

Membrane reactor commissioning and testing, J.W. Dijkstra

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Public Summary

A Process Development Unit (PDU) has been built for the testing of hydrogen membrane reactors. The PDU consists of a test rig section for gas supply, product handling, gas analysis, and a membrane reactor section for carrying out reactor and membrane separation tests. The membrane reactor is an 8-tube reactor applicable for both membrane assisted water-gas-shift and membrane reformer applications. The application primarily aimed at is power production combined with CO₂ capture. The concept can also be used for (co)-production of hydrogen.

During cold commissioning of the setup, issues with hardware and control were solved. The most important part was to obtain stable flow and pressure control. The hot commissioning of the PDU revealed mainly issues concerning the tracing and insulation, which required changing the tracing setup.

Membrane reactor assembly and testing showed that the reactor construction can be used as expected. Proper positioning of the membranes in the centre of the membrane reactor was successful. Some issues with small and diffuse leakages appeared, especially in the flanges and packings, these could however be mitigated to a satisfactory and safe level.

The first results of operating the setup are shown. Temperature gradients along the length of the reactor tube are encountered due to heat leakage. The first results of a membrane permeance measurement are also shown. In the future the PDU setup will be used for more extensive membrane reactor testing.