Master Thesis in Chemistry and Chemical Technology

Design of experiment in optimization of constituents in high entropic oxides for CO_2 hydrogenation to methanol

This thesis focuses on the synthesis and optimization of high-entropy oxides (HEOs) as heterogeneous catalysts for CO_2 hydrogenation to methanol. First, a novel shaping and synthesis method for HEO catalysts will be investigated, followed by a structured design of experiments (DoE) approach. An initial coarse DoE will be conducted to screen and evaluate the influence of each constituent, simplifying the vast compositional space. Based on these findings, a refined DoE will then target the most impactful constituents for further optimization. Once an optimal composition is determined, activation protocols will be studied to enhance catalytic performance in CO_2 hydrogenation.

Tasks

- Develop a shaping and novel synthesis process for high entropic oxide catalysts
- Perform a design of experiment for the composition of a selected high entropic oxide
- Evaluate the catalytic performance of high entropic oxides in the hydrogenation of CO_2
- Study catalyst activation protocols to further optimize the catalysts

Expertise

- Proficiency in statistics and setting up and analyzing DoE
- Background in characterization of materials including surfaces and crystal structures
- Hands-on skills in operating pressurized catalytic reactors
- Good analytical and problem-solving skills
- Independent and structured workflow
- Effective communication skills in both English and German

Offer

- Engage in cutting-edge research to develop heterogeneous catalyst for the hydrogenation of CO_2 and contributing to carbon circularity
- Earn a competitive salary while researching CO_2 abatement strategies
- Work alongside academic professionals and industry partners building your expertise in heterogeneous catalysis, materials science and sustainability