Bachelor thesis project proposal

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Supervisors:  Joren Vos (j.e.vos@uu.nl), Ben Erné (b.h.erne@uu.nl)

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Experimental Thermodynamics of Electrodes for Desalination

Shortage of drinking water affects one billion people world-wide. One technological solution is to desalinate brackish water, which is too salty for human consumption, via capacitive deionization.[1] Using a voltage source, one electrode is made positive, attracting negative ions, and a second electrode is made negative, attracting positive ions. At low concentrations, below 100 mM, the salt concentration decreases between the electrodes. At high concentrations, however, the main effect at each electrode is that co-ions are exchanged for counter-ions, resulting in no change in the amount of salt between the electrodes.[2]

In this project, the transition from low to high salt regime will be studied using porous electrodes with a huge salt uptake capacity. For the first time, this will be done via a new experimental method that we developed and that makes it possible to determine the electrical potential inside the pores, whose walls are merely 1 nm apart. The measurements will enable a new test of physical theory that explains capacitive deionization and that predicts the salt uptake efficiency. The student will perform computer-controlled experiments with a unique homebuilt setup, analyze the numerical data, and delve into physical theories from the literature, to compare their predictions to the outcome of the experiments.

References