Semester Project

Evaluating the strength of cation exchanged Lewis acidic zeolites for ring opening hydration of epoxides

The LAS in zeolites exhibit remarkable activity for a number of important chemical transformations in biomass conversion. These LAS can be generated by many different methods e.g. incorporation of heteroatoms into the framework of zeolites, high temperature calcination, acid/base leaching, and/or steaming. In recent years, Lewis acidic zeolite catalysts have gained extensive research attention for catalytic hydration of epoxides (such as ethylene oxide, propylene oxide) which is one of the most important route for the production of glycols. The glycols produced from the direct ring-opening hydration of epoxides, are widely used as intermediates for making polyester resins, antifreezes, cosmetics, medicines, and other products. However, the direct epoxide hydration is an energy extensive process as non-catalytic hydration process needs a large amount of water for obtaining high glycol selectivity. Therefore, researchers have attempted different modifications on zeolites to tailor the LAS for catalytic hydration of epoxides and still there is a large room for research to develop an efficient solid catalyst being able to catalyze the hydration reaction with high glycol selectivity and minimum water consumption. One of the emerging ways of enhancing the Lewis acidity is by introducing heteroatoms at extra-framework positions of zeolites. The aim of this project is to evaluate the strength of Lewis acid sites incorporated in zeolites by of cation-exchange, for the ring opening hydration of epoxides. In particular, the focus will be to investigate the effect of LAS concentration on conversion and selectivity. The student will therefore gain experience in many aspects of catalysis research by performing a variety of tasks related to synthesizing and evaluating catalysts within a relatively short period, with assistance from the supervisor.

Responsibilities

- Synthesis of cation-exchanged zeolite catalysts
- Catalytic testing using lab-based reactor equipment and GC-FID
- Characterization of materials using relevant lab-based characterization techniques i.e. FT-IR, NMR, ICP PXRD and N_2 physisorption
- Propose structure-performance relationships of catalysts based on results

Learning Benefits

- Training and experience in standard and advanced characterization techniques to strength prior theoretical knowledge
- Experience on presentation and writing of scientific results to improve written and oral communication skills
- Working with an international team

Requirements

- Interest in material science,
- Knowledge of heterogeneous catalysis
- Commitment in research

Contacts

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