MSc Project Posted on: 27-05-2024

Ionic transport in anion exchange membrane – ionomer phase conductivity

Motivation and background

Reducing greenhouse gas emissions while producing fuels and value-added chemicals requires transforming petrochemical plants toward sustainability. Electrochemical CO_2 reduction – converting CO_2 into useful chemicals – is one of the technologies aiding this transition. Governing equations for the transport of ionic and neutral species in the ionomer phase help to estimate electrolyte conductivity, thus calculating the potential and current profiles over the membrane electrode assembly (MEA) cell. These calculations are usually estimated by applying secondary current distribution formulation in the cell. However, developing a model using a tertiary current distribution approach is necessary to achieve accurate models for CO_2 electrolyzers.

This MSc thesis project is a component of the FlexEchem project, under the umbrella of e-Refinery, to investigate the design and control of the CO_2 electrochemical reduction process to ethylene over large load changes.

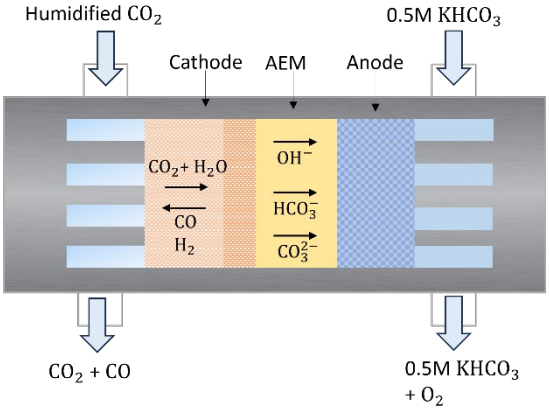

Figure 1. Exchange MEA cell.

Figure 2. 1D modeling domain.

Objective of MSc-research project

Within this project, we aim to develop a steady-state macroscale model of a single MEA cell using COMSOL Multiphysics, by applying the Nernst-Planck equation for the transport of ionic species in the ionomer phase.

Contact information:

If you are interested in improving your skills in modeling electrolyzers, then contact us at n.heydari@tudelft.nl. This project will be supervised by Nasim Heydari and Prof. Ruud van Ommen.