DEPARTMENT OF ENERGY TECHNOLOGY
AALBORG UNIVERSITY

PhD Public Defence

Title: Experimental and Numerical Analysis of Gas – Liquid Flow in PEM Water Electrolysis

Location: Pontoppidanstræde 111, auditorium

Time: Thursday 9 May at 13.00

PhD defendant: Saeed Sadeghi Lafmejani

Supervisor: Professor Søren Knudsen Kær

Moderator: Associate Professor Mads Pagh Nielsen

Opponents: Associate Professor Matthias Mandø, Dept. of Energy Technology, Aalborg University Esbjerg (Chairman)
Dr. Felix Büchi, Paul Scherrer Institute, Switzerland
Dr. Uwe Reimer, Forschungszentrum Jülich, Germany

All are welcome. The defence will be in English.

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Abstract:

As the share of renewable energy in the electricity grid increases, the necessity of a set of storage systems intensifies. Existing power plants currently follow demand for electricity, meaning that they generate the amount of electricity that consumers need (grid balancing). Adhering to the same grid balancing method becomes challenging when more renewable energy sources such as wind and solar are involved. Hydrogen production and storage of the surplus of renewable energy has received increasing attention in recent years. Among different hydrogen generation technologies, proton exchange membrane (PEM) water electrolysers are highly responsive; therefore, they can effectively stabilise the electricity grid. Improving their cell performance to operate at high current densities prepares the technology for large scale hydrogen production. This entails a greater understanding of the various phenomena occurring in the cell. This study first focuses on the numerical simulation of the gas---liquid flow in the anode channel and porous transport layer. To validate the CFD simulation, two types of experimental facilities were designed and constructed. One focused on the fluid mechanics in the channel, and another included the electrochemical reactions. Ultimately, expanded metal mesh was tested to measure the pressure loss and visualise the flow of air and water along the mesh flow field at different orientations.