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Our mission



Experimental campaign progress



ISO TC 197 PWI

Our mission

PRESLHY project addresses the pre-normative research for a safer use of cryogenic and liquid hydrogen (LH₂) as an energy carrier. The project aims at achieving the following objectives:

- ⇒ Identify the critical safety areas with knowledge gaps and need of specific standards;
- ⇒ Carry out an experimental campaign addressing LH₂ relevant phenomena;
- ⇒ Develop and validate suitable models and engineering correlations;
- ⇒ Underpin a cost-efficient and inherently safer design for LH₂ infrastructure;
- ⇒ Improve techniques for determining hazard zones for LH₂ technologies, where they are currently inconsistent or over-conservative;
- ⇒ Support international Standard Developing Organisations (SDO) in the update of existing standards and development of new ones.

Project progress

During the first phase of PRESLHY project, the consortium has met several times during the project meetings and events held in Karlsruhe (Germany), Paris (France), Buxton (UK) and Bergen (Norway).

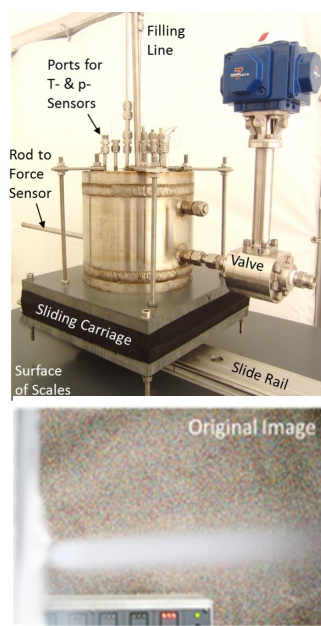
PRESLHY consortium organized 3 workshops in collaboration with HySafe to exchange knowledge and expertise on special measurement technologies, experimental procedures and tools:

- * Optical and electrostatic measurement
- * Cryo-techniques
- * Concentration and flow measurement techniques

The material associated to the workshops is available at PRESLHY website www.preslhy.eu in the events section.

PRESLHY research priorities workshop was held in Buxton, UK, on the 18th of September 2018, as part of the biannual research priorities workshop organized by HySafe and attended by worldwide hydrogen safety experts. The meeting summarised the state-of-the-art to derive the research priorities for the safer use of liquid hydrogen in non-industrial settings.

Launch of DISCHA experimental campaign



The first tests on releases of LN₂ in the cooled DISCHA facility in KIT were started on 17th of April 2019, to calibrate the experimental facility. Afterwards, hydrogen releases from four nozzle diameters ($d = 0.5, 1, 2, 4$ mm) were investigated at seven initial pressure in the range 5-200 bar. Every experiment was repeated at least two times to ensure reproducibility. Preliminary results for a cold experiment ($T \approx 80$ K) with the 4 mm nozzle and an initial pressure of 200 bar showed a decrease of temperature to 110 K at the thermocouples in proximity of the release point, causing a strong freezing of the ambient humidity at the release nozzle. The near-field to the release point is shown in figure on the left (bottom).

Three thermocouples and a pressure sensor were located inside the vessel to monitor storage parameters and verify whether the cryo-compressed gaseous hydrogen liquefies inside the tank during the blowdown.

The experimental tests on unignited releases were completed. The following set of experiments will involve ignited jets at same release pressure and temperature to investigate the thermal and pressure effects in the surroundings of the jet fire.

Figures: DISCHA experimental set-up (top); Near-field image of release at 80K, 200 bar and $d=4$ mm (bottom)

Experimental campaign on ignition of hydrogen-air mixtures

INERIS performed a series of tests on ignition by hot surfaces of hydrogen-air mixtures with temperature down to 120 K, to investigate the effect of the mixture temperature on standard ignition parameters. Hydrogen concentration in air was varied within the range 4 - 80%. It was observed that the temperature of the hot surface required to ignite the mixture was marginally affected by the temperature and composition of the gas mixture.

INERIS is conducting a second experimental campaign to assess the Minimum Ignition Energy (MIE) of hydrogen - air mixtures at cryogenic temperature. A first set of measurements were performed on mixtures at ambient temperature. Currently, the MIE device is being adapted to the use with cryogenic temperatures.



Figure: experimental set-up for ignition by hot surface

ISO TC 197 accepted "Safe use of LH₂ in non-industrial settings" as PWI



"Safe Use of Liquid Hydrogen in Non-industrial Settings" has been set up as a Preliminary Working Item (PWI) N. 24077 at the plenary meeting of the ISO TC 197 in Vancouver (6-7 December 2018). The PWI proposal received unanimous support by the committee. Dr. Thomas Jordan, the PRESLHY coordinator, has been nominated as "project manager" of the PWI.

LH₂ Safety Workshop - 6th March 2019, Bergen, Norway

PRESLHY and SH2IFT consortiums joint their forces and expertise to organize a workshop on LH₂ Safety - production, transport and handling. The event took place on the 6th March 2019 at Gexcon AS facilities in Bergen, Norway. The workshop aimed at presenting the results and plans of the two LH₂ related projects, supported by an update on the current state-of-the-art, research and industrial applications through the invited talks of experts from Kawasaki HI, MAN Cryo, Sandia National Laboratories, Norled and Moss Maritime. Details and presentations are available at: www.sintef.no/en/events/hydrogen-safety-liquid-hydrogen-workshop/.

Forthcoming events

- ⇒ European Hydrogen Safety Panel meeting & RCS Strategy Coordination Group workshop on RCS and safety, Brussels, Belgium (24-26 June 2019)
- ⇒ International Conference on Hydrogen Safety 2019, Adelaide, Australia (24-26 September 2019)
- ⇒ PRESLHY 4th project meeting and workshop, Buxton, UK (6-8 November 2019)
- ⇒ FCH JU Review Days, Brussels, Belgium (November 2019)



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To find more information about our research activities, please visit: www.preslhy.eu

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