Improving Catalysis Via Metal-Organic Frameworks and Continuous-Flow

PROJECT DESCRIPTION

Metal-organic frameworks (MOFs) are a relatively new class of materials that have shown great potential in the field of heterogeneous catalysis due to their porous nature and relatively high stability. The overall goal of this research project is to design and synthesize catalysts/ligand systems that can be immobilized via incorporation into MOFs. These MOFs will then be utilized in the continuous-flow production of industrially relevant materials in order to improve the sustainability of current industrial chemical syntheses. To meet this goal, there are a number of specific objectives that must be met.

Objective 1:

- Ligand/catalytic systems that are suitable for incorporation into MOFs must be identified. This can be done by surveying the literature. Once chosen, synthetic modification of the ligand/catalytic systems will facilitate the formation of the catalyst-containing MOFs.

Objective 2:

- The catalyst-containing MOFs must be screened for a variety of industrially relevant organic transformations. This can be achieved by testing different substrates against the catalysts in a continuous-flow reactor.

Objective 3

- Catalytic activity and selectivity must be optimized. This can be achieved by varying the continuous-flow reaction parameters (e.g. temperature, pressure, flow-rate, etc.). Such a study may also provide mechanistic insights that would be useful for future catalyst design.

Objective 4

- Factors affecting the lifetime of the catalyst-containing MOFs must also be identified. This can be achieved by characterizing the catalysts before and after reaction.

Students will be working closely with the primary investigator to develop and test catalyst-containing MOFs. The plan for the project is as follows:

- Ligand/catalytic systems that are suitable for incorporation into MOFs must be identified. The student role for this portion of the project will largely focus on surveying and evaluating the current literature.

- Synthetic modifications of the ligand/catalytic systems will be performed in an effort to facilitate their incorporation into MOFs. An example of a potential modification includes the incorporation of suitable organic moieties into the ligand backbone. Subsequent synthesis of catalyst-containing MOFs will then be performed. The student role for this portion of the project will largely focus on performing organic and inorganic synthetic transformations in a laboratory setting and analyzing spectral data.

- The activity and selectivity of the catalyst-containing MOFs will be analyzed under batch and continuous-flow conditions. The analysis can be done using standard NMR and GC techniques and will allow us to evaluate catalyticc efficiency and the suitability of the immobilization method. The student role for this portion of the project will largely focus on performing catalytic transformations in a laboratory setting and product analysis using analytical instrumentation.

FACULTY-DEPARTMENT

Augustana - Science

OPEN TO STUDENTS FROM THE FOLLOWING INSTITUTIONS

Chinese universities participating in the *Double First-Class Initiative*.

DESIRED FIELD OF STUDENT STUDY

Chemistry

INTERNSHIP LOCATION

Augustana Campus, Camrose

NUMBER OF INTERNSHIP POSITIONS

2

INTERNSHIP DATES

Start: July 2, 2019

End: October 2, 2019

ARE THE DATES FLEXIBLE?

Yes, I am flexible regarding the internship dates. Selected students can contact me to request a date change.