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DISSERTATION TITLE: *Improvement of the methanol-to-hydrocarbons catalytic performance for one-dimensional zeolites obtained by post-synthetic modifications*

Denne avhandlingen tar for seg dannelsen av mesoporor i endimensjonale 10-ring-zeoliter som følge av etterfølgende behandlinger med base og syre. Arbeidet viser at slike katalysatorer får forbedret levetid i omdanningen av metanol til hydrokarboner, og at de gir et bensinlignende produkt med meget lavt innhold av aromatiske forbindelser.

The relatively short lifetime (or low conversion capacity) of one-dimensional medium-size zeolites in the methanol to hydrocarbons (MTH) reaction is improved by introducing mesoporosity in the zeolite crystals via sequential desilication and acid post-synthetic treatments. Unidimensional 10-ring zeolites are effective catalysts for producing high quality low-aromatics gasoline precursors from non-oil (syngas) carbon source synthesized methanol. The drawback associated of such promising process is the rapid deactivation due to easy pore blockage by coke species formed during the MTH reaction. Notably, the fast deactivation is alleviated and the catalytic selective production of the characteristic aromatic-free C₅₊ alkene product is upgraded for the treated catalysts.

By preparing a large set of samples by using two morphologically distinct starting ZSM-22 zeolites and three different desilication methods (standard NaOH solution and mixtures of NaOH with CTAB surfactant with TBAOH hydroxide) and exhaustively characterizing them, the study concludes that the treatment conditions need to be adjusted depending on the properties of the parent material in order to produce more efficient catalysts. Particularly, the morphology of the starting material is found to be the dominant parameter determining the mesopore formation in unidimensional 10-ring zeolites.

The influence of the starting material on the change in the catalyst properties (composition, acidity, porosity) and the need of the acid washing is also reflected in the catalytic improvement, which is explained based on more efficient use of the hierarchical zeolite, allowing a longer propagation of the active alkene-producing cycle during the MTH conversion. The *operando* high-energy XRD experiments provided structure-based insights into the H-ZSM-22 deactivation mechanism as a function of the applied post-synthetic method and co-feeding experiments. The knowledge gained might be extended to other zeolites with similar structure as well as to other catalytic processes requiring high accessibility to the active sites and enhanced coking resistance.