# High Throughput Testing of Catalysts with Fast Deactivation for Methanol-to-Hydrocarbons (MTH)

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## Abstract

In this article we will focus on the Methanol-to-Hydrocarbons (MTH) reaction that has been thoroughly investigated with current state-of-the-art catalyst SAPO-34. This process represents a challenging application for parallel testing of catalysts which was met by appropriate test protocols and an advanced analytical setup to detect complex multi-component products in connection with a fully automated data evaluation.

### Results and Discussion

The evolution and distribution of products on SAPO-34 was studied in a fixed-bed reactor at different severities ranging from 0.2-20 $h^{-1}$. Thereby, the timescale of deactivation at low severities smaller 1 $h^{-1}$ is slow enough for online GC to give detailed information on changes of the product distribution and the reaction network. However, at higher and commercially relevant severities > 1 $h^{-1}$ the timescale of deactivation becomes too fast to be adequately followed by online GC. To follow the rapidly changing reaction products, FTIR spectroscopy in the gas-phase was applied in measurement intervals down to 5 s. Multivariate analysis of the FTIR spectra and correlation to the online product analysis by GC was used for *in-situ* training of chemometrical models for all major products between C1-C5. These models were used for the prediction of product yields from the FTIR spectra in high time resolution.

### Conclusions

The application of FTIR and chemometrics allowed for a high-resolution time-on-stream dependent product analysis of induction, steady-state and deactivation of the catalyst under commercially relevant conditions.

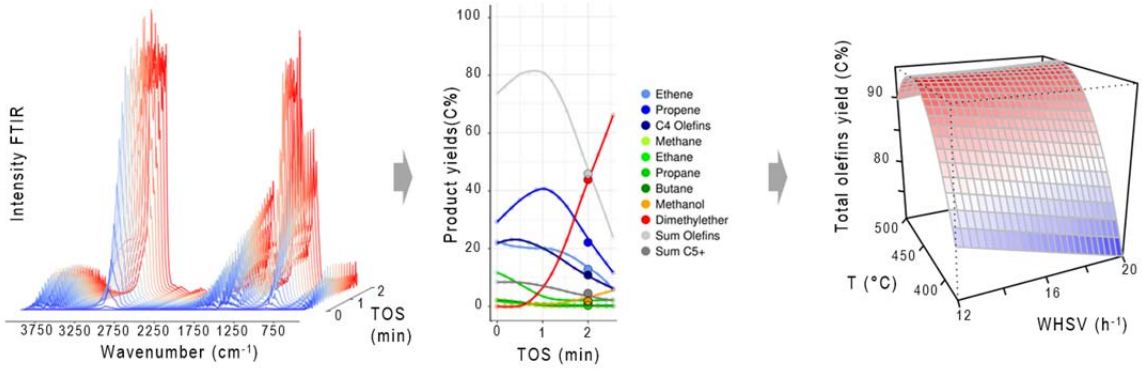


**Figure 1.** Data evaluation workflow from FTIR spectra (left) to chemometrical interpretation (middle) to regression of design of experiments DoE (right).