Enhancing Metathesis Reaction Performance *via* Organic Solvent Nanofiltration

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Homogeneous catalysis, especially with transition metals, offers several advantages compared to heterogeneous catalysis, such as higher activity and selectivity. One striking example is the well-known olefin metathesis, where two alkenes swap their alkylidene groups. This very versatile reaction is used in various industrial applications, for example the Shell Higher Olefin Process (here with heterogeneous catalysts), to control the chain length of alkenes.

Nevertheless, one major drawback for homogeneous systems is the hurdle of recycling the catalyst from the reaction media and reusing it. In order to further develop this equilibrium reaction type to its full potential, we combine metathesis with nanofiltration as a means of process intensification and additional selectivity control by reaction engineering. Ideally, the membrane allows the substrates and products to permeate but retains the catalyst complex in its active state inside the reactor system.

Results from literature report good retentions for several reaction systems and various catalyst complexes but lack from a short catalyst lifetime due to deactivation. To tackle this issue, the Grubbs-Hoveyda II catalyzed self-metathesis reaction of 1-octene to 7-tetradecene is chosen as model reaction (figure 1).

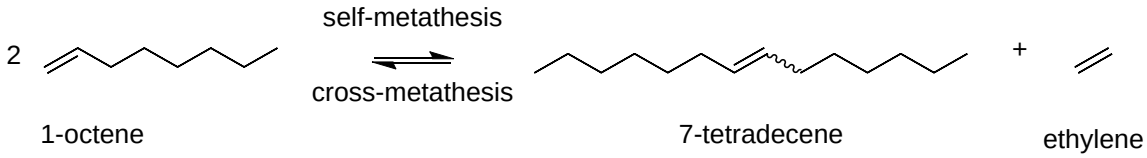

Figure 1: self-metathesis of 1-octene as model reaction.

The design of experiments leads to optimized reaction conditions in terms of low catalyst loading and high selectivity (>90 %). In a consecutive step, suitable commercially available OSN membranes are investigated regarding their influence on the catalyst performance and lifetime. The most promising results were obtained with polyimide membranes, which later on were applied in a membrane miniplant setup for continuous flow experiments.