ROAD TRHYP

ROAD TRAILER DESIGN: USE OF TYPE V THERMOPLASTIC TUBE WITH LIGHT COMPOSITE STRUCTURE FOR HYDROGEN TRANSPORT

Project ID	101101422
PRR 2024	Pillar 2 – H_2 storage and distribution
Call topic	HORIZON-JTI-CLEANH2-2022-02-07: Increased hydrogen capacity of GH 2 road trailers
Project total cost	EUR 2 642 912.59
Clean H_2 JU max. contribution	EUR 2 499 999.50
Project period	1.1.2023–31.12.2025
Coordinator	Air Liquide SA, France
Beneficiaries	Arkema France SA, Centre national de la recherche scientifique, Covess NV, École Nationale Supérieure de Mécanique et d'Aérotechnique, Efectis France, Envitest J. Pacholski Sp J, Politechnika Wrocławska, Segula Engineering, Segula Slovensko s.r.o., Université de Poitiers

http://road-trhyp.eu/

PROJECT AND GENERAL OBJECTIVES

The overall ambition of the ROAD TRHYP project is to demonstrate that using a trailer made out of thermoplastic composite tubes (type V) is a suitable solution to maximise the amount and the quantity of H_2 transported while satisfying end-user requirements (safety, ability to be decontaminated) and enforced regulations with a low TCO.

The main objectives are to:

- design type V 700-bar tubes according to EN 17339 and key performance tests;
- elaborate a decontamination methodology to ensure H_2 purity;
- demonstrate the safety of type V tubes;
- demonstrate that a trailer made with type V tubes will achieve the expected key performance indicators in 2030 and improved environmental impact;
- formulate the regulatory recommendations aimed at accelerating the deployment of the technology.

PROGRESS AND MAIN ACHIEVEMENTS

- Type V cylinders have been developed and preliminary testing is ongoing.
- Raw material to be processed to make type V cylinders has been developed and optimised with a carbon fibre content of 57 % by volume.
- The methodology for carrying out a design of experiments analysis and the bench test to enable testing to find the optimised parameters for a type V cylinder are ready.
- A safety study has shown that the three main accident scenarios for a trailer are hose rupture, leakage of the filling hose and leakage of the piping. An assessment of the severity of H_2 flammable cloud ignition consequences in the case of no mitigation measures has been carried out.
- The initial trailer design work done so far has shown that the target of 1.5 t of H_2 stored in a trailer is achievable.
- An assessment of the regulation of H_2 cylinders and ancillary components, H_2 fuelling stations and H_2 transport has been carried out.
- Life-cycle analyses carried out on a type I and a type IV trailer show that there is a benefit in terms of reducing CO_2 emissions, the use of fossil and mineral resources, and particle emission, among other things.

FUTURE STEPS AND PLANS

The next steps are:

- finalise preliminary type V cylinder testing;
- carry out decontamination tests on one cylinder;
- start ambient extreme temperature cycling tests and bonfire tests;
- conduct permeation tests;
- recommend regulations for operating trailers with type V cylinders in hydrogen refuelling stations;
- determine barriers to the safe operation of a trailer with type V cylinders;
- determine thermophysical properties of the processed material and study the mechanical behaviour of the cylinder in response to fire;
- finalise the trailer design and design a demonstration unit;
- manufacture the demonstration unit;
- model temperature when filling and defueling, then fill and defuel the demonstration unit to calibrate the prediction tool developed;
- carry out a bonfire test on a demonstration unit to simulate the behaviour in response to fire of a cylinder and a set of cylinders;
- finalise the life-cycle assessment with a trailer equipped with type V cylinders;
- assess the TCO.

PROJECT TARGETS

Target source	Parameter	Unit	Target	Target achieved?
Project's own objectives	Operating pressure	bar	700	
	Tube trailer payload	kg	1 500	
	Tube trailer CAPEX	€/kg	400	

Clean Hydrogen Partnership
Co-funded by the European Union