IR spectroscopy of methanol-to-olefins catalysts at work

The methanol-to-olefins (MTO) conversion is an efficient and promising catalytic technology to obtain valuable light olefins from alternative "feedstocks" such as coal, natural gas and biomass [1]. Intensive research have yielded many advances in the understanding of the reaction mechanism, which follows the so-called "hydrocarbon pool mechanism" [2]. Despite the effort made to elucidate the activation and deactivation mechanisms during the MTO process, knowledge of the detailed chemistry and formation mechanism behind the species active for olefins production and the species deactivating the catalyst materials are still limited. IR spectroscopy can shed some light on the structural characterization of species involved on catalytic reactions under reaction condition and thus disentangle the catalytic chemistry of the MTO process.

In this talk I will give an overview of our results on the use of infrared spectroscopy and microspectroscopy to investigate zeolite catalysts under in-situ or operando conditions during the MTO reaction. With these studies, we learned the chemistry of the species involved during the induction, active and deactivating steps and their role on the catalytic reaction. Two studies will be highlighted: first at the bulk level with industrially relevant catalysts [3] and then at the single particle level with ideal micron-sized catalyst particles [4, 5].

References

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