**Publications/Articles:**
- Genome sequencing, UD researchers publish paper on CHO-K1 cell genome sequencing
  [http://www.udel.edu/udaily/2012/aug/cho-k1-genome-080411.html](http://www.udel.edu/udaily/2012/aug/cho-k1-genome-080411.html)

**Dates to Hold**
- **Michael T. Klein – Named Professor Lecture and Reception**
  Wednesday, October 26, 2011
  3:30pm
  Location: TBD

- **Wilfred Chen - Named Professor Lecture and Reception**
  Wednesday, November 2, 2011
  3:30pm
  Location: TBD

**Events:**
- You are invited to attend the second annual **Undergraduate Research and Service Celebratory Symposium**, scheduled from 8:30 a.m.- 4:30 p.m., Wednesday, Aug. 10, at Clayton Hall. This Symposium is a collaborative effort of the Alliance for Summer Scholars Programs.

  Please join us to celebrate the work of more than 300 undergraduate research and service scholars representing every college and discipline. The majority of these students have been involved in intensive 10-week summer experiences in labs, studios, schools, hospitals and several international locations.

  In addition to the student presentations, Graham Hatfull of the University of Pittsburgh will discuss "Exploration and Exploitation of Mycobacteriophages" at 1:30 p.m. in Clayton Hall.

  An art show by students in the Undergraduate Research Program, the Office of Service Learning Program and the ArtsBridge Scholars Program will be presented from 4:30-6:30 p.m. in the Studio Arts Building.

  For the complete program, including links to student abstracts, please visit the Undergraduate Research and Experiential Learning website at [http://www.urel.udel.edu](http://www.urel.udel.edu).

**Thesis/Dissertation Defense:**
- You are cordially invited to **Xin Li’s Ph.D. dissertation defense** entitled "Investigation of M1 phase Molybdenum Based Mixed Metal Oxide Catalysts for Selective Oxidation of Propane" which will be held on **Wednesday, August 10th at 10 AM in CLB 366**. Refreshments will be available at 9:45 AM. An abstract for the presentation is below.

  **ABSTRACT**
  Acrylic acid and acrylonitrile produced by propylene oxidation and ammoxidation are important intermediates for producing paints, adhesives, plastics, and fibers, etc. During the past two decades, replacing propylene with the cheaper and more abundant propane has attracted a lot of research interest, and Mo-V-Te-Nb-O mixed metal oxides are the most efficient catalysts so far. Two orthorhombic phases named $M_1$ and $M_2$ have been identified, and $M_1$ is generally considered the key component for propane activation. In particular, the [001] face of the $M_1$ structure has been proposed to provide active centers and the valence distribution on [001] face is believed to play an important role.
role in determining the reaction mechanism. However, the detailed mechanism is not fully understood yet, which can be related to the difficulty in synthesizing M1 phase with high purity. Thus, in this work, we carried out investigations of the highly pure M1 catalyst focusing on the synthesis, catalytic behavior, and structural model development.

The slurry method was used to synthesize catalyst samples. It is found that, besides M1 and M2, TeMo$_5$O$_{16}$, V-substituted Mo$_5$O$_{14}$, and Mo-substituted V$_2$O$_5$ are also often formed together. The final phase composition can be significantly affected by nominal metal composition, slurry pH, calcination heating rate, etc. Further, it is found that washing the mixture with concentrated H$_2$O$_2$ solution offers the most effective removal of undesired phases. A complete procedure for obtaining highly pure M1 phase has been developed.

The synthesized M1 catalysts were tested by running propane oxidation in a fixed-bed reactor. Reaction results show that M1 phase itself is capable of converting propane to acrylic acid with good selectivity. Oxygen amount has a weak impact on propane conversion, while introduction of extra steam can effectively improve the overall catalyst performance. The roles played by water include promoting desorption of formed acids and involvement in a possible hydration-dehydration process between propylene and isopropanol. Network analysis suggests that propylene is likely to be a primary first intermediate. CO$_x$, acetic acid, and acetone are observed as major byproducts.

An improved structural model of the M1 phase has also been developed using Rietveld method. The new model suggests that V is concentrated in sites that link the pentagonal rings. Combined analysis of bond valences and the electroneutrality constraint suggest that the linking sites S4 and S7 may contain a mix of Mo$^{5+}$ and V$^{5+}$, which is consistent with the proposed catalytic mechanism in which V$^{5+}$ plays an important role in propane activation.

- You are cordially invited to Irene Hsu’s Ph.D. dissertation defense entitled "Novel Catalyst Synthesis Methods for Fuel Cell Applications" which will be held on Friday, August 12th at 10am in CLB 366. Refreshments will be available at 9:45 AM. An abstract for the presentation is below.

ABSTRACT

Many resources have been devoted to developing novel catalytic systems in efforts to improve the chemical activity of electrochemical reactions while reducing noble metal loadings. For example, DFT calculations and planar model surfaces have been utilized to demonstrate the novel catalytic performance of monolayer bimetallics for the oxygen reduction reaction (ORR). However, in order for these catalyst systems to be relevant industrially they must be in the form of particles. Conventional synthesis methods are too simplistic for these systems, which require a higher level of control in their synthesis.

Atomic layer deposition (ALD) was used to deposit Pt layers on tungsten monocarbide (WC) particles in an effort to produce monolayer Pt-WC catalysts. This system has been identified as a promising alternative to bulk Pt in a number of electrochemical applications. For example, DFT calculations predicted that one monolayer of Pt on a WC substrate should perform as well as a Pt catalyst for the ORR. Pt ALD was first demonstrated on WC thin films and the growth and nucleation characteristics were studied. A nucleation period was observed where the growth per cycle was quite slow. After that period, the growth rate increased considerably. SEM imaging showed that when few ALD cycles were used, small Pt particles were dispersed on the WC surface, but eventually with increased ALD cycles, merged to form a continuous layer. Pt monolayer growth is difficult on WC because there are few available adsorption sites for the Pt precursor, and discrete Pt particles are created instead. With increasing ALD cycles, existing Pt particles are more likely to grow rather than nucleate elsewhere on the WC surface. Therefore, in order to make thinner Pt layers the nucleation density must be increased at low ALD cycles. Pt ALD was then scaled to powder WC substrates, and a similar growth mechanism was also observed on the WC particles. The presence of free carbon was found to affect the Pt ALD by blocking adsorption sites on WC and also providing its own sites for Pt particle
nucleation. It is, therefore, important to have WC with minimal free carbon impurities, as it not only affects the Pt deposition, but can also be detrimental in its catalytic performance. The catalytic performance of the ALD Pt-WC samples was evaluated for the ORR using a rotating disk electrode. The mass specific and specific activities for the 30 and 50 ALD cycle samples were found to be comparable to a 10 wt% Pt/C catalyst with more than half the Pt loading, indicating that the Pt utilization of these catalysts is more efficient than the bulk Pt catalyst. However, the oxygen reduction mechanism on the Pt-WC catalysts was found to be less efficient than on the Pt/C catalyst. Higher overpotentials were observed, and the reduction was found to take the 2-electron peroxide reduction pathway, the less desirable pathway for fuel cell applications. To explain some of the observations in electrochemical activity found with the ALD Pt-WC samples, WC disks with one monolayer of Pt were produced to make idealized surfaces. This system was also found to have lower ORR activity than bulk Pt. The lower than expected activity was attributed to the lack of stability of the WC substrate in oxygen-saturated acid media, which also affects the integrity of the Pt monolayer. Regardless, the Pt-WC core shell system could be potentially useful for other reaction systems, such as hydrogen evolution reaction.

**Seminars/Workshops**

- **CCST/CCEI Seminar**
  Dr. Takahiko Moteki – University of Tokyo, Okubo-Shimojima Laboratory
  Monday, August 15, 2011
  10:00 am - 366 Colburn Lab

- **Workshop on Multiscale Computing of Cloud Physics**
  Monday, August 15, 2011
  8:30am – 6:00pm
  120 Clayton Hall Conference Center
  https://spreadsheets.google.com/spreadsheet/viewform?formkey=dGNpMUg2V3JyVFUxVWI2UDRnUKw1NUE6MQ

- **Department Seminar**
  Klavs Jensen, Massachusetts Institute of Technology, Department of Chemical Engineering
  Robert L. Pigford Memorial Lecture
  Friday, September 9, 2011
  10:00am in 102 Colburn Lab
  "Shrinking and Accelerating the Lab - Microreactors in Discovery and Development"

- **MSEG Seminar**
  Shaoyi Jiang, Ph.D.. Boeing-Roundhill Professor of Chemical Engineering & Adjunct Professor of Bioengineering University of Washington, Seattle
  Wednesday September 21, 2011
  10:00am – 11:00pm, Center for Composite Materials (CCM 106)
  “Molecular Understanding, Design and Development of Ultra Low Fouling Zwitterionic-based Functional Materials”

**Jobs:**

- Available position can be found on the Chemical Engineering opportunity website (http://www.che.udel.edu/opps.html), so be sure to check it regularly.