

# University of Stuttgart

## Institute of Technical Chemistry

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Research Internship  
Bachelor thesis  
Master thesis

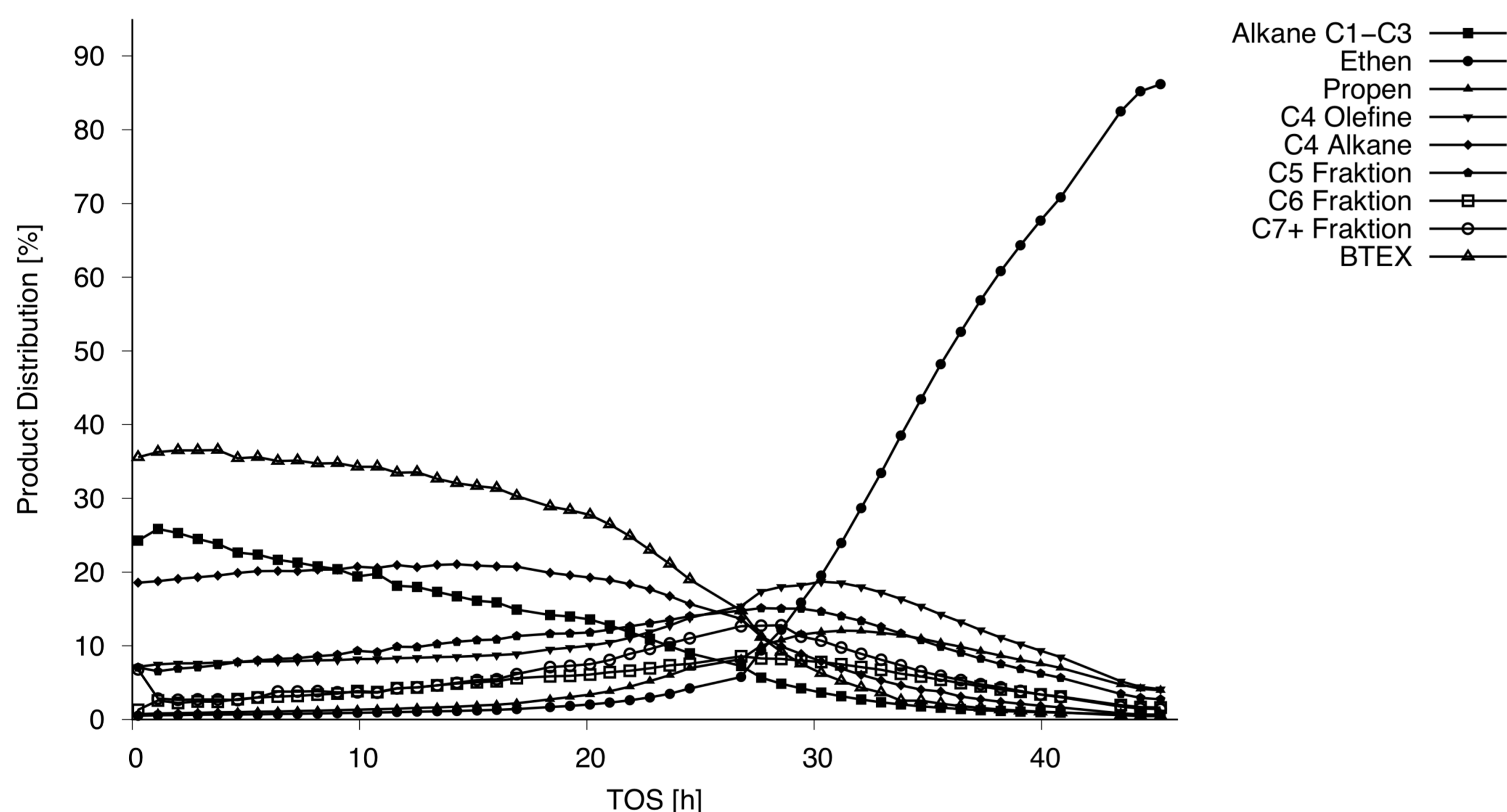
## Synthesis, Characterization and Testing of Zeolite Catalysts for Alcohol Conversion

### Motivation

Ethanol is nowadays mainly used to blend fuels, in the future cars will be electrified therefore there will be an excess bio based ethanol. On the other hand, BTEX-aromatics and the middle distillates are difficult to synthesize in large quantities from renewable sources, and therefore affords of the chemical industry aim on replacing the fossil-based routes by CO<sub>2</sub>-neutral alternatives.

### Project

My project focus is the ethanol to aromatics conversion. You can get insights into the research in big chemical companies, on all steps of catalyst research, including Synthesis, Characterization, and Catalytic Testing of zeolite catalysts.

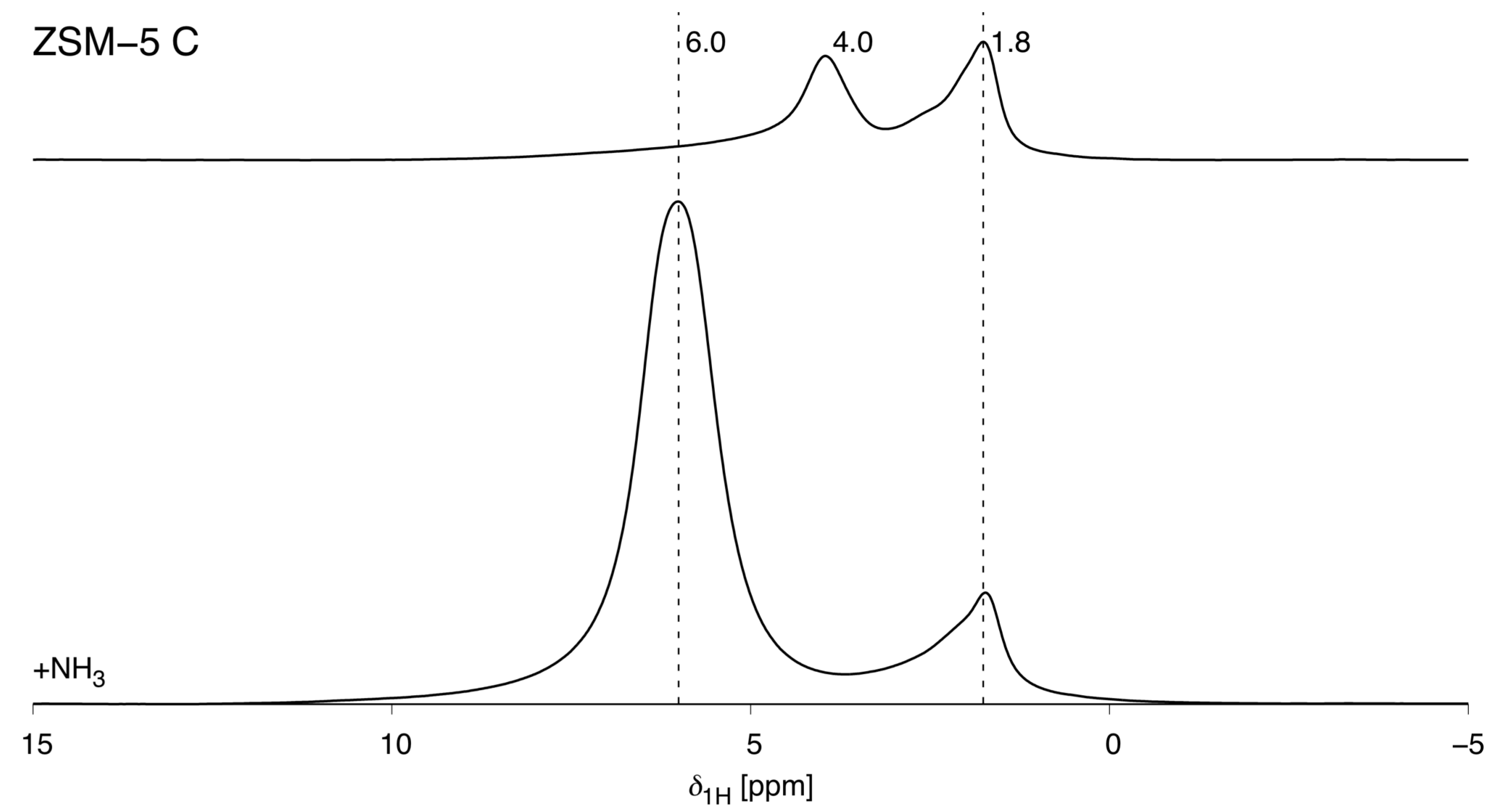


**Figure 1:** A typical catalytic reaction of ethanol to aromatics, recorded over 40 h using a catalytic testing rig and GC-chromatography.

### Your Thesis

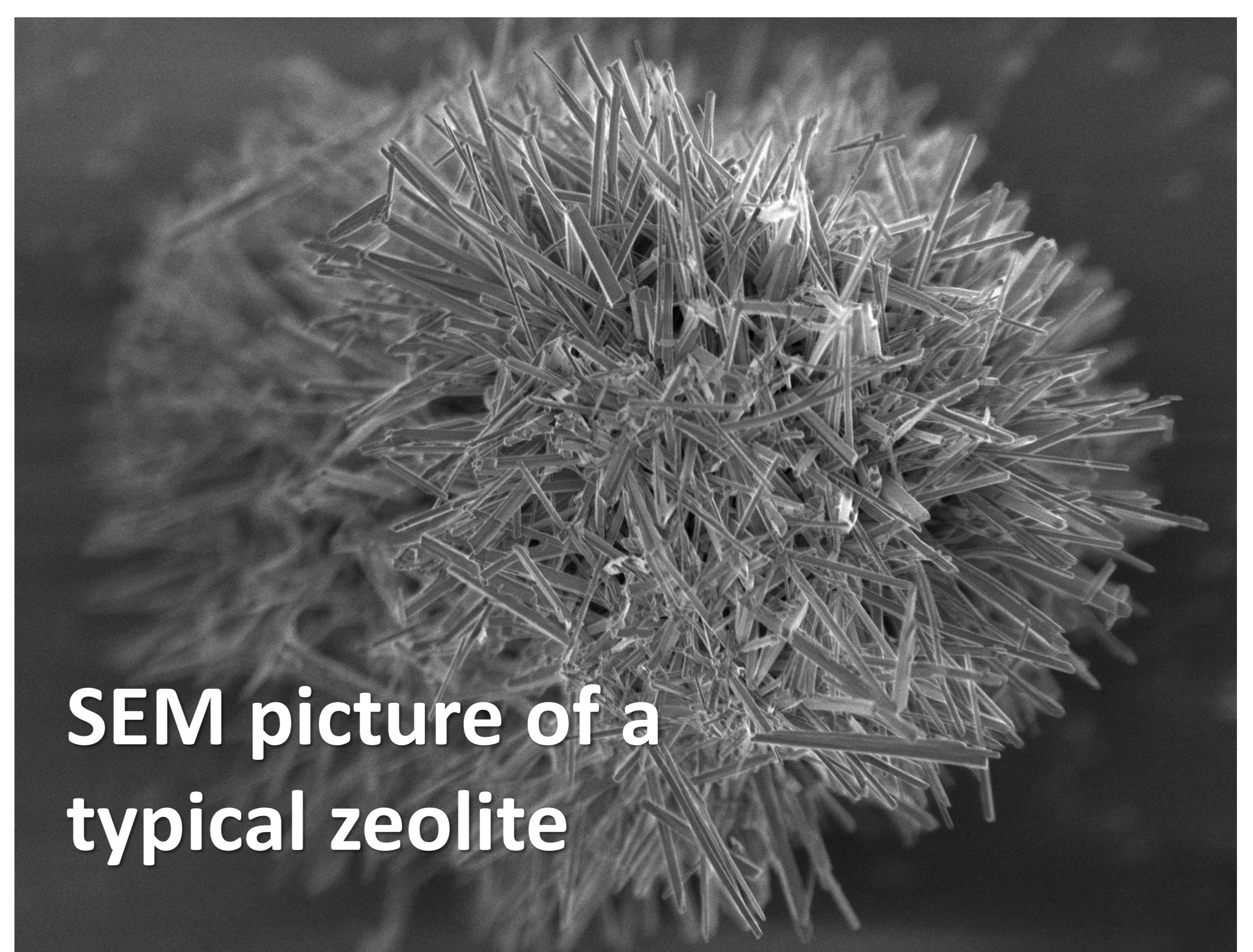
The topic of your thesis will depend on my current work and is set in discussion with You. If You are interested in a thesis or research internship, feel free to contact me. Your thesis can be done both in German or English.

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**Figure 2:** A <sup>1</sup>H Mas NMR spectrum of a zeolite, before and after loading a probe molecule. From the signals qualitative and quantitative insights into catalytic properties can be gained.

Part one of the work is the synthesis or post-synthetic modification of a catalyst by state-of-the-art techniques, such as ion exchange, impregnation or desilication. The catalysts are in a second step characterized, using the typical solid-state techniques like X-Ray diffraction, scanning electron microscopy and advanced techniques of solid state NMR. Using a combined probing technique with ammonia, triphenylphosphine, <sup>1</sup>H-MAS-NMR and <sup>31</sup>P-MAS-NMR gives an insight in the spatial distribution of the Brønsted acid centers. Using <sup>27</sup>Al-MAS-NMR and <sup>29</sup>Si-MAS-NMR reveals properties of the framework, build up of SiO<sub>2</sub> and Al<sub>2</sub>O<sub>3</sub>.



**SEM picture of a  
typical zeolite**