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D3.3 Lab scale Raman device development

By HORIBA



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About DELYCIOUS

As Europe accelerates its transition to clean energy, the Net Zero Industry Act identifies low-carbon hydrogen production as a strategic priority. DELYCIOUS tackles key challenges in water electrolysis technology, focusing on extending electrolyser lifespans and reducing operational costs under variable renewable energy sources. In DELYCIOUS, the development of cost-efficient, innovative, open, universal, and safe diagnostic tools to investigate the chemical and electrochemical properties of electrolysis systems is foreseen. This project combines Raman Spectroscopy (Raman) and Electrochemical Impedance Spectroscopy (EIS), to explore the chemical and electrochemical properties of electrolysis systems. By using both physical and data-driven modeling, it will be possible to identify important degradation parameters. To ensure that the diagnostic tools work effectively in various temperature ranges and across various electrolysis technologies, three technologies namely Alkaline Electrolysis (AEL), Proton Exchange Membrane Electrolysis (PEMEL), and Solid Oxide Electrolysis (SOEL) are addressed in this project, with a demonstration on alkaline electrolysers beyond 100 KW.

Consortium



Coordinator



UNIVERSITY
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DUMAREY

HORIBA

etaflorenc 

 stargate
hydrogen



Publishable Summary

A novel Raman gas analyser prototype has been developed as part of the DELYCIOUS project, which aims to advance cost-efficient, innovative, open, universal, and safe diagnostic tools for electrolyser systems. This device is designed to analyse gas compositions in real-time, offering non-invasive insights into the gas composition in electrolysers.

The Raman gas analyser combines advanced optics and spectroscopy with robust hardware and software integration. It can quantitatively measure hydrogen, oxygen, nitrogen, and water vapor concentrations at >1% level, even under varying temperature and humidity conditions. The system includes two probes for simultaneous monitoring of hydrogen and oxygen sides and is compatible with three electrolyser technologies of the partners: Alkaline (AEL), Proton Exchange Membrane (PEMEL), and Solid Oxide (SOEL).

Developed by HORIBA, the prototype operates within TRL4–TRL6. Raman gas analyser prototype comes with a developed software allowing for easy measurement and calibration using a defined workflow. It supports Ethernet and EtherCAT communication and uses a custom AK protocol for streamlined data acquisition. The device's performance has been validated through lab-scale experiments.