Vacancy for PhD on Technology for Electrochemical Membrane Processes

Job description

The energy transition impacts all energy- and chemistry-related processes. Two rapidly growing fields in this sector are 1) and conversion of renewable electricity into synthetic chemicals and fuels, such as green hydrogen, and 2) and the electrification of chemical plants. The scales of these processes are astronomical. The chemical industry is responsible for >10% of fossil fuel consumption in EU, from which roughly half the energy is spend on separation processes, and 90-95% of these separation processes are currently thermally driven (i.e., burning fossils). Moreover, the electrolyzer capacity is expected to increase from the present-day <1 GW to >40 GW for the EU by 2030, which is >5% of the total EU's primary energy consumption.

Electrochemical conversion, for example as CO_2 electrolysis, is playing a crucial role in harnessing renewable energy to form chemical bonds. However, electrochemical technologies for making sustainable chemicals, such as CO_2 electrolysis, are still to be upscaled and intensified. Mass transport, water management and stable membrane materials are pivotal in making this electrochemical technologies scalable and perform at industrial standards. In this project, we will explore to use a new strategy, using multilayer ion exchange membranes, to target the insufficiencies in selectivity, water management and catalyst interaction. You will develop new types of polymer-based membranes, using an hierarchical layered approach, to address water transport, ion selectivity and conductivity in separate layers. You will develop integrated membranes structures to allow water channels at microscale, and introduce layers of porous, capillary-active materials to distribute the water to the reaction spots. You will also study the impact of different ions and membrane chemistry on the selectivity and rate of the electrocatalysis reaction. Finally, you will implement high-tech optical techniques to map the flow and concentration of reactants inside an operating electrochemical cell.

This PhD project is part of the NWO-funded Vidi project. You will collaborate closely with another PhD candidate in this project (working on developing new membrane materials) and 4 industrial partners. Your daily operation is in the David Vermaas research group, where our group of ~10 PhD's and postdocs are working together and sharing work on electrochemical flow systems, including applications of electrolysis, water technology, CO_2 capture and flow batteries. The work will also contribute to TU Delft's e-Refinery institute on electrochemical synthesis that includes >20 principal investigators across the campus, where electrochemical advances are used and valorised in upscaled prototypes, in collaboration with industrial partners.

Job requirements

We're looking for a candidate with:

- A MSc degree, in chemical engineering, process technology, mechanical engineering, water technology, biotechnology, applied physics or similar.

- Please be aware that we are NOT looking for material scientists for this position; an engineering education is mandatory.
- An excellent track record in terms of grades and university background
- Experience with performing experimental work
- Experience in working with process design is considered a plus
- Experience in working with electrochemical systems is considered a plus
- Pro-active and creative mind-set
- Fluent in English. Speaking Dutch is a plus
- Starting date between Nov 2024 and February 2025

TU Delft creates equal opportunities and encourages women to apply.

About the department

The Faculty of Applied Sciences is the largest faculty of TU Delft, with around 550 scientists, a support staff of 250 and 1,800 students. The faculty conducts fundamental, application-oriented research and offers scientific education at the bachelor, master and doctoral levels. The faculty has 7 departments, from which the Department of Chemical Engineering is one of them, where this project is being performed.

The department of Chemical Engineering (tudelft.nl/ChemE) is active in the field of energy, circularity and health. TU Delft's strong reputation in the field is emphasized by top rankings; for example being ranked 8th of universities worldwide in the QS World Ranking 2023 for the subject Chemical Engineering.

Conditions of employment

This engineering position offers:

- Challenging job in a highly innovative technology field
- Embedding in an enthusiastic team of engineers and researchers
- A funded PhD position for 4 years

The salary scale is determine in the UNL salary scale. Salary and benefits are in accordance with the Collective Labour Agreement for Dutch Universities. In addition, TU Delft offers a customisable compensation package, a discount for health insurance and sport memberships, and a monthly work costs contribution. Flexible work schedules can be arranged. An International Children's Centre offers childcare and an international primary school. Dual Career Services offers support to accompanying partners. TU Delft creates equal opportunities and encourages women to apply.

How to apply?

To apply, please apply via the TU Delft application system, and provide at least:

1) A one-page motivation letter that is specific to this vacancy
2) A detailed resume (1-3 pages)
3) Contact information of at least 2 references (name + e-mail)

The position will remain open until September 25.