Biogas to SNG Demonstration Plant

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1. Introduction

Following the European climate strategy #mission 2030 Austria will cover 100 % of the national total electricity consumption from renewable energies. The shift from carbon-based energy sources to renewables is indicated through a high increase of wind power and photovoltaic. These technologies require long-term storage options due to the high volatility. The key systems for the storage of fluctuating renewable energies are hydrogen and synthetic natural gas (SNG). Green energy from wind power and photovoltaic is used in water electrolysis for hydrogen production and its subsequent methanation of carbon dioxide for the production of the SNG.

An existing biogas plant in the southern region of Austria is currently operating at half capacity. Coupling it with a load-flexible methanation plant can optimize the generation, storage and utilization of renewable energies. The experimental results of a laboratory scale plant already showed a 100% CO_2 conversion from the input gas to methane and water. [1] [2] [3]

The Renewable Gasfield project combines the hydrogen production via electrolysis and the load-flexible methanation plant on a large scale and its SNG product distribution. For the synthetic natural gas production, ceramic honeycomb nickel catalysts are used. (Fig. 1) To prevent catalyst poisoning the raw biogas requires pretreatment by adsorption, saving the usually necessary and cost-intensive CO_2 separation.

2. Methodology

In the laboratory methanation plant at the MU Leoben investigations on the necessary stationary operation parameters for the highest possible CO_2 conversion are being explored. Three fixed-bed reactors connected in serial offer a variation of test conditions concerning the composition of the input gas, amount and the material of catalyst, pressure and the flow rate.
Experiments at a pressure level from 7.5 to 10 bar (which corresponds to the optimum pressure for the methanation) with a H_2 surplus from 0 to 10 % and different flow rates are being conducted. All tests are being done with the coated ceramic honeycomb catalysts whereas comparison tests are performed by using a commercial nickel bulk catalyst under the aforementioned conditions.

3. Conclusion and Outlook

The poster will introduce the Renewable Gasfield Project. The first performance results for the methanation process are obtained with a commercial bulk catalyst. For the utilization of wash coated honeycomb catalysts these results constitute an important indication and facilitate the identification of the optimum operation parameters like pressure level, H_2 surplus and flow rate.

4. References

[1] Biegger P. et al. Energies 2018, 11,1679; doi:10.3390/en11071679

[2] Kirchbacher f. et al.: Energy 146 (2018) 34-46; doi: 10.1016/j.energy.2017.05.026

[3] Kirchbacher et al. ChemEngTrans 52 (2016) 1231-1236; doi: 10.3303/CET1652206

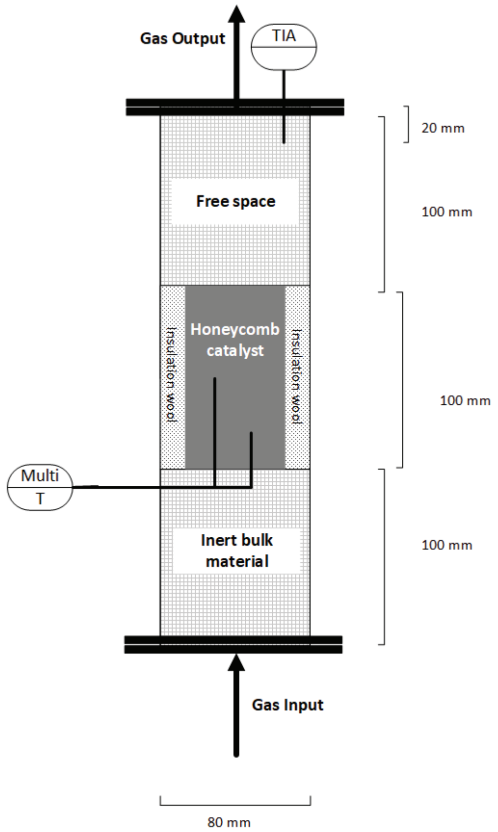

Fig. 1: Scheme of a reactor with honeycomb catalyst loading