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School of Engineering

HySelect

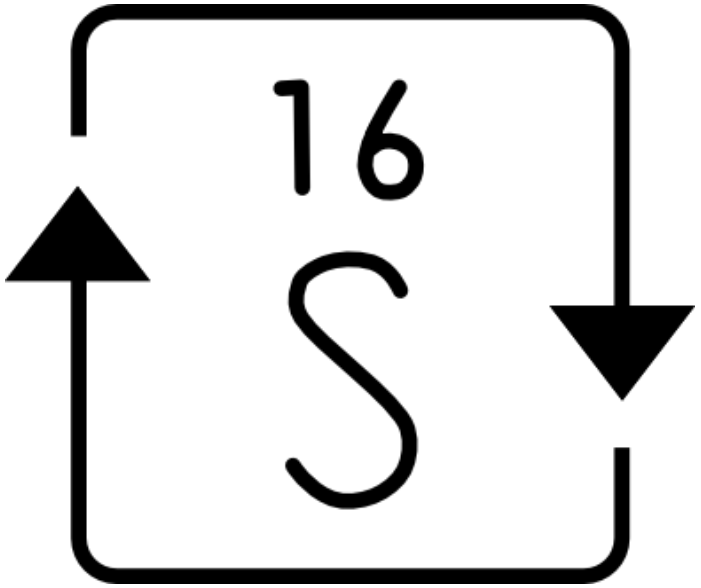
Efficient industrial grade hydrogen production with SO_2 depolarized electrolyser

Pragya Narayana Prasad

HySelect Duisburg Plant – proposed site

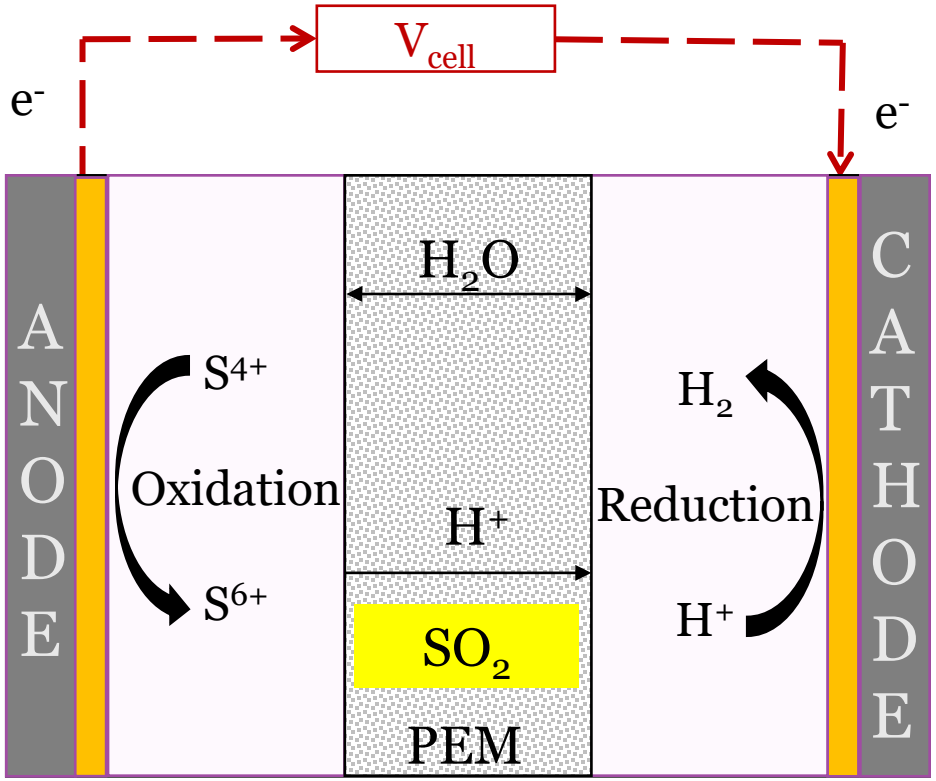
SO_2 depolarized electrolyser (SDE)

- ✓ First presented by Juda and Moultan in 1967 for cheaper H_2 production for use in basic chemicals
- ✓ E^0 = 0.158V (can only be realized between 0.5-1.2V) in comparison to water electrolyser with E^0 = 1.23V
- ✓ SDE would only require 25-60% of the electrical energy compared to the conventional electrolyser



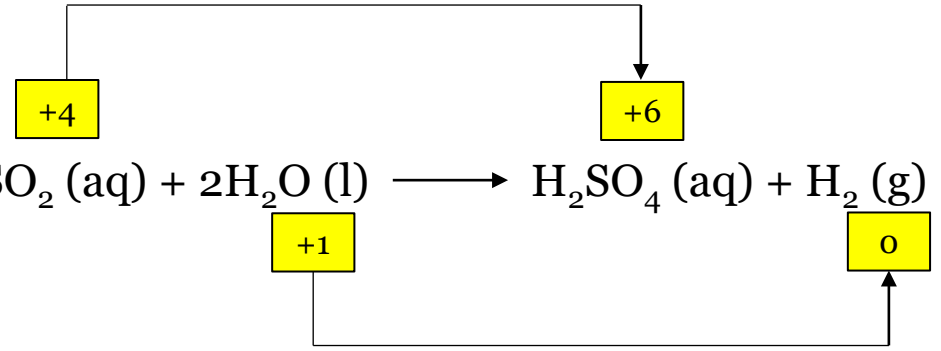
Juda, W. and D. Moulton, CHEAP HYDROGEN FOR BASIC CHEMICALS. 1967, Prototech Co., Cambridge, Mass.

How does it work??



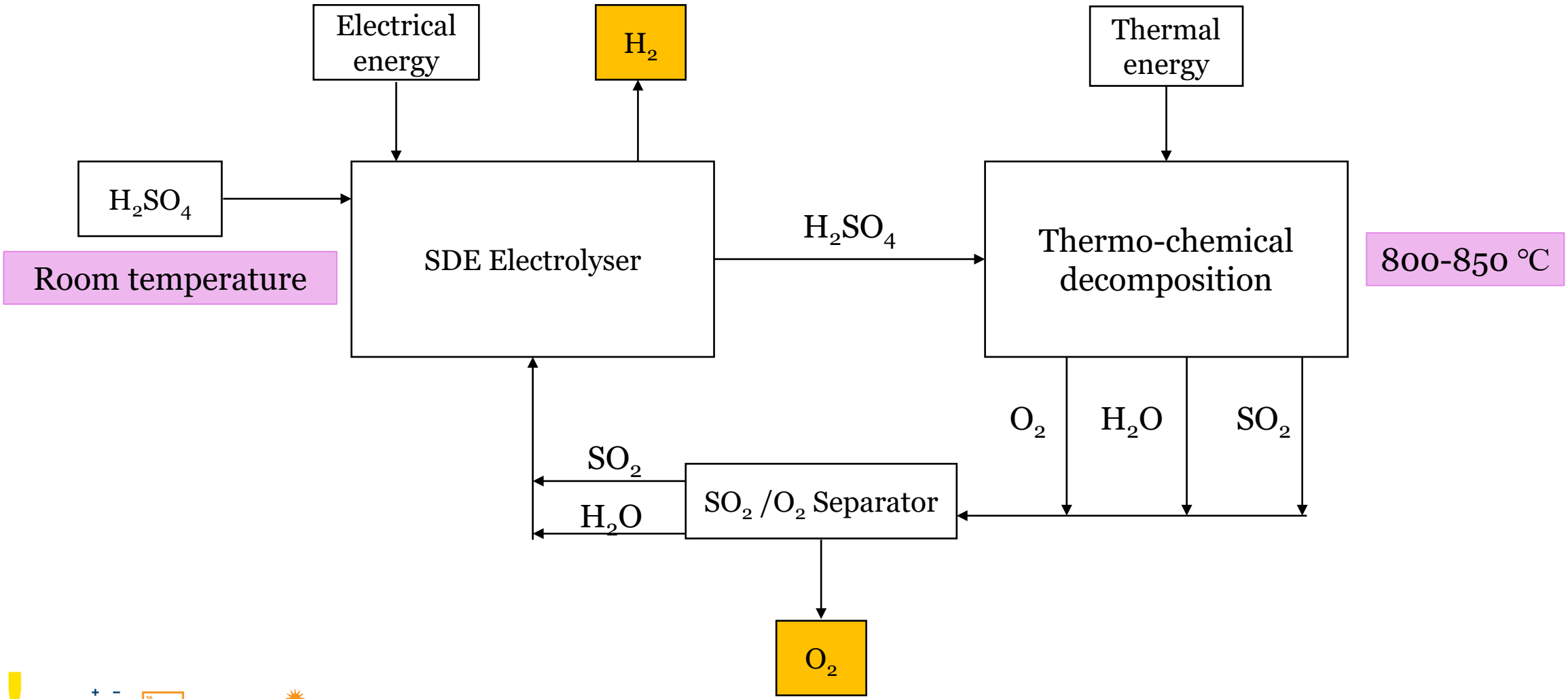
Anode: $SO_2\,(aq) + 2H_2O\,(l) \longrightarrow H_2SO_4\,(aq) + 2H^+ + 2e^-$

Cathode: $2H^+ + 2e^- \longrightarrow H_2\,(g)$



Overall: $SO_2\,(aq) + 2H_2O\,(l) \longrightarrow H_2SO_4\,(aq) + H_2\,(g)$

Hybrid Sulphur Cycle (HyS)



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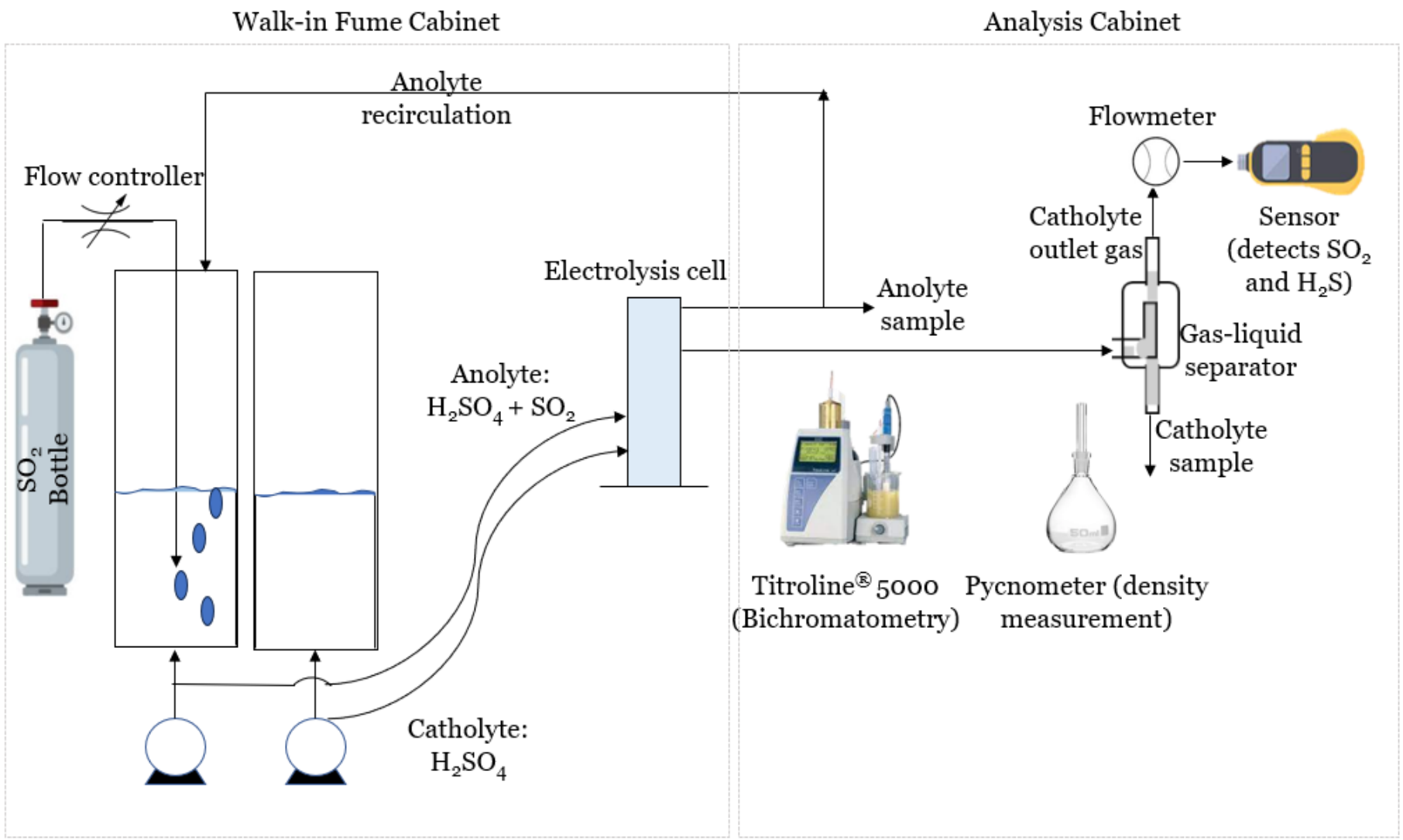
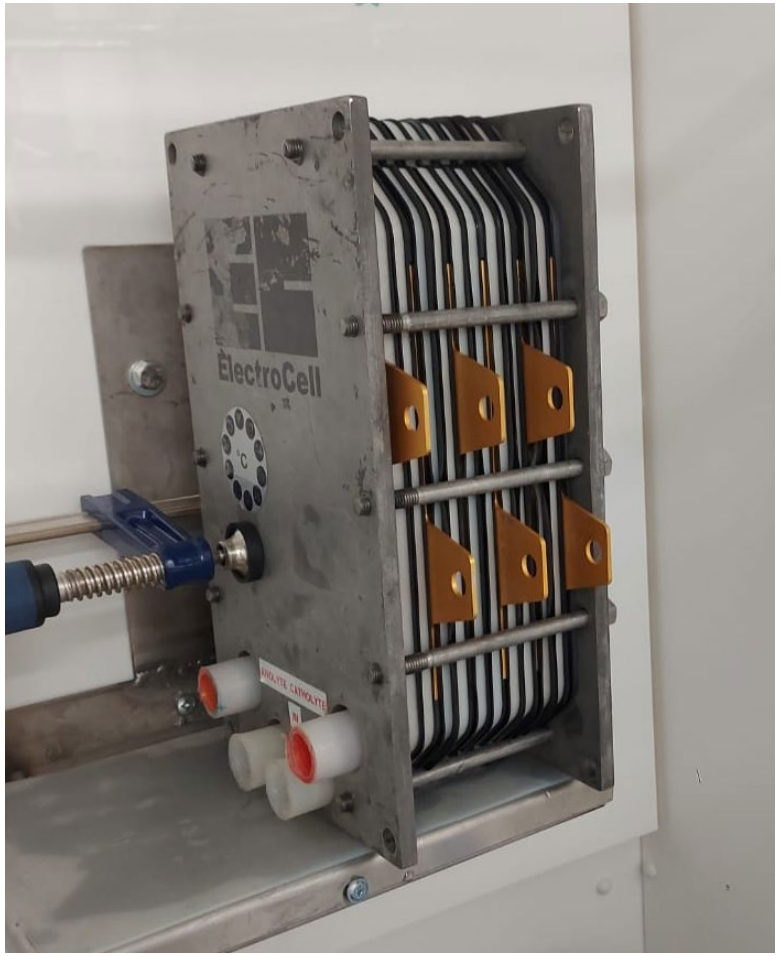
Brecher, L., S. Spewock, and C. Warde, The Westinghouse sulfur cycle for the thermochemical decomposition of water. International Journal of Hydrogen Energy, 1977. 2(1): p. 7-15

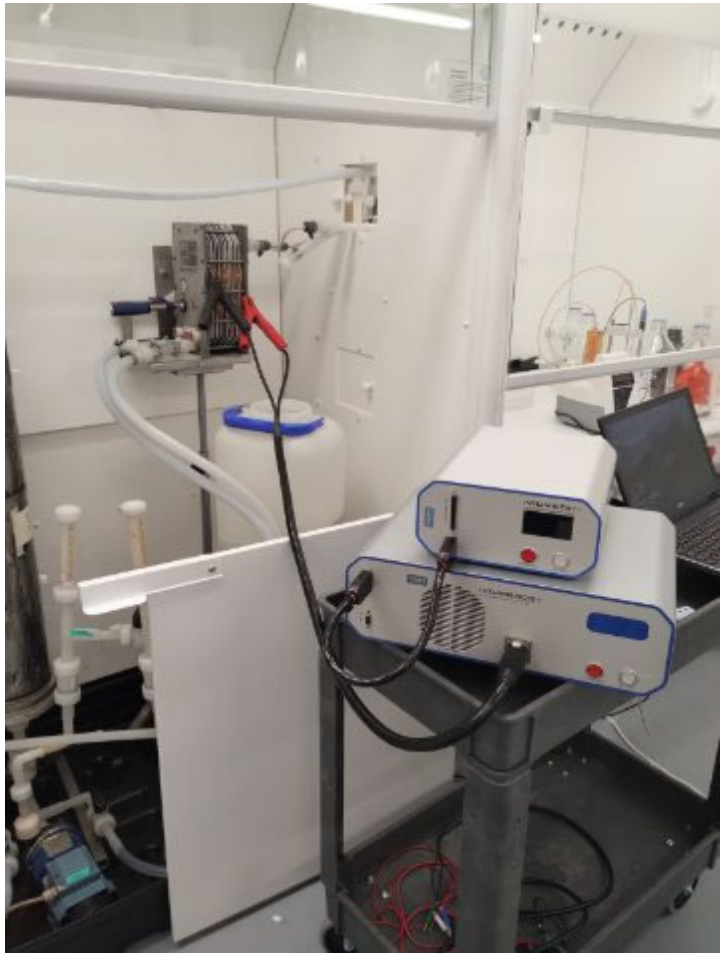
Schematic of Lab setup



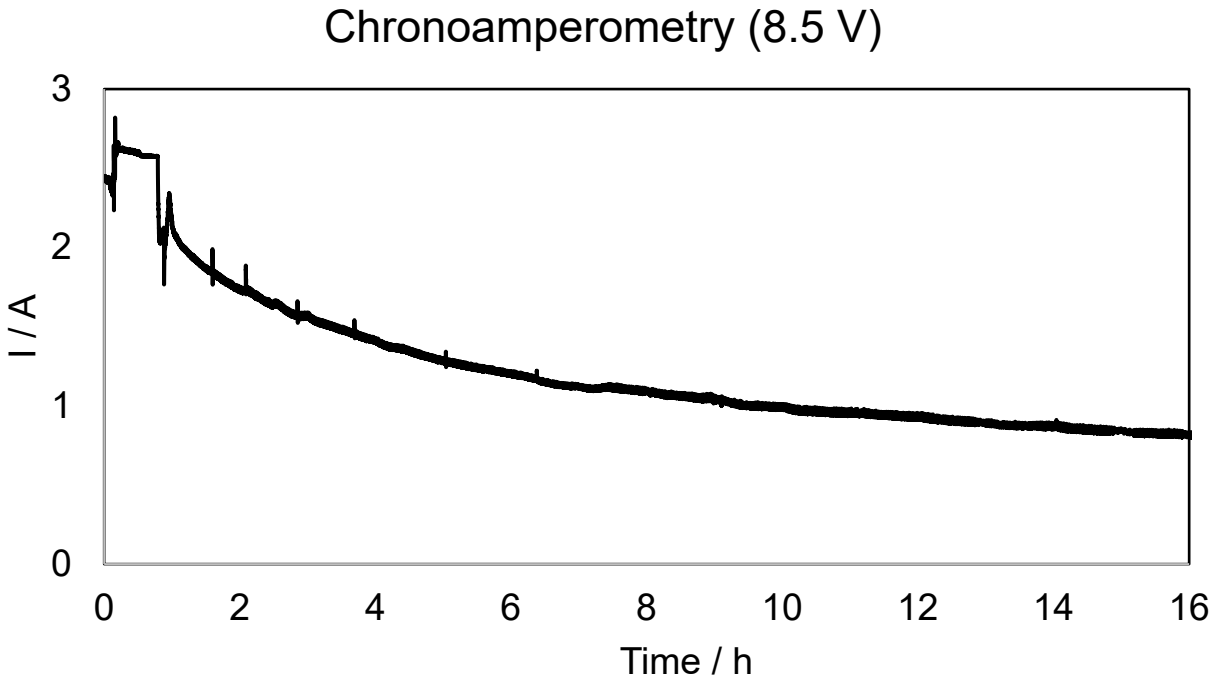
Stack assembly

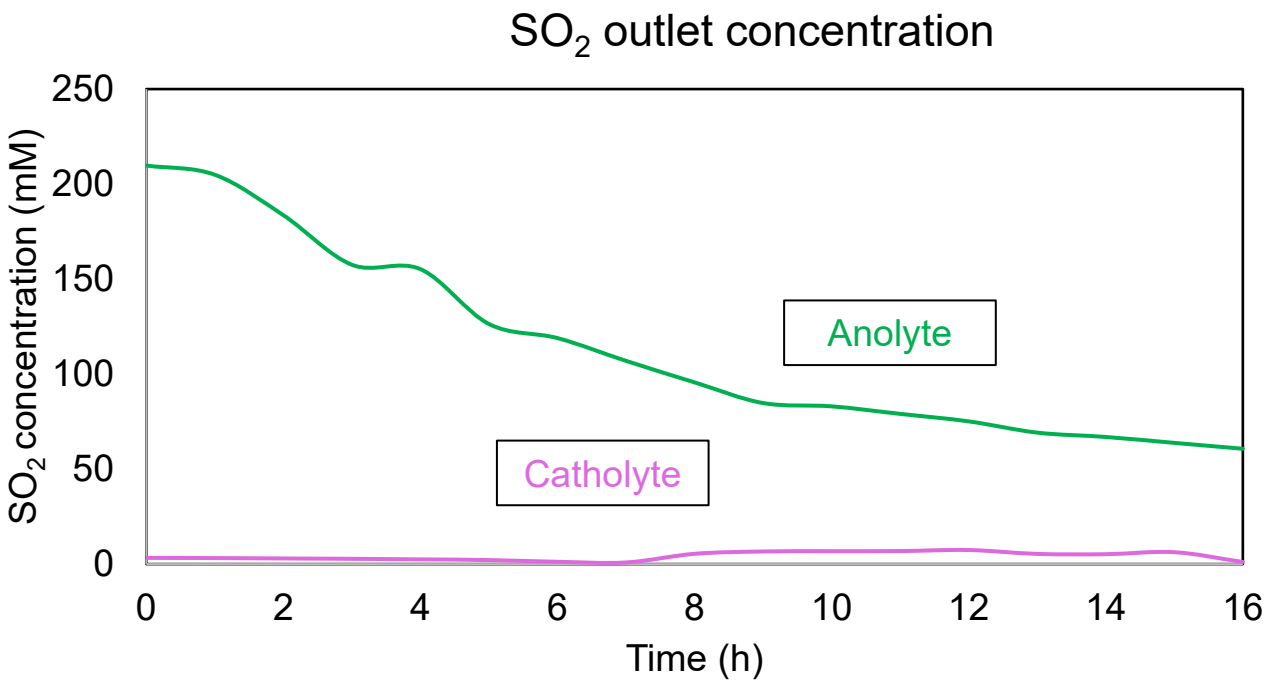
- Cell used – Electro MP-5 cell stack
- Bipolar plates – SS 904L with Au coating (100 nm) and active surface area of 100 cm^2
- PEM –Nafion® 117
- Catholyte - 5 wt% H_2SO_4
- Basis for Anolyte - 5 wt% H_2SO_4



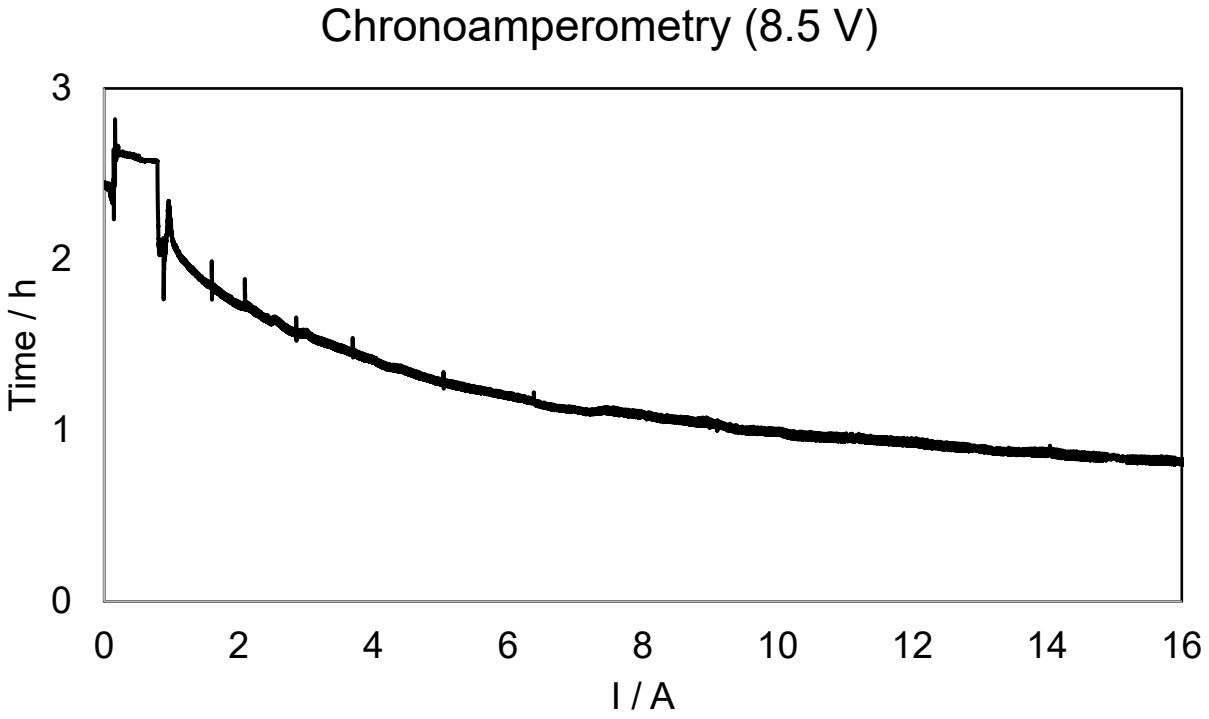


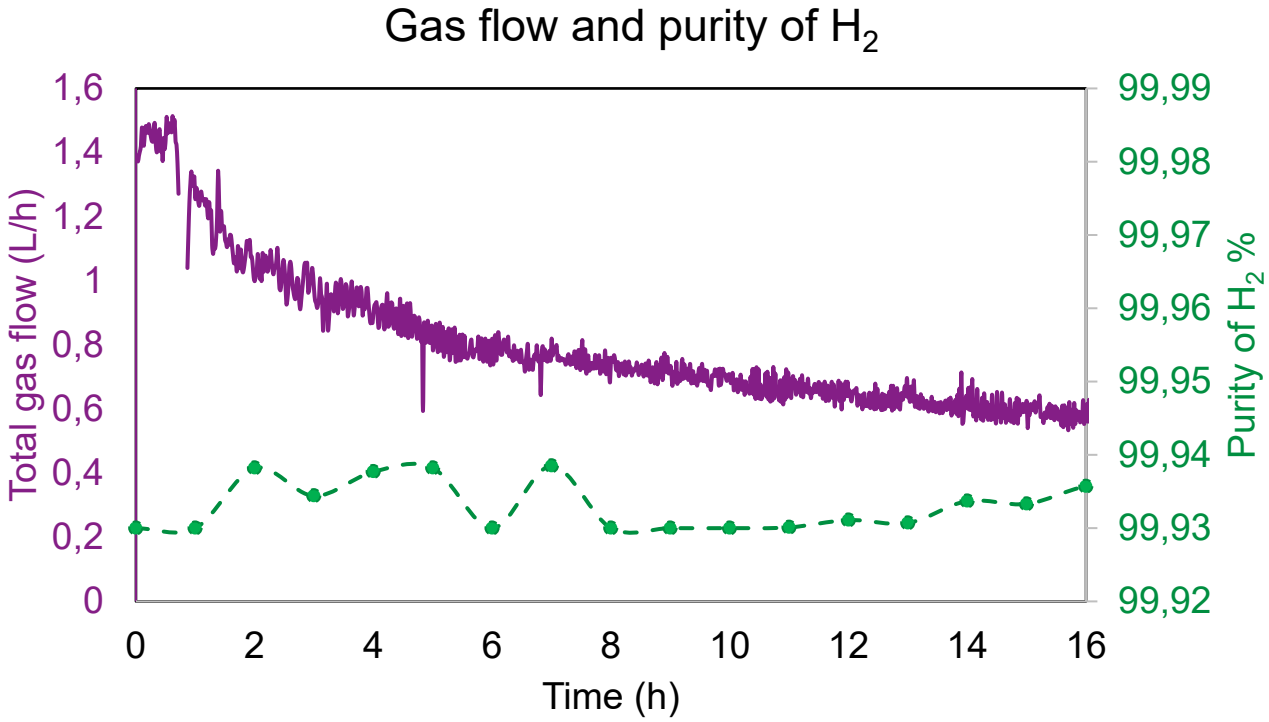
Long-term operation of SDE – 16 hrs





Long-term operation of SDE – 16 hrs





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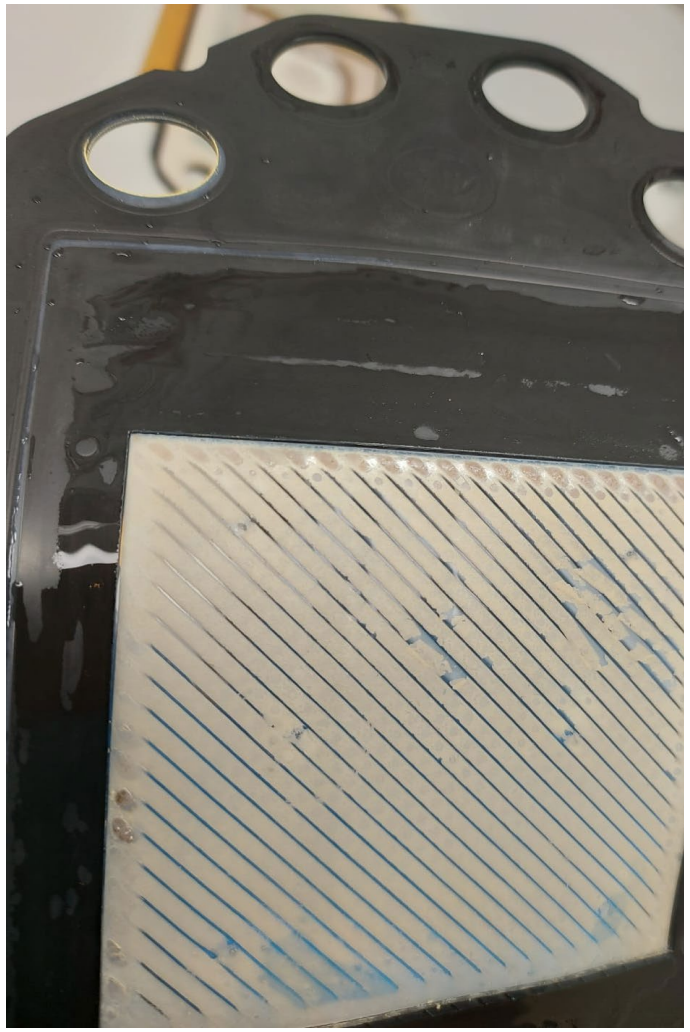
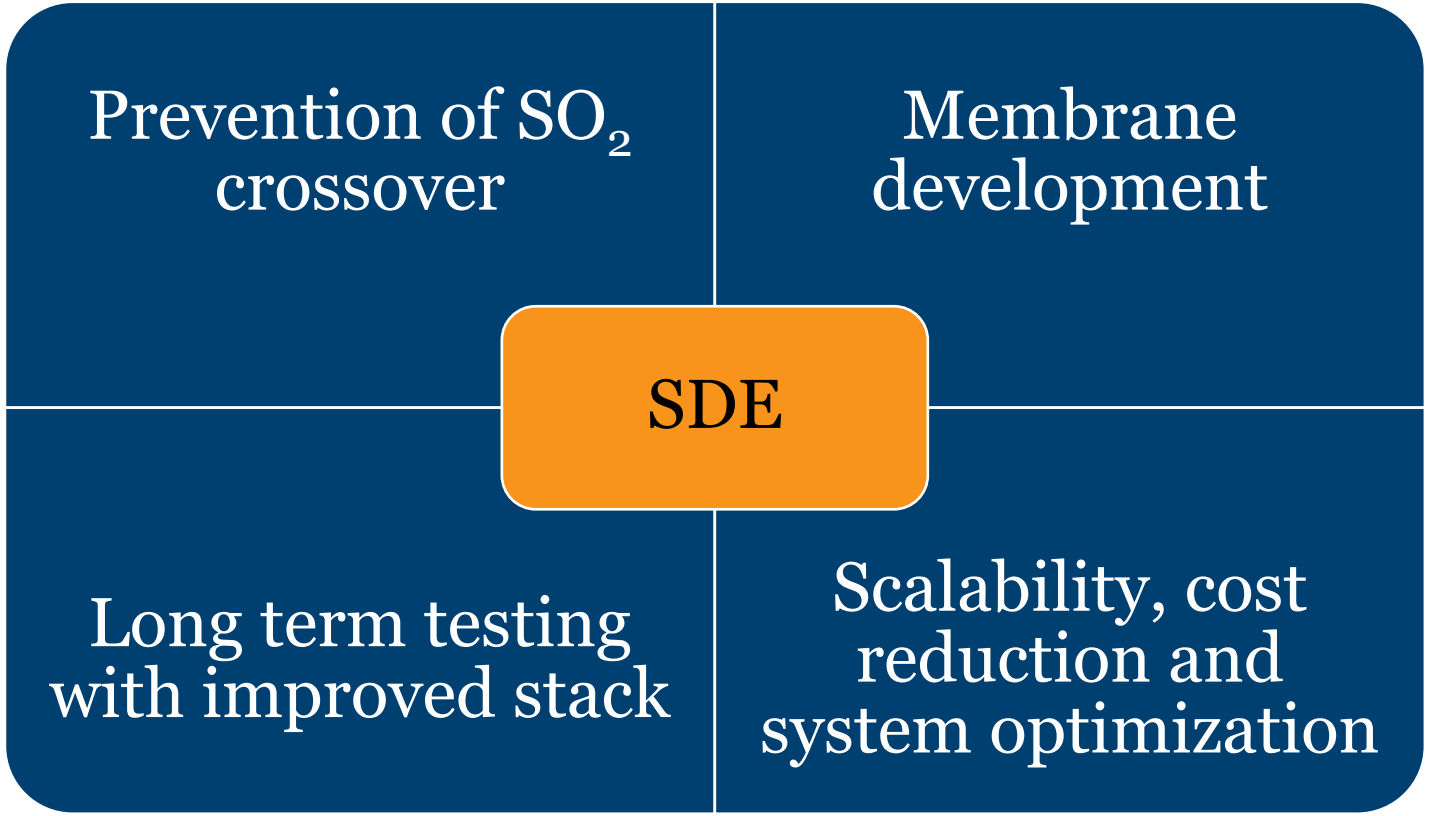
Sulfur formation on flow fields and membranes



Future directions



Clean Hydrogen Partnership

Co-funded by the European Union

HySelect

Efficient water splitting via a flexible solar-powered Hybrid thermochemical-Sulphur dioxide depolarized Electrolysis Cycle

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*This project is supported by the **Clean Hydrogen Partnership** and its members **Hydrogen Europe** and **Hydrogen Europe Research** under the Grant Agreement Nr. 101101498.*