers at events.

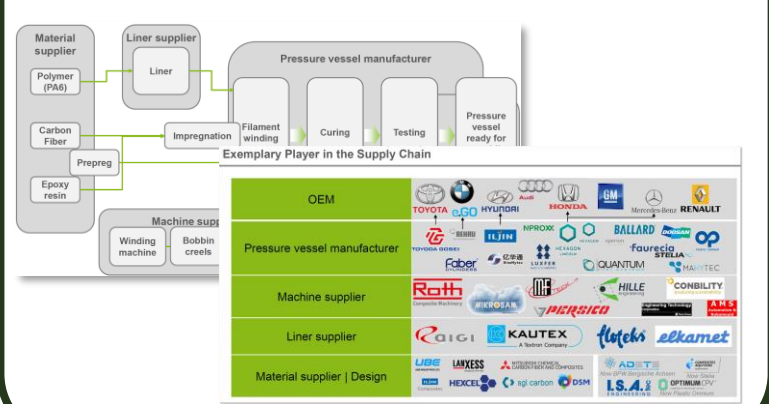
Note: Actual demonstrator manufacturing and testing may be performed in individual follow-up projects.

Topics to be considered in the Joint Partner Project

Market overview



Value chain



Regulations



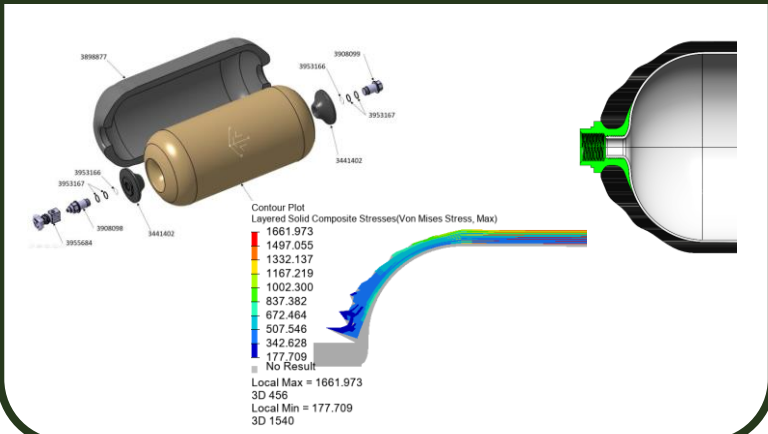
Materials



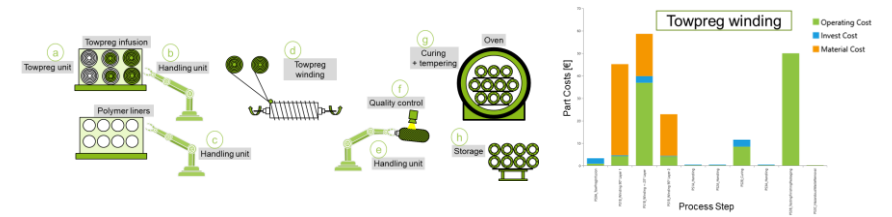
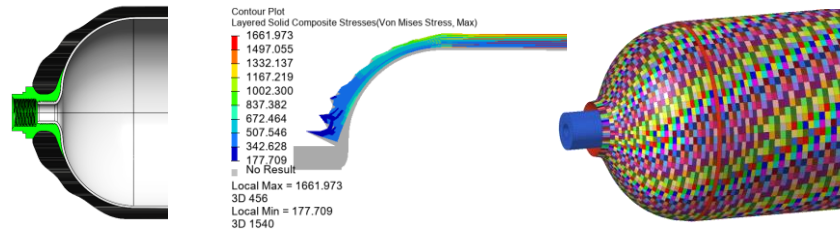
Technologies



Designs



Work Packages



WP1 Overview state of the art

Questions to be answered:

- Which are the major players?
- What are typical requirements?
- What are typical layouts and design principles? Information on liners, bosses, valves, sealing, winding patterns, etc.
- What are typical materials?
- What are typical processing routes for liner and shell?
- What are the trends?
- Which concepts for recycling exist?

WP2 Design & Analysis

Design and CAE analysis of a nominal 700 bar pressure vessel:

- Definition of material properties to be used
- Liner and boss design
- Winding pattern for thermoset vessel
- Winding pattern for thermoplastic vessel, using tape laying design freedom (non-geodesic, start-stop)
- Effect of process or environment variations: tension, liner pressurization, temperature, moisture variations
- Optimizations for the different materials will be based on the burst pressure load case. Analysis on thermal cycling and drop impact will also be performed.

WP3 Processing, Cost and CO₂ analysis

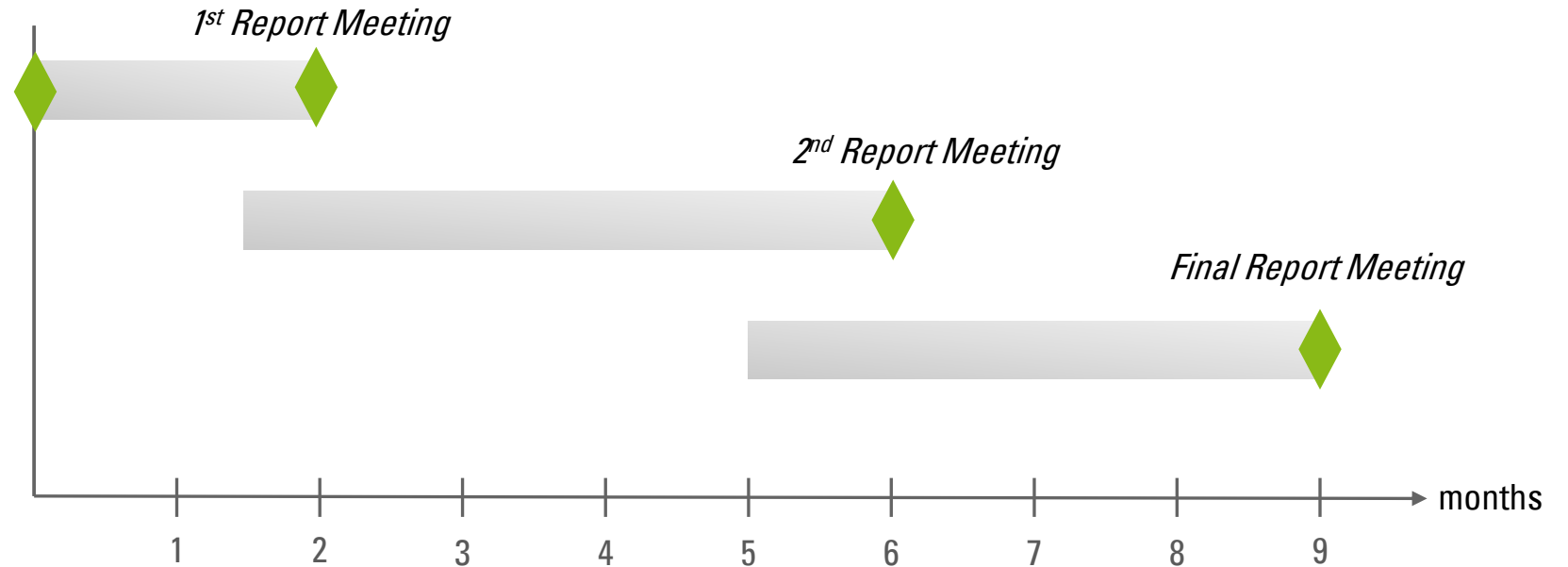
Cost, weight, CO₂ and recyclability evaluation:

- Different processing routes will be modelled for the thermoset design, such as wet winding and towpreg winding. Equipment will be defined, and options to increase the winding speed.
- For the thermoplastic design, the production process will be modelled for both a regular winding path design and a design specifically optimized for thermoplastic tape materials.
- Cost and CO₂, cradle to gate, will be calculated in Oplysis software
- Recycling options for both thermoset and thermoplastic vessels will be evaluated.

Estimated time planning and cost

Kick-off Meeting
November 14th 2023

- WP 1:
Overview state of the art
- WP 2:
Design and Analysis
- WP 3:
Processing, Cost and CO₂ analysis



Open to join!



International Project Consortium



Joint Technology Development through Cost-Sharing

Completed Activities

Joint Partner Project
Battery Casing Follow-Up: Bottom Impact Protection

Joint Partner Project
Battery Casing Follow-Up: Fire Protection

Joint Partner Project
Multi-Material Battery Casing

Joint Partner Project
Inductive Double Belt Press

Joint Partner Project
Ultra-Fast Manufacturing

Joint Market & Technology Study
New Potentials for Composite Technologies in Buildings & Infrastructure

Joint Market & Technology Study
Composites in the Furniture Industry

Joint Market & Technology Study
Potentials and Challenges of Thermoplastic Tapes for SME Injection Molders

Joint Market & Technology Study
Next Generation Mobility Solutions

Joint Market & Technology Study
Energy Storage Systems

Joint Market & Technology Study
High-Performance SMC

Joint Market & Technology Study
Bio-based Composites

Get more details on completed activities!

Let's talk!



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