PEACE

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on pressurized cell qualification

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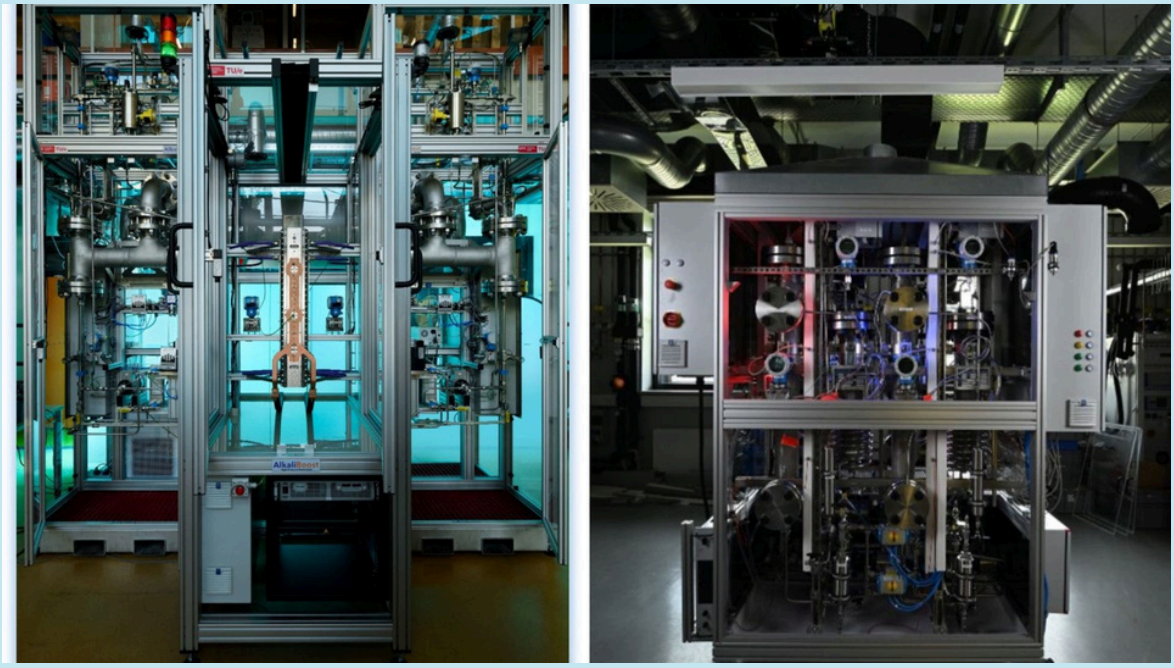

Facility used for electrochemical performance testing under pressurized conditions within the PEACE project (left: at TU/e, right: at DLR), Source: TU/e & DLR (CC-BY-NC-ND 3.0)

PEACE Project: Cell Qualification in Pressurized Single Cell – Next Generation Alkaline Water Electrolysis

The **PEACE project**, funded by the Clean Hydrogen Partnership under the Horizon Europe programme, has reached another key milestone in its mission to develop a highly efficient **pressurized alkaline electrolyser (AEL)** for cost-effective green hydrogen production. Following the successful testing activities, the pressurized cells were successfully qualified.

"This is a critical step towards the realization of the PEACE AEL stack, as we now know that the cells can perform well under pressurized hydrogen production," expressed clearly **Dr. Fatemeh Razmjooei**, Project Coordinator at German Aerospace Center (DLR).

AEL Cell qualifications

The best substrates in terms of electrochemical performance and mechanical stability were successfully tested at **German Aerospace Center (DLR)** and **Eindhoven University of Technology (TU/e)**. These materials combine good electrochemical activity with sufficient mechanical strength, helping to prevent fluttering in open-flow channel electrolyser designs. A variety of diaphragms and membranes were investigated to determine the optimal separator for large-scale alkaline water electrolysis operation. Based on the extensive experiments, Zirfon UTP 500 was chosen as the most suitable option, as it offers lower gas crossover, a major concern under high-pressure hydrogen operation, and greater cost-effectiveness.

To further minimize hydrogen crossover, experiments examined the introduction of a **small gap between the cathode and membrane**. An optimized gap was found and suggested to significantly reduce gas crossover while having only a minimal effect on overall resistance.

"Our findings show that introducing small electrode–membrane gaps can be a simple yet highly effective design improvement to enhance both safety and efficiency in high-pressure electrolysers," said **Dr. Thijs de Groot**, Team Leader at Eindhoven University of Technology (TU/e).

Key Results under Pressurized Conditions

Testing under pressurized single-cell conditions confirmed the suitability of the selected materials and configurations:

- Under pressurized conditions, **cell potentials below 1.8 V at 1 A cm^{-2}** with stable operation over time were successfully achieved, demonstrating the applicability and high efficiency potential of the cells under pressurized conditions.
- Advanced gas crossover modelling suggests that **flexible operation up to 50 bar** is feasible, though higher pressures may require innovative mitigation strategies such as electrode–membrane gaps.

Next Steps: Towards the Full AEL system demonstration

The PEACE **short-stack electrolyser** will be assembled and will undergo large-scale testing under pressurized conditions at **Brandenburg University of Technology Cottbus–Senftenberg (BTU)** within its high-pressure test vessel. This activity will pave the way for the construction of the **>50 kW PEACE electrolyser demonstrator**, expected to be operational at BTU in early 2026.

About the PEACE project

The **PEACE concept** of hydrogen production is based on the development of a pressurized, high-efficiency stack. The **two-stage pressurization approach** is implemented: stack-level pressure combined with hydraulic pressure within the vessel in which the stack is mounted. This concept will be demonstrated on an **AEL system exceeding 50 kW,** capable of operating at pressures **above 50 bar**.

Hydrogen produced through PEACE will already be **compressed**, allowing direct feed into **gas networks or industrial chemical processes**. This innovation aims to **reduce both capital (CAPEX) and operational (OPEX) expenditures** of electrolysis systems used in the chemical sector.

Executive Summary

The PEACE project has reached a key milestone in developing pressurized alkaline electrolysers (AEL) for cost-effective green hydrogen. Under pressurized single-cell conditions cell delivered potentials below 1.8 V at 1 A cm^{-2} with stable operation over time. These results pave the way for the PEACE short-stack and >50 kW demonstrator, set for testing at BTU Cottbus–Senftenberg in early 2026.

Media Contact:

Dr. Fatemeh Razmjooei, PEACE project Coordinator
German Aerospace Center (DLR)
info@h2peace.eu

PEACE

WWW.H2PEACE.EU

info@h2peace.eu

#peaceh2

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PEACE MEMBERS

DLR Deutsches Zentrum für Luft- und Raumfahrt German Aerospace Center

MaterialsM Instruments

TU/e EINDHOVEN UNIVERSITY OF TECHNOLOGY

b-tu Brandenburg University of Technology Cottbus - Senftenberg

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