

Fabrication of bipolar membrane using the electrospinning technique

Master thesis project

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Motivation

Recently, there have been advancements in energy storage systems capable of storing GWh-scale energy capacity, such systems despite being promising they still possess several environmental and safety issues. In this project, Acid-base flow battery (ABFB) is employed as a storage system with water and salt as active materials. The core component of this flow battery is the bipolar membrane capable of dissociating water into acid and base at the junction during the stage of charging. Then acid and base are stored in tanks till the discharge state where they recombine to produce water and salt.

Concept

Electrospinning utilizes electrostatic forces produced by a high voltage source to stretch a macromolecular system injected through a spinneret with a fine orifice (See electrospinning equipment in Fig. 1). Electrospinning produces nano-/micro fibers from polymer solutions. This project aims to fabricate the bipolar membrane (BPM) using electrospinning technique in order to achieve a fibrous membrane structure.

The fibers made from anion and cation exchange polymer solutions will be electrospun simultaneously to make them intertwined at the junction layer. As an advantage of that, the area of contact between the anion and cation exchange layers increases drastically. **Additionally, such a technique is capable of producing highly intact BPM with a high-rate combination of acid and base without the issue of delamination.**

Objectives

1. Optimizing the electrospinning process conditions to fabricate bipolar membranes (BPMs).
2. Material characterization of the membranes (SEM-EDX, IEC ...etc).
3. Electrochemical characterization (Testing the performance of the BPM in the acid-base flow battery).

Your profile

- Specialization in material science, chemical engineering, membrane engineering, preferably with a background or experience in polymer chemistry.
- Enrolled in graduate (MSc) studies.
- Interest for practical laboratory experience and analytical work.
- Fluent in English language (writing and communication skills).
- Good motivation and team-working spirit.

NOTE!!

This offer is for EU citizens only. Non-EU citizens need to be enrolled at a Dutch university to be eligible for this project.

Duration: 5 to 8 months ,**starting date:** May 2021 (Flexible).

Benefits:

- Gaining practical research experience.
- Working in a motivating multicultural multidisciplinary environment.
- Allowance: 175 €/month.

How to apply:

Interested students are invited to send their transcript of records, motivational letter and a CV (max. 2 pages) to *Emad Al-Dhubhani* (emad.al-dhubhani@wetsus.nl). Please indicate (**electrospinning for BPM master thesis application**) as the subject of the email.



Fig 1. The electrospinning set-up