OPTIC FIBRE-BASED HYDROGEN LEAK CONTROL SYSTEMS

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Introduction

The OPTHYCS project is developing a continuous monitoring system based on optic fibre for H2 detection. The aim is to develop a sensor that combines the benefits of different detection technologies and to validate it at realistic use cases scenarios, aiming to achieve at least TRL 5, being the basis for further R&D and potential market entrance in the longer term.

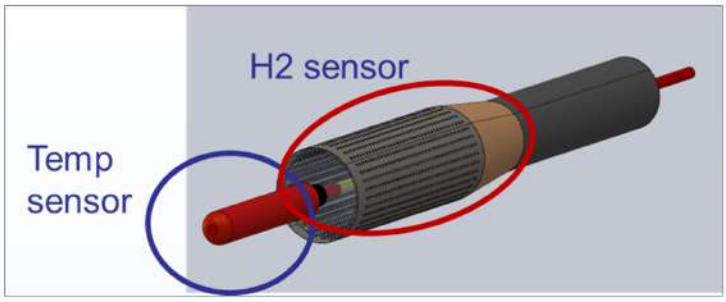

Fig.1 Combination of distributed sensing (DAS/DTS) & specific localized sensing (FBG)

Methods

The work has been divided into specific technical subjects for a better approach:

- Specification of technical requirements requested to the detection systems.
- Development of sensor solutions: new coating materials for Bragg grated sensors for hydrogen detection validated at experimental level.
- Development of a combined detection system merging three different technologies: innovative combination of Bragg grated sensors with distributed fibre optic sensing based on DAS and DTS technology.
- Development of interrogator and interpretative software.
- Validation tests for the assessment of the system in realistic conditions.

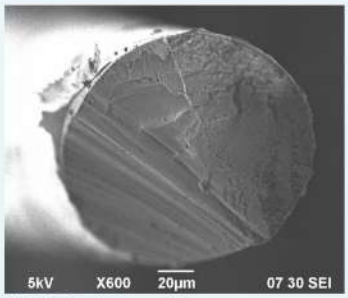

Fig 2. SEM analysis

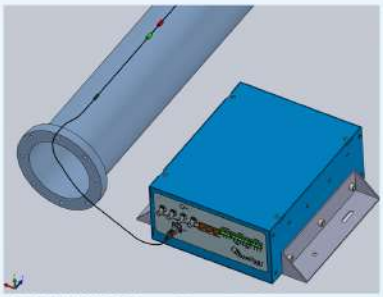

Fig 3. LUMIKER FBG new Interrogator System

Results

The project aims to develop a high-resolution sensor with a sensitivity of 10 ppm and an accuracy of ±10%. It will detect hydrogen concentrations up to the Lower Explosive Limit (LEL) of 4%, with detection and recovery times of less than 1 minute. The sensor will operate reliably in temperatures ranging from -20°C to 70°C, be maintenance-free, and have a lifespan of over 5 years. Additionally, it will exhibit no interference from other gases, ensuring precise and reliable hydrogen detection in various environmental conditions.

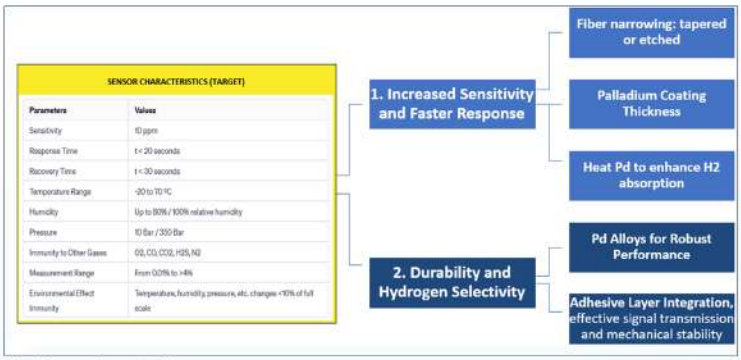

Fig. 4 Sensor characteristics

Fig.5 Pressure Regulating Station (Enagas)

Conclusion

The targeted outcome of OPTHYCS is the development of Proof of Concept (POC) for the technology validated for pipeline leak detection for H2 and H2/NG, for Hydrogen Refuelling Stations and for Gas Midstream installations (such as compressor stations), that could be used across the future H2 value chain.

References

- [1] CHJU, 2022. Summary report of the Clean Hydrogen Joint Undertaking expert workshop on the Environmental Impacts of Hydrogen
- [2] ISO 26142:2010, Hydrogen detection apparatus - Stationary applications
- [3] Pathak, A.K.; Verma, S.; et al., 2023. Recent Advances in Optical Hydrogen Sensor including Use of Metal and Metal Alloys: A Review. Photonics 2023, 10, 122

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