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Hydroformylation with Integrated Catalytic-Membrane Separation Reaction System

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Catalysis with supported homogeneous catalyst systems has successfully been established over the last decades as an industrially attractive approach.[1] Hydroformylation of olefins by syngas to produce aldehydes is an important industrial reaction.[2] However, the long-term catalytic performance of such systems is often negatively influenced due to the formation of "heavies" by undesired condensation reactions hampering activity and selectivity.

In the HORIZON2020 project Reactor Optimisation by Membrane Enhanced Operation (ROMEO)[3] a new "two-in-one" reactor concept is being developed. The unique ROMEO reactor will overcome present challenges in the hydroformylation technology and its industrial application by combining two process steps in one module as depicted in Figure 1.

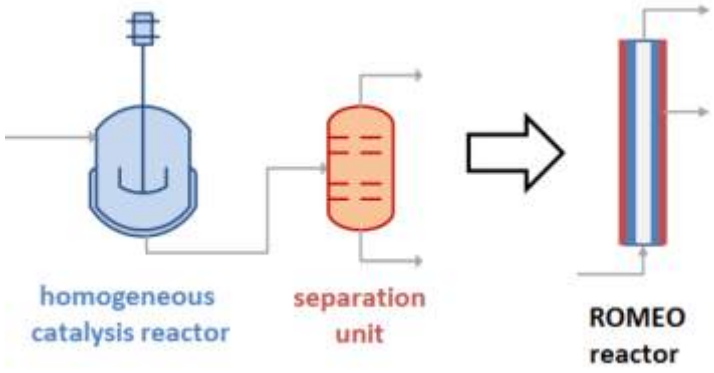

Fig. 1. Reactor Optimisation by Membrane Enhanced Operation (ROMEO) technology combines two standard process steps.

The ROMEO reactor is based on a catalytically active membrane, which is combined with a homogeneous catalyst to generate the "two-in-one" reactor module. Depending on the properties of the membrane, either the product or byproduct passes through the membrane once the reaction has taken place at the catalyst surface.

Preliminary investigations of olefin hydroformylation have demonstrated that the system is catalytically active affording high activity and selectivity. The results indicate that the ROMEO "two-in-one" reactor concept has a great potential to be applied in the chemical industry. Furthermore, a reduction in emissions, energy consumption, space needs and costs in the chemical industry are expected with this novel reactor type.

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