MSc thesis topic: Green Hydrogen Generation from Seawater Electrolysis

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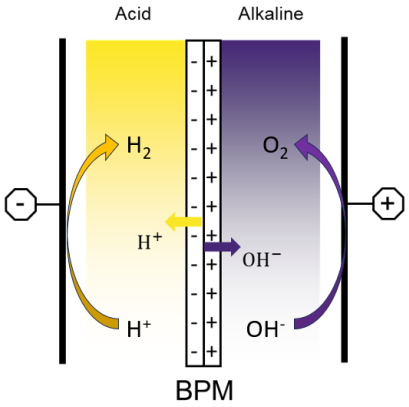
To accelerate the energy transition, the conversion of renewable energy in fuels and chemicals is indispensable. Green hydrogen is rapidly gaining interest as sustainable fuel, or can be used as precursor for chemical processes. For the production of green hydrogen, large water electrolyzers are envisioned for offshore or near shore, to ease the connection to wind energy and/or floating solar. However, conventional electrolysis requires a substantial amount of water at extremely high purity. The combination of water use in electrolysis and the huge seawater availability has created the idea to develop a seawater electrolyzer.



Initial tests for seawater electrolysis have been performed, and main challenges have been identified. One of the challenges in seawater electrolysis is to prevent deposition of contaminants on the cathode. This can be mitigated by controlling the pH in the cathode compartment. In this MSc thesis project, you will study pH tuning, using bipolar membranes (BPM) that create in-situ acid and base, as pre-treatment for stable water electrolysis. You will investigate the effectiveness of pH tuning and the energy consumption for different processes. The work will be focused on modelling in Aspen, complemented with experimental validation of the model.

Your activities will be:
- Constructing a model that combines existing setups on bipolar membrane electrodialysis and water electrolysis;
- Constructing a water electrolysis cell to monitor the pH change and the electrode condition;
- Conducting high-tech electrochemical analysis (voltammograms, impedance spectroscopy, high-speed current interrupts) and electrode analysis (microscopy, X-ray techniques);
- Combining results to better understand and control conditions for stable seawater electrolysis.

We are looking for: M.Sc. student Chemical Engineering, Mechanical Engineering, Environmental Engineering or Sustainable Energy Technology, with interest in innovation, electrochemistry, experimenting and hydrogen. Good teamwork is expected, as this work is a part of a cross-discipline collaboration project.

What's in it for you?: Working on this topic will make you ready for industry/academia job by
- Combining multiple disciplines into a practical technology analysis;
- Working on improving existing renewable energy technologies;
- Experience with state-of-the-art electrochemical techniques;
- Working together in a large team of electrochemical engineers and researchers.

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