Please join in welcoming Dr. Yushan Yan, whose Colburn office is 257 CLB. He will be moving his group from UC Riverside during August.

Please discontinue using x3009 as a fax number. When possible, please contact vendors/associates that may be using this number as a fax number and give them the department fax line (302-831-1048). Thank you.

Publications/Articles:

- Sign up now for 2011-2012 parking  
  [www.udel.edu/permits](http://www.udel.edu/permits)
- MERCK KGAA : Udit Batra to Lead Consumer Health Care Division  
- First green roof on UD campus will keep class comfortable  
  [http://www.delawareonline.com/article/20110726/NEWS/107260345/First-green-roof-on-UD-campus-will-keep-class-comfortable?odyssey=tab%7Cmostpopular%7Ctext%7CFRONTPAGE](http://www.delawareonline.com/article/20110726/NEWS/107260345/First-green-roof-on-UD-campus-will-keep-class-comfortable?odyssey=tab%7Cmostpopular%7Ctext%7CFRONTPAGE)
- University honored in Chronicle's Great Colleges to Work For 2011  

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:

- Please note that eCALC I (046CLB) will be closed for at least 2 weeks while new equipment is installed.

Thesis/Dissertation Defense:

- You are cordially invited to Kory Blocker’s PhD defense on Monday, August 8th at 10:00am in 366CLB. Refreshments will be served at 9:45am. The title is "Development of a Tailorable and Tunable Mechanism for Cell-responsive Substrate-mediated Gene Delivery".

  Abstract
  Due to the spatial and temporal control as well as the cell-type specificity necessary to extend gene delivery to therapeutic applications, there exists a need to create systems that are well-understood and easily manipulated. Furthermore, the creation of well-comprehended systems will enable further exploration of the correlation between biochemical cues and the resulting cellular responses. In response to this need, a system capable of cell-responsive substrate-mediated gene delivery was developed for this dissertation. Through the use of non-viral gene delivery, flexibility of the vehicle design was incorporated into the system. Using PNA technology, pDNA was specifically tethered to a self-assembled monolayer via an enzymatically-labile peptide tether.

  This system promoted cell-responsive delivery while retaining flexibility over the chemical and physical properties of the vehicle and substrate. By alteration of some system parameters including tether number,


The development of sustainable sources of energy to decrease our dependence on non-renewable fossil fuels and the reduction of emissions causing global warming are important technological challenges of the 21st century. Production of solar fuels by photocatalysis is one potential route to reduce the impact of those problems. The most widely applied photocatalyst is TiO$_2$ because it is stable, non-toxic and inexpensive. Still, it cannot utilize the solar spectrum efficiently as its band gap is 3.2 eV thus able to absorb only 3% of sun light. This thesis therefore explores multiple avenues towards improving the light absorption capability of semiconductor materials without loss in activity. To achieve this objective valence band hybridization method of band gap reduction was utilized. This technique is based on introducing new orbitals at the top of valence band of the semiconductor that can then hybridize with existing orbitals. The hybridization then raises the maximum of the valence band thereby reducing the band gap. This technique has the added advantage of increasing the mobility of oxidizing holes in the now dispersed valence band. In practice, this can be achieved by introducing N 2p or Sn 5s orbitals in the valence band.

We initially designed novel zinc gallium oxy-nitrides, with the spinel structure and band gaps in the visible region of the solar spectrum, by nitridation of a zinc gallate precursor produced by sol-gel synthesis. These spinel oxy-nitrides have band gaps of 2.5 to 2.7 eV, surface areas of 16 to 36 m$^2$/g, and nitrogen content less than 1.5%. They are active towards degradation of organic molecules in visible light. Density functional theory calculations show that this band gap reduction in part is associated with hybridization between the dopant N 2p states with Zn 3d orbitals at the top of the valence band. While spinel oxy-nitrides are produced under nitridation at 550°C, at higher temperatures they are consumed to form wurzitic oxy-nitrides. The wurzite materials also have band gaps less than 3 eV but their surface areas are 2 to 5 m$^2$/g. The thesis explores in detail the changes associated with the gallium coordination as the spinel zinc gallate precursor transforms into the spinel oxy-nitride at 550°C, and further changes into the wurzite oxy-nitride at 850°C are studied through X-ray diffraction, ultraviolet-visible diffuse reflectance spectroscopy, neutron powder diffraction, X-ray absorption spectroscopy and other techniques. We believe that the protocol developed in this thesis opens an avenue for the synthesis of semiconductors having the spinel crystal structure and band gaps engineered to the visible region with potential applications for opto-electronic devices and photocatalytic processes.

Though the spinel oxynitrides are interesting, they suffer from vacancies and low surface areas from the high temperature nitridation step. This could be overcome by synthesizing photocatalysts hydrothermally. We proceeded to explore the interactions of Sn$^{2+}$ 5s orbitals with O 2p orbitals towards hybridizing the valence band. This led to the development of novel visible-light-active Sn$^{2+}$-TiO$_2$ and SnO$_x$–ZnGa$_2$O$_4$ materials. The former catalysts are prepared from the reaction of titanium butoxide and several tin precursors at 80°C in aqueous solutions. Samples synthesized with SnCl$_2$ have lower band gaps (red-shifted to the visible region) with respect to anatase TiO$_2$. The catalysts are isstructural to anatase TiO$_2$ even at the highest loadings of Sn$^{2+}$. When the precursor is changed to SnCl$_4$, rutile is the predominant phase obtained but no reduction in the band gap is observed. The experiments also indicate the presence of chlorine in the samples, also influencing the optical and catalytic properties as confirmed by comparison to materials prepared using bromide precursors. These catalysts are photocatalytically active for the degradation of organic molecules with rates higher than the standards (P25 TiO$_2$, ZnGa$_2$O$_4$) and also evidenced from the generation of hydroxyl radicals using visible light. This protocol could be extended to incorporate Sn$^{2+}$ into other oxide semiconductors to prepare photocatalysts with interesting electronic properties as was done with SnOx-ZnGa2O4.

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**Abstract**

You are cordially invited to Bharat Boppana’s Ph.D. dissertation defense, entitled "Design and Analysis of Novel Photocatalytic Materials." The defense will be held on Monday, August 08th at 1100 AM in CCM Conference Room 104/106. Refreshments will be available at 1045 AM. An abstract for the presentation is with this message.

The pDNA surface coverage, and complexation agent, temporal control over the release profile was also achieved. Furthermore, the adaptability of the system was detailed by transitioning to a poly-D-lysine coated substrate upon which the pDNA was immobilized.

This dissertation details proof-of-principle work in the formation of a controlled-release gene delivery system that may be used to promote understanding of cellular responses to biochemical signaling and may be extended to use in tissue engineering applications.
Seminars/Workshops

- **Lourdes F. Vega**, director of MATGAS, Wednesday, August 3
  10:30 a.m. in 103 Gore Hall
  “CO₂ capture, storage and utilization: a key player in the sustainable energy scenario”

- **Lourdes F. Vega**, director of MATGAS
  Wednesday, August 3, 2011
  3:00 p.m. in 366 Colburn Lab
  “Molecular simulations: a tool for engineering design and optimization from molecular basis”

- **CMET/COBRE Seminar**
  Dr. Dganit Danino – Technion – Isreal Institute of Technology
  “Sneak Peek of our Cryo-TEM of Soft Matter: Self-Assembly, Dynamics, and Nanostructure”
  Wednesday, August 3, 2011
  10:00 AM in 366 Colburn Lab

- **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**
  Free online registration until Friday, August 5th.
  Monday, August 15, 2011
  8:30 AM – 6:00 PM
  120 Clayton Hall Conference Center
  [https://spreadsheets.google.com/spreadsheet/viewform?formkey=dGNpMUg2V3JyVFVuVWI2UDRnUkw1NUE6MQ](https://spreadsheets.google.com/spreadsheet/viewform?formkey=dGNpMUg2V3JyVFVuVWI2UDRnUkw1NUE6MQ)

Jobs:

- **Post-Doctoral Position, Schlumberger-Doll Research** (see link [http://www.che.udel.edu/pdf/IndustryOpps/SchlumbergerDoll_07212011.pdf](http://www.che.udel.edu/pdf/IndustryOpps/SchlumbergerDoll_07212011.pdf) for more information)

- **Post-Doctoral Position, University of Chicago** has two openings for postdoctoral researchers in the areas of nanoparticle membranes and granular materials/suspension rheology. If you know of highly motivated graduate students who have done outstanding research, are close to completing their degree (or recently have done so) and might be interested working in the very collaborative environment at the James Franck Institute, please have them contact me. Information on recently completed projects can be on our website [http://jfi.uchicago.edu/~jaeger/group/](http://jfi.uchicago.edu/~jaeger/group/).

- **Senior Modeling Scientist, Johnson Matthey, Inc.** (see link [http://tbe.taleo.net/NA12/ats/careers/requisition.jsp?org=JOHNSONMATTHEY&cws=1&rid=620](http://tbe.taleo.net/NA12/ats/careers/requisition.jsp?org=JOHNSONMATTHEY&cws=1&rid=620) for more information)

- **Instructor, Assistant, Associate or Professor, Chemical and Biological Engineering, South Dakota School of Mines and Technology** (see link [https://yourfuture.sdbor.edu/applicants/jsp/shared/frameset/FrameSet.jsp?time=1311604556195](https://yourfuture.sdbor.edu/applicants/jsp/shared/frameset/FrameSet.jsp?time=1311604556195) for more information)

- **Tenure-track faculty position, Cornell University, invites application for a tenure track faculty position at the Assistant Professor level.**
  This biological engineering tenure-track position requires a balanced effort between research (50%) and teaching (50%) on an academic year basis. The successful candidate is expected to develop a nationally recognized research program and become a leader in the field of biomaterials engineering. The department seeks a distinguished and productive junior scholar who shares our passion for outstanding teaching and
advising in the context of a leading research university with a top-ranked, accredited undergraduate biological engineering program. Service to the department and university is expected of all members of the faculty. The ideal candidate will work in the area of biomaterials engineering with a focus on biologically-derived materials with broad applications in biological, environmental, agricultural or food systems. Innovative research may be focused at the nanoscale, molecular, cellular or organism level. Examples of possible research emphases include the following areas: bio-derived and bio-inspired materials and biomaterials engineering based on self assembly, biomolecular engineering, and nanobiotechnology. We are looking for candidates who would excel in the multidisciplinary research environment which is a hallmark of Cornell University. The successful candidate will collaborate with other faculty within the department and university. Publishing in peer-reviewed journals and securing external funding to support research program is a major expectation of the successful candidate. The successful candidate will also support the teaching of core courses at the undergraduate and graduate level including developing a course that is explicitly designed to educate students on biomaterials topics. The department values excellence in undergraduate and graduate mentoring and is seeking a candidate that shares these values.

Applications including a resume, statements on research and teaching interests, copies of relevant publications or preprints, reference letters and transcripts should be submitted online at: https://academicjobsonline.org/ajo/jobs/721. Applications will be reviewed starting August 15, 2011 and will be accepted until this position is filled.

- **Tenure-track faculty position, Western Michigan University** invites applications for a tenure track faculty position at the Assistant or Associate Professor level. Preferred areas of interest for the position are: biochemical, biomedical, bio systems, coatings, nanostructures, and printed electronics. Other areas will be considered. Each successful candidate is expected to teach undergraduate and graduate courses in chemical engineering, to advise graduate students, and to develop an externally funded research program. Each candidate must have an earned PhD in chemical engineering or other closely related field and be eligible to work in the United States. The successful applicants will be expected to start in the Spring semester (preferably) or Fall 2012.

Western Michigan University is a Carnegie doctoral research extensive institution serving 25,045 students at its main and branch campuses. The College of Engineering and Applied Sciences offers 17 undergraduate, 9 master’s and 6 doctoral programs.

Candidates must submit their application materials via Western Michigan University’s web site at: www.wmich.edu/hr/careers-at-wmu.htm. Create an account and then search for posting 0601299 and select the “view” link. Once you have viewed the posting, click “Apply for this Posting.” Complete the Faculty Credential Summary and then upload your application materials. Application materials must include a current curriculum vitae, a description of research plans and teaching interests, and contact information for a minimum of three references. To ensure full consideration, a complete application must be received by August 29, 2011. Application review will begin immediately thereafter, and continue until the position is filled.

Questions about this position should be sent to Dr. Andrew Kline, search committee chair, at andrew.kline@wmich.edu. Additional information is available on the College of Engineering and Applied Sciences website: http://www.wmich.edu/engineer/.

- **Tenure-track faculty position, California Institute of Technology** invites applications for a tenure-track faculty position in the Division of Chemistry and Chemical Engineering in the area of chemical engineering. Candidates with strong commitments to research and teaching excellence are encouraged to apply. We expect to make the appointment at the assistant professor level, but consideration will be given to exceptionally well-qualified applicants at the full professor level. Appointment will be contingent upon completion of all requirements for a Ph.D. in chemical engineering or in a related field. Each application should include a curriculum vita, publication list, a description of proposed research, and three letters of recommendation, and should be sent via email (search@cheme.caltech.edu) to: Chair of the Chemical Engineering Search Committee, M/C 210-41, California Institute of Technology, Pasadena, CA 91125. Applications should be received by October 1, 2011. The California Institute of Technology is an Equal Opportunity/Affirmative Action Employer. Women, minorities, veterans, and disabled persons are encouraged to apply.

- **Tenure-track faculty position, University of South Alabama** invites applications for a tenure-track faculty position at the Assistant Professor level. Applicants must have a Ph.D. in Chemical Engineering or a related field by the time of appointment, an outstanding academic record, a demonstrated commitment to excellence in
undergraduate and graduate education, and be capable of establishing a strong international reputation for their research program. Research interests are open but process systems engineering and bioengineering areas are preferred. The Department has an ABET accredited undergraduate program and an industrially oriented Masters program. Furthermore, the Department participates in a Ph.D. Biomedical Engineering track in the Basic Medical Sciences Program in the College of Medicine. The Department is moving to a new state-of-the-art 155,000 sq. ft. Engineering & Computing Science building in Spring 2012. The preferred appointment is for Fall 2012; however, a review of applications will begin September 26, 2011 and continue until the position is filled. A complete job posting and application process can be found on our website at www.southalabama.edu/engineering/chemical/. Applicants must be eligible to work in the U.S. The University of South Alabama is an Affirmative Action/Equal Opportunity employer.

- **Intel Corporation** has several openings for physical science Ph.D.’s to support/direct R&D of advanced processing methods used to manufacture the next generation of microprocessors. Positions are available in the areas of Thin film deposition, Electrochemistry, and Chemical mechanical polish. Openings are at Intel’s primary development facility (Ronler Acres) located ~10 miles west of Portland OR. Ph.D. candidates in Materials Science, Chemistry, Chemical Engineering, Physics, Electrical Engineering or related fields should email resumes to jennifer.y.lee-feldman@intel.com.

These and other 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.