Power2ValueChemicals: Evaluating the Suitability of CO_2-Derived CO for the Chemical Industry

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Abstract

Carbon monoxide is an essential building block in the chemical industry and is used on a large Scale. Since carbon-containing raw materials like coal, natural gas, and petroleum are to be completely eliminated from production chains as part of the defossilation of the chemical industry, new production routes are needed to provide CO in sufficient quantities as a climate-neutral feedstock. One way to achieve this while keeping the carbon cycle closed is the co-electrolysis of carbon dioxide to CO using sustainably produced electricity [1].

As part of the Power2ValueChemicals project, the Forschungszentrum Jülich plans the installation and continuous operation of a low-temperature CO2-to-CO electrolyzer developed by Siemens Energy in various operating modes. In the second part of the project, the continuous conversion of the electrolysis gas through a homogeneously catalyzed methoxycarbonylation reaction will be carried out to evaluate the economic and ecological potential of the electrolysis gas for the chemical industry. For this purpose, a mini-plant will be planned and built at the Max Planck Institute for Chemical Energy Conversion.

To ensure the continuous operation of the process, an efficient method for catalyst recycling is required. Since homogeneous catalysts are dissolved in the reaction medium, their separation and reuse pose a significant challenge for process efficiency and sustainability. Therefore, various commercially available membranes were investigated regarding their catalyst retention performance. Based on these findings, a process was designed, and a corresponding mini-plant was constructed to enable the continuous operation of the reaction using the selected membrane system for efficient catalyst recycling.

Literature

[1] S. Foit, I. C. Vinke, L. G. J. de Haart, R. A. Eichel, Power-to-Syngas: An Enabling Technology for the Transition of the Energy System?, Angewandte Chemie, 2017