Faculty of Engineering and Applied Science
Chemical Engineering Seminar Series

Heterogeneous Catalysts for the Conversion of CO_2 to Value-added Products

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Dupuis Hall Room 215

We now live in a world where we are seeing the frequency of extreme weather events, as well as the average global temperature, increasing year-over-year. There is no dispute among the academic community that this is due in large part to elevated atmospheric levels of greenhouse gases, which includes massive CO_2 emissions resulting predominantly from human activity.

As a result, the development of technologies and methodologies for minimizing and mitigating these emissions has become a high priority for both policymakers and researchers around the world. While the increasing electrification of transportation and industry holds great potential from reducing CO_2 emissions from myriad small sources, the resulting intensification of CO_2 emissions from large point sources, such as power plants, remains an ongoing concern. As such, there is a great need for new methods of preventing CO_2 release to atmosphere.

One such approach involves the conversion of CO_2 into value-added molecules for use as chemical reagents or renewal fuels. Due to the high stability of the CO_2 molecule, this is best accomplished by using catalysts to lower the energetic barrier of these conversion reactions. Implementing such technology on a sufficiently large scale, however, requires the development of catalyst materials that are sufficiently abundant, non-toxic, and inexpensive to make the process worthwhile. Thus, the use of gas-phase heterogeneous catalysis using transition metals offers an appealing route to CO_2 activation and conversion.

Current research in the Duchesne Group focuses on the development and characterization of such catalysts and emphasizes the use of in-lab performance testing and synchrotron-based X-ray characterization techniques for understanding and optimizing catalyst performance. Elements of this research, from catalyst preparation to characterization and performance testing, will be discussed, along with illustrative examples drawn from recent studies.