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1-1-2016

Design Nano Catalysts at the Atomic Level

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Recommended Citation

Lei, Yu, "Design Nano Catalysts at the Atomic Level" (2016). *Summer Community of Scholars (RCEU and HCR) Project Proposals*. 301.

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Design Nano Catalysts at the Atomic Level

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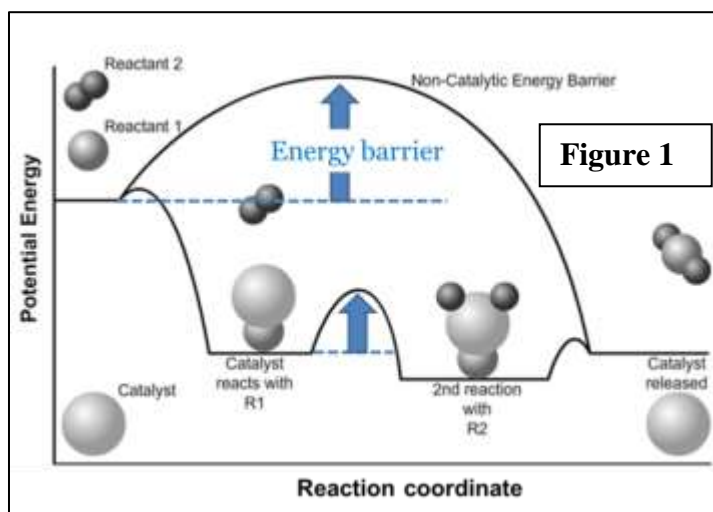
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Project Summary

Catalysis (Figure 1) is of great importance to the chemical industry. It has been estimated that ~90% of worldwide commercial chemical processes utilize catalysts in one form or another in their daily productions. New catalysts are increasingly demanded for environmentally friendly and energy efficient chemical processes. The key for improving catalyzed transformation is to build the catalysts structure/performance relationships.



We believe that substantial gains can be achieved by combining precise synthesis and state-of-the-art characterization techniques. New synthetic and stabilization methodologies, based on atomic layer deposition (ALD) will be developed for achieving highly active and stable catalysts. This technical allows us to design and synthesize nanostructured catalysts in an atom-by-atom fashion. Advanced techniques using one of the brightest artificial X-ray and Neutron beams at Department of Energy (DOE) national facilities will be employed to understand the catalyst active sites and local structure in real time under working conditions.

The research will integrate efforts in: 1) synthesis and stabilization of uniform, supported catalysts; 2) characterization of geometric and electronic structure of catalysts during synthesis; 3) investigation of catalytic and chemical events on the catalysts that are relevant to propylene oxide production. Student will be involved in the frontier research of material science and surface science and experience the state-of-the-art scientific equipment and techniques.

Student Duties

Soak up as much knowledge as you can – provide enthusiasm in return.

The perspective student will work closely with a graduate student Mr. Zheng Lu on his PhD thesis project. The perspective student's responsibilities, as described in the Project Summary, focus on catalysts performance testing using the catalyst evaluation system located at Shelby Center 309 (Figure 2). Specifically, the student will help evaluate the performance of the catalysts for propylene epoxidation, including light-off curve and kinetics measurements. Other key job functions are catalyst synthesis and characterization.

The perspective student is also expected to become familiar with the literature that is relevant to this project and with the wider literature in general.

The undergraduate research is desired to conduct the required work in a timely manner as directed by the mentors.

In summary, this project will be a great learning experience for developing scientific skills and teamwork spirit.



Figure 2

Required Experience and Education

Basic knowledge of chemistry, catalysis and gas delivery systems

Training in Chemical Engineering, Chemistry, Materials Science and related disciplines is a plus.

Mentor Supervision and Interaction

The perspective student is encouraged to see the mentor if there is anything he/she wants to discuss, science or otherwise.

Lab Visit. The mentor will work in the lab with students when it is necessary. This will allow students to have access to qualified, expert advice when it is needed.

Individual Meeting. A definite schedule of individual meetings and team meetings is adopted weekly in our group. The group member will meet with the mentor in an informal fashion to discuss recent progress.

Group Meeting. Our group has biweekly group meetings together with Professors George Nelson and Eunseok Lee of Mechanical and Aerospace Engineering Department. Each group meeting can be divided into two parts: literature survey and research progress. The perspective student will participate in our weekly group meeting and be able to interact with graduate students and faculty members. He/She will also present a literature survey in the area of ALD, nanotechnology and catalysis during the summer. At the end of the summer, the student will present research progress made during the period of this project at UAH.