NEAT ORU
Nanomaterials in the Environment, Agriculture and Technology
Organized Research Unit
UCDAVIS
Spring 2007

NEAT HIGHLIGHTS

DIRECTOR'S STATEMENT

It has been too long since we put out a NEAT newsletter; time has gotten away from us because so many things, mostly good, have been happening. Here I summarize our activities in the last 18 months. There are a number of new opportunities for NEAT.

Successes: NEAT submitted 40 research proposals in this period, of which 13 were funded for a total of $4,414,075. Ten were declined, and 17 are pending. The launch of the spectral imaging facility, the acquisition of new x-ray diffraction and calorimetric equipment, and the confederation of ICAM and NEAT (see separate items below) are major milestones. We were finalists but unfortunately not winners in the full proposal IGERT competition with a proposal submitted by Professor Sabyasachi Sen entitled "IGERT: Glass: From Volcanoes to Food". We have the university's green light to resubmit this proposal in the current round of pre-proposals. The NEAT-ICAM-Thermochemistry administrative staff has been expanded and reorganized. We believe our office is now running smoothly and we hope we provide you the service you need in terms of proposal and grant administration and the encouragement of interdisciplinary activities. Please do not hesitate to provide feedback to me and/or Carlos. As I constantly remind my research group, a problem we do not know about cannot be fixed.

Research Directions, Especially Energy: We had a successful and very valuable External Advisory Committee meeting in February 2006 and plan one for the summer or early fall of 2007. They rightly pointed out that NEAT needs a stronger focus to bring us together, and that the developing national and local initiatives in energy may provide such a focal point. Since then, a number of developments in this direction have taken place. On the national scene, energy indeed looms high, with nuclear energy, hydrogen, and CO_2 management as major initiatives. NEAT has responded to DOE calls for proposals in these areas with a NERI Nuclear Energy Research Initiative proposal chosen for funding (Navrotsky and colleagues at Sandia National Labs). We are still awaiting funding decisions on proposals submitted to the Basic Research for the Hydrogen Fuel Initiative and for Solar Energy Utilization. On the state level a proposal has been submitted to the University of California Energy Institute and is pending a funding decision.

At UC Davis, the Energy for the Future Initiative has brought fourteen new faculty positions to campus. In addition, two unfilled positions in NEAT have been transferred to this initiative, to capture research, which unifies NEAT and Energy areas. In the 06-07 and 07-08 academic years, a total of seven positions in fundamental energy research, with potential overlap with NEAT, are being recruited: one in Physics, four in Chemistry, two in Chemical Engineering and Materials Science. In addition searches in condensed matter in Physics and in electron microscopy in Chemical Engineering and Materials Science are likely to bring people with some interests in nanomaterials and/or energy. Despite the announced "pause" in general faculty hiring, these ongoing searches are likely to greatly enhance the level of NEAT-inspired activity. I believe this is indeed recognition of the success and future promise of our interdisciplinary campus-wide activities. There are also positions in more applied fields, and a major challenge is to link the fundamental and applied science aspects of energy.

A 5-year $25 million agreement between UC Davis and Chevron-Texaco has been formalized in the area of biofuels research, with the goal of supporting the development of biofuels other than corn-based ethanol. The project is evolving to involve a very interdisciplinary group, the Bioenergy Research Group (BERG) (http://bioenergy.ucdavis.edu/index.html) of faculty from agriculture, genetics, plant and microbiology, engineering, and the physical sciences. There is clearly an interface with NEAT and ICAM, which needs further exploration.

The university, with active mentoring by Barry Klein, is trying to organize all energy related activities under an umbrella organization, perhaps an Energy Institute. How the different parts will relate to each other and still remain independent is not yet

clear. There is also talk about a possible building. There is an Energy Steering Committee, of which I am a member, which is working on these issues. Clearly NEAT has to be an active and positive player in energy, with our concern that the basic science be well represented. I am very involved in this and in the faculty recruitments (serving on four search committees this year). All this will be important in the five year review of NEAT, which will occur in the 07-08 academic year, that is, after the five years are up rather than in the fifth year. We are living in times of rapid change and great opportunity, in which NEAT must evolve and thrive.

PETER A. ROCK THERMOCHEMISTRY LABORATORY

The Thermochemistry Facility has been renamed the Peter A. Rock Thermochemistry Laboratory in honor of the late Peter Rock, Professor of Chemistry, a thermodynamicist himself, and founding Dean of the Division of Mathematical and Physical Sciences. He was instrumental in the recruitment of Professor Navrotsky and the founding of NEAT. A celebration will be held on Thursday, May 3, 10:00 a.m., and will take place outside of Room 4415 in the Chemistry Annex. The Peter A. Rock Thermochemistry Laboratory continues to be a world-unique research facility (http://thermo.ucdavis.edu; http://thermo.ucdavis.edu/docs/ThermochemistryBrochure.pdf). It has some endowment funding and continuity of university support and is an integral part of NEAT. One of the Energy/NEAT faculty positions to be recruited in 2007-08 in CEMS will be a junior faculty member to add strength and youth to thermochemistry research.

THE INSTITUTE FOR COMPLEX ADAPTIVE MATTER JOINS NEAT ORU

As of June 2006, the Institute for Complex Adaptive Matter has joined the NEAT ORU, moving from its previous home at the University of California President's office. ICAM (http://icam-i2cam.org) is a worldwide network focused on the science of emergent phenomena in matter linking 45 branches and 67 institutions. The co-directors are Daniel Cox and David Pines, Professors of Physics at UC Davis. NEAT is now the administrative hub of ICAM.

What is emergence? It is generally acknowledged that many of the key challenges and opportunities in the study of matter involve understanding complex and collective phenomena. Because these challenges frequently fall at the boundaries between conventional scientific disciplines, there is an urgent need to create new kinds of thinking and institutions capable of exploiting these opportunities. At the core of this new enterprise in the study of matter is the search for an understanding of emergent behavior – phenomena whose ultimate cause involves interactions among many simple units but which cannot be easily predicted from knowledge of the component parts alone. Our shorthand designation for soft, hard, and living matter exhibiting emergent phenomena is complex adaptive matter. The properties of nanomaterials not predicted from those of either molecules or bulk matter is one example of emergent behavior. The emergence (and nature) of consciousness in living creatures is another – from molecules to mind.

The ICAM Mission: It is this primary scientific strategy and philosophy that underlies the Institute for Complex Adaptive Matter, an open distributed experiment-based dynamic multi-institutional partnership whose purpose is to identify major new research themes in complex adaptive matter and to nucleate and conduct collaborative research and scientific training that links together scientists in different fields and different institutions. In so doing, ICAM draws from the chemical, physical and biological viewpoints on its research themes.

ICAM History: Established in March 1999, ICAM became, in April 2002, a Multidisciplinary Research Program of the University of California, with nine founding branches. In July, 2004, it received an award by NSF to establish the International Institute for Complex Adaptive Matter (I2CAM) as an integral part of ICAM to continue and expand ICAM's international scientific and educational activities. Since then ICAM-I2CAM has grown rapidly to its present constellation of branches: 26 in the US, 12 in Europe, 3 in Asia, 1 in Australia, 1 in the Middle East, 1 in South America and three European affiliates. Altogether, ICAM links 67 centers worldwide.

ICAM Activities: ICAM's integrated scientific and educational program includes exploratory workshops, symposia, fellowships, and research and educational networks. It has a well-developed communication, governance and advisory structure. Moreover, at each branch there is in turn an interdisciplinary grouping at the local level – from materials science, physics, chemistry, and biology, from theory and experiment. ICAM received early support from the Alfred P. Sloan Foundation, the David and Lucille Packard Foundation, the University of California Office of the President, Los Alamos National Laboratory, and the Richard Lounsbery Foundation. Its' current activities are supported by the National Science Foundation, Los Alamos National Laboratory, the A.P. Sloan Foundation, the Trinity Capital Corporation and cost sharing contributions from its branch members.

ICAM at Davis: Many Davis faculty have helped organize ICAM workshops (D. Cox, D. Pines, R. Singh, Physics; A. Navrotksy, Materials Science; A. Parikh, Applied Science; S. Kauzlarich, C. Lebrilla, Chemistry), participated in ICAM workshops, or hosted/sent ICAM Exchange Awardees or Fellows (D. Cox, D. Pines Physics; S. Kauzlarich, G. Yu Liu, Chemistry; S. Simon, Biomed engineering). ICAM has also provided occasional ad hoc support to workshops and seminars. The local branch steering committee is composed of Daniel Cox, Physics, Tom Jue, Biological Chemistry, College of Medicine, Susan Kauzlarich, Chemistry, Margie Longo, Chemical Engineering and Materials Science, and Atul Parikh, Applied Science. The local branch has some funds available from the Office of Research for student/postdoc travel, seminar support, and occasional workshop support.

ICAM Annual Meeting: The ICAM annual `business' meeting is May 21-22, 2007, in Davis. The primary function of the meeting is to convene our Board of Governors, which oversees policy, budget and other governance matters, and our science steering committee, which considers workshop proposals and the overall scientific agenda of ICAM. There will be three public science events accompanying this meeting- a poster session open to attending ICAM scientists and the UC Davis ICAM community (Monday, May 21 at the Alumni Center from 5:30-6:30 pm); a joint ICAM/Physics Colloquium by Paul Chaikin from New York University (Monday, May 21 in Roessler Hall 55 at 4:10 pm), and a public lecture by Nobel Laureate Robert Laughlin from Stanford in 123 Science Lecture Hall , 8:00 p.m., May 22. Check out the ICAM web site (http://icam-i2cam.org) for further details, or contact Daniel Cox (dlcox@ucdavis.edu) or the ICAM administrative assistant Hanouvi Agbassekou (icamadmin@ucdavis.edu).

GAS ADSORPTION CALORIMETRY

As part of the Chevron grant, Thermochemistry is purchasing an additional gas adsorption system and Calvet microcalorimeter for use in energy-related research for work on biofuels, catalysis, and other projects. These instruments are coupled together to do gas adsorption calorimetry. This will give us the flexibility to accommodate and assist more users from outside the Navrotsky research group. We will provide more information and talk about capabilities when the equipment arrives. If you have possible projects of interests, contact Professor Navrotsky (anavrotsky@ucdavis.edu).

NEW X-RAY DIFFRACTOMETERS

In May 2007, the Peter A. Rock Thermochemistry Laboratory will replace the 20-year- old Scintag PAD V powder diffractometer with a new, state-of-the-art diffractometer. A Bruker D8 Advanced Diffractometer System will significantly expand our capabilities to analyze powder samples. In addition to the current para-focusing geometry of the current system, the D8 can easily be reconfigured to a parallel geometry that expands the types of x-ray diffraction analysis possible. This includes particle size analysis of nanomaterials by Small Angle X-ray Scattering (SAXS) and phase identification of surfaces on solid objects that do not have flat surfaces. The versatility of the system will also be further enhanced by a variety of detectors (scintillation and a 1-dimensional area), sample holders (fixed, rotating, and capillary), and beam conditioning devices (computer controlled variable slits, diffracted beam monochromator, and Gobel mirror). Finally, the addition of the Bruker analytical software will complement the XRD Laboratory's existing analytical software packages. The instrument will be housed in Chem Annex 4450 and the person in charge is John Neil (jmneil@ucdavis.edu). As with the prior instrument, this system is primarily for thermochemistry research, but we can accommodate other users on a case-by-case basis when they have special needs that can only be met by our system and expertise.

Also arriving to UC Davis in May 2007 will be a Bruker D8 Discover Diffractometer System specially configured for the full characterization of thin films. This system will provide measurement capabilities that previously have not been available at UC Davis. These new capabilities will include x-ray reflectometry (XRR), high resolution x-ray diffraction (HR-XRD), texture measurements, reciprocal lattice mapping, and grazing incidence diffraction (GID) measurements. The system hardware will include a centric Eulerian Cradle which provides four circles of sample rotation (theta, two theta, chi, and phi rotations), in addition to x-y-z translations. Incident beam optics will include a stand alone Goebel mirror for polycrystalline materials and a Goebel mirror combined with an asymmetrically 022 germanium channel cut crystal for the analysis of epitaxial films with only $K_{\alpha 1}$ radiation. Other options include a rotary absorber to extend the dynamic range of the measurements, computer controlled variable divergence slits and a variety of detectors (scintillation detector and 1-dimensional detector). Grazing incidence measurements of in-plane lattice constants and of ultra-thin films are facilitated with a rotatable source (linear x-ray beam parallel and perpendicular to the plane of diffraction) and a tilt stage for tilting the sample around two additional axes, zeta and xi. The software accompanying the system will include the Bruker measurement and evaluation software and the LEPTOS thin film analysis software package. This package includes a materials database capable of handling amorphous and crystalline materials from all 230 crystallographic space groups. The instrument will be housed in the Physics/Geology Building Room 214. Contact Yayoi Takamura (ytakamura@ucdavis.edu) and Peter Klavins (pklavins@ucdavis.edu) for more information. This system can be used on a case-by-case basis when users have special needs that can only be met by our system and expertise.

SPECTRAL IMAGING FACILITY

The NEAT ORU Spectral Imaging Facility opened in September of 2005 to support investigation and research in bio-nano and nanomaterials with an instrumentation grant from the National Science Foundation MRI program. The facility has a state-of-the-art (CCOAFM) high resolution combined Atomic Force Microscope and Laser Scanning Confocal Microscope implemented with the Asylum Research, Inc. MFP3D atomic force microscope and the Olympus America FV1000 laser scanning confocal microscope.

In April of 2006, through an instrument gift from Agilent, Inc., the facility acquired an Hitachi High Technologies America, Inc. S-800 turbo FE-SEM (Field Emission Scanning Electron Microscope) with an Oxford Instruments, Inc. INCA Energy EDS (Energy Dispersive X-ray Spectrometry) attachment which allows for digital electron micrograph capture, as well as, nano-feature elemental analysis.

The shared use facility on the UC Davis campus is located in Chemistry Laboratory 0011. The basement location was chosen specifically for the low vibration environment required by the ultra-sensitive CCOAFM imaging system. Additional quiet laboratory features include a half-ton isolation chamber for the CCOAFM positioned on a vibration-dampening pad.

The operating goal of the **Spectral Imaging Facility** is to become self-supporting by recharging University of California users and affiliates at tiered rates for both weekday and after hours instrumentation use. Users may submit samples for imaging or complete instrument user training and become a certified user with the associated privilege of after hours access at a reduced recharge rate. Also available for general use is a dedicated computer work station affording image analysis using off-line versions of the instrumentation software. Please contact the development engineer for the facility, Mr. Alan Hicklin (aghicklin@ucdavis.edu), for details regarding training, scheduling, and advice on sample preparation. See also facility information under Spectral Imaging Facility at http://neat.ucdavis.edu/.

STUDENT ACCOLADES

Physics Graduate Student Randy Dumas (a student of Kai Liu's) won a Leo M. Falicov Award at the American Vacuum Society (AVS) 53rd International Symposium in San Francisco on November 15, 2006. The Falicov Award recognizes best graduate student research and presentation in the Magnetic Interfaces & Nanostructures Division (MIND). Randy used a first order reversal curve method to study the change of magnetization reversal mechanisms in Fe nanomagnets.

Davis High School Senior Alexandra Courtis is one of 40 high school students worldwide who were named finalists in Intel's Science Talent Search. Alexandra's project, "Bright Luminescent Silicon Nanoparticles for Biological Applications," is a nanoscience project carried out with the help of her postdoctoral mentors at UC Davis where she spends most afternoons volunteering in the lab of Professor Susan Kauzlarich of the Chemistry Department.

Materials Science Graduate Student Weiqun Chen (working with Professor Alexandra Navrotsky) won the American Ceramic Society Electronics Division's Best Student Presentation Award at the 6th Pacific Rim Conference on Ceramic and Glass Technology, held in Maui, Hawaii, in September 2005. The title of her poster is "Energetics of Cerium-Zirconium Substitution in $xCe_{0.8}Y_{0.2}O_{1.9}(1\text{-}x)Zr_{0.8}Y_{0.2}O_{1.9}$".

FACULTY AWARDS

National Academy of Engineering

Professor Bruce Gates of the Department of Chemical Engineering and Materials Science was elected to NAE in February 2007. This is a major national honor awarded for his past and continuing work in catalysis.

Distinguished Faculty Teaching Award

Professor Kent Pinkerton received the Distinguished Faculty Teaching Award in the School of Veterinary Medicine for 2006, in recognition of distinguished teaching contribution in comparative anatomy.

Nanotech Briefs' Nano 50 Award

The UC Davis Carbon Nanotube Supercapacitor, developed by Professor Ning Pan, was named a winner in the second annual *Nanotech Briefs*' Nano 50 Awards in the Technology category. The Nano 50 recognizes the top 50 technologies, products, and innovators that have significantly impacted, or are expected to impact, the state of the art in nanotechnology. Professor Pan was presented with this award in at a conference in Boston in November 2006.

Outstanding Junior Faculty Award

Professor M. Saif Islam received the Outstanding Junior Faculty Award for the College of Engineering Dean's Faculty Award Program. This is the highest honor the College of Engineering can bestow upon its faculty. The award was presented to Professor Islam at the Dean's Annual Award Reception in November 2006.

Joe and Essie Smith Endowed Professor

Roland Faller, Associate Professor in Chemical Engineering & Materials Science, has been named the Joe and Essie Smith Endowed Professor for a five-year term.

Helmholtz-Humboldt Prize

Professor Charles S. Fadley has been awarded a Helmholtz-Humboldt Prize, including a 50,000 Euro personal award, and a 25,000 Euro additional sum via the Julich Research Center for research collaboration expenses. Professor Fadley is spending a 2006-2007 sabbatical at the Julich laboratory, working on magnetic nanostructure studies, and the University of Hamburg, making use of a unique free-electron laser facility for nanostructure characterization.

Rossini Lectureship Award

The International Conference on Chemical Thermodynamics (ICCT) chose Professor Alexandra Navrotsky as the 2006 Rossini Awardee. The Rossini Lectureship Award is given in recognition of a significant contribution to the field of thermodynamics. Professor Navrotsky was presented with the award at the 19th ICCT, which was held in Boulder, Colorado in August 2006.

Harry H. Hess Medal

Professor Navrotsky was selected by the American Geophysical Union (AGU) as the 2006 Harry H. Hess Medalist. This medal is awarded for outstanding achievements in research of the constitution and evolution of Earth and other planets. The award was presented to Professor Navrotsky at the 2006 AGU Fall Meeting, which was held in San Francisco in December 2006.

NEW NEAT FACULTY AND STAFF

January 2006
Carlos Garcia, Management Services Officer, NEAT ORU
July 2006
Yayoi Takamura, Assistant Professor, CEMS
Hanouvi Agbassekou, ICAM
August 2006
Jennifer Valiente, Executive Assistant, NEAT ORU
February 2007
Eva Wong, Financial Assistant, NEAT ORU

NEW GRANTS RECEIVED June 2006 – March 2007

NSF: Intermediate-range Structure and Dynamics in Complex Ge-As-Chalcogenide Glasses and Liquids – Sabyasachi Sen, PI
NSF: Theoretical and Experimental Study of the Thermodynamic Stability of Amorphous Thin Films Based on Zirconia and Hafnia - Alexandra Navrotsky, PI
NSF: Calorimetry Under Extreme Conditions (renewal) – Alexandra Navrotsky, PI
DOE: Thermochemistry of Anion Defect and Charge Coupled Substitutions in Fluorite and Peroskite Based Materials (renewal) - Alexandra Navrotsky, PI
DOE: (NERI) New Fission-Product Waste Forms: Development and Characterizations – Alexandra Navrotsky, PI
DOE: Thermodynamics of Minerals Stable Near the Earth's Surface (renewal) – Alexandra Navrotsky, PI
UC Davis Cancer Center Support Grants: Using Nanotechnology to Regulate Cell Signaling Processes – Gang-Yu Liu, PI
Philips Lighting B.V.: Enthalpies of Formation of Selected Aluminates – Alexandra Navrotsky, PI
BHP Billiton: Melt Formation and Crystallization – Alexandra Navrotsky, PI

Department of Energy Awards $5.6 Million to U.S. Universities for Nuclear Research (DOE, Press Release, March 5, 2007)

The U.S. Department of Energy (DOE) announced it will award $5.6 million over three years (FY'07-'09), subject to appropriate from Congress, to U.S. universities in 12 cooperative research projects, under the Nuclear Energy Research Initiative (NERI). These awards will further engage U.S. university professors and their students in advanced nuclear fuel cycle research and development (R&D), supporting President Bush's Global Nuclear Energy Partnership (GNEP) and his American Competitiveness Initiative. "Engaging leading universities and researchers is crucial to supporting the development of GNEP and to expanding the use of safe, emissions-free nuclear power worldwide" Secretary Bodman said. "As our need for energy will increase, so too does our need for nuclear power, and the Energy Department has a strong set of nuclear programs that we believe can create an environment for a nuclear renaissance." Awards announced support innovative research for nuclear energy and bring total federal funding for NERI to approximately $4 million in FY 2007 and; $11.4 million for the life of the projects. Since 2005, DOE has awarded $43.9 million for 82 NERI projects. Selected universities will contribute to the development of advanced nuclear technologies that will reduce America's reliance on fossil fuels and their associated environmental impact.

Projects selected will be conducted by 15 U.S. universities in 12 states. Seven of these universities are participating in a NERI project for the first time, demonstrating the program's success in broadening the nation's nuclear research base: Cornell University, the University of California Davis, and the University of Missouri-Columbia as lead research institutions; Brigham Young University, Idaho State University, the University of Chicago, and the University of Texas at Austin as first-time collaborators.

Award amounts are subject to negotiation and are expected to be determined in June, 2007. Each project's lead university will contribute an additional 20 percent cost share, totaling $1.2 million. Projects announced today, along with ten Generation IV and Nuclear Hydrogen Initiative projects awarded earlier this year, were selected on the basis of a rigorous peer review of 79 proposals submitted by universities across the United States.

MEDIA UPDATE

Professor Navrotsky participated in two interviews during the fall of 2006, one which aired on a Davis radio station and the other which aired on Sacramento's News 10.

On **October 3, 2006**, Professor Navrotsky was interviewed by Kirsten Sanford, host and producer of This Week in Science. This show is aired weekly on UC Davis' KDVS, 90.3FM. Professor Navrotsky gave an overview of nanoscale science and technology, including practical applications in areas such as medicine and industry.

On **November 9, 2006**, News 10 aired Professor Navrotsky's interview with anchor/reporter Cristina Mendonsa. Ms. Mendonsa's report was entitled, "Nanotechnology – A Rapidly Shrinking Future."

NEAT FACULTY COLLABORATIVE PUBLICATIONS

2006

"Laboratory Study of Simulated Atmospheric Transformations of Chromium in Ultrafine Combustion Aerosol Particles", Michelle Werner, Peter Nico, Bing Guo, **Ian Kennedy, Cort Anastasio**, *Aerosol Science and Technology*, 40:545–556 (2006).

"A mechanism for copper inhibition of infectious prion conversion," **D.L. Cox**, J.P. Pan, **R.R.P. Singh**, *Biophys. J.* 91, L11 (2006).

"Prion disease: exponential growth requires membrane binding," **D.L. Cox, R.R.P. Singh,** S.C. Yang, *Biophys. J.* 90, L77 (2006).

"Fe-core/Au-shell nanoparticles: growth mechanisms, oxidation and aging effects" **Liu, Kai**, Cho, Sung-Jin, **Kauzlarich, Susan M**., Idrobo, J. C., Davies, Joseph E., Olamit, Justin, **Browning, N. D**., Shahin, Ahmed M., Long, Gary J., Grandjean, Fernande, *Materials Research Society SymposiumProceedings*, 887:121-132 (2006).

"Quantitative Measurements of the Generation of Hydroxyl Radicals by Soot Particles in a Surrogate Lung Fluid", Heejung Jung, Bing Guo, **Cort Anastasio, Ian M.Kennedy**, *Atmospheric Environment*, 40: 1043-1052 (2006).

"The Formation of Cubic and Monoclinic Y2O3 Nanoparticles in a Gas-Phase Flame Process", Bing Guo, Ashley Harvey, **Subhash Risbud, Ian M. Kennedy,** to appear in *Transactions of the Philosophical Magazine* (2006).

"A Systematic Study of the Oxygen K Edge in the Cubic and Less Common Monoclinic Phases of the Rare Earth Oxides (Ho, Er, Tm, Yb) by Electron Energy Loss Spectroscopy", Ashley Harvey, Bing Guo, **Ian Kennedy, Subhash Risbud**, Valerie Leppert, *J. Phys.: Condens. Matter* 18: 2181-2189 (2006).

"Measuring the Size Dependence of Young's Modulus Using Force Modulation Atomic Force Microscopy", W. J. Price, S. A. Leigh, S. M. Hsu, **T. E. Patten, G. Y. Liu**. *J Phys. Chem.* 110: 1382-1388 (2006).

"A Simple Miniaturization Protocol to Produce Multicomponent Micro- and Nanostructures", Zhenqian Ouyang, Li Tan, Maozi Liu, Onkar S. Judge, Xiaodong Zhang, Hai Li, Jun Hu, **Timothy E. Patten and Gang-yu Liu,** *Nano Micro Small* Vol. 2, No. 7: 884-887 (2006).

"Half-Metallic Digital Ferromagnetic Heterostructure Composed of a □ -doped Layer of Mn in Si", M. C. Qian, C. Y. Fong, **Kai Liu, W. E. Pickett,** J. E. Pask, L. H. Yang, *Physical Review Letters,* 96: 027211-1-4 (2006).

"A Magnetic and Mössbauer Spectral Study of Core/Shell Structured Fe/Au Nanoparticles", S. Cho, A. M. Shahin, G. J. Long, J. E. Davies, **Kai Liu,** F. Grandjean, **S. M. Kauzlarich,** *Chemistry of Materials*, 18: 960-967 (2006).

"Karhunen-Loeve Analysis for Pattern Description in Phase Separated Lipid Bilayer Systems" J. M. Switzer, S. V. Bennun, **M. L. Longo**, A. Palazoglu, **R. Faller**. *Journal of Chemical Physics*, 124: 234906 (2006).

"Calorimetric Determination of the Enthalpies of Formation of Hydrotalcite-like Solids and Their Use in Geochemical Modeling of Metals in Natural Waters", R.K. Allada, E. Peltier, **A. Navrotsky, W. H. Casey**, A. Johnson, H. T. Berbeco, D. L. Sparks, *Clay and Clay Minerals*, 54: 409-417 (2006).

"A Nanowire-Nanoparticle Crosslinking Approach to Highly Porous Electrically Conducting Solids", Nick Akl, Olga Trofymluk, Xiubin Qi, Jin Y. Kim, **Frank E. Osterloh, Alexandra Navrotsky.** *Angew. Chem.* Int. Ed. Engl. DOI: 10.1002/anie.200503950 (2006).

"A Molecular Dynamics Investigation of Hydrolytic Polymerization in a Metal-Hydroxide Gel", **J. R. Rustad, W. H. Casey**. *Journal of Physical Chemistry* B 110 (14): 7107-7112 (2006).

"A Molecular Dynamics Investigation of the Titration of a Trivalent Aqueous Ion", **J. R. Rustad, W. H. Casey**. *Theoretical Chemistry Accounts* 115 (2-3): 136-144 (2006).

"Low-Frequency Cooperative Dynamics in L-, D-, and DL-Alanine Crystals: A ^{13}C and ^{15}N Cross-Polarization Magic-Angle-Spinning NMR Study" **S. Sen,** P. Yu, **S.H. Risbud,** R. Dick and D. Deamer, *J. Phys. Chem. B*, published on web 8/18/2006.

"Spray Pyrolysis Synthesis of Particles Possessing Magnetic and Luminescent Properties: Application of Magnetic/Luminescent Particles in Immunoassays", D. Dosev, M. Nichkova, R. K. Dumas, **Kai Liu**, **I. M. Kennedy**, in *BioMEMS and Nanotechnology II*, Dan V. Nicolau, Editor, *Proceedings of SPIE* Vol. **6036**, 60360T-1-10 (2006).

"A Simple Miniaturization Protocol to Produce Multicomponent Micro- and Nanostructures", Ouyang, Z.; Tan, L.; Liu, M.; Judge, O. S.; Hu, J.; **Patten, T. E.; Liu, G.-Y.** *Small*, **2**, 884-887 (2006).

"High-Efficiency Stepwise Contraction and Adsorption Nanolithography." Tan, L.; Ouyang, Z.; Liu, M.; Ell, J.; Hu, J.; **Patten, T. E.; Liu, G.-Y.** *J. Phys. Chem. A*, 110: 23315-23320 (2006).

"Eu^{3+} - doped Gd_2O_3 Nanoparticles as Reporters for Optical Detection and Visualization of Antibodies Patterned by Microcontact Printing", Mikaela Nichkova, Dosi Dosev, Richard Peron, Shirley J. Gee, **Bruce D. Hammock**, **Ian M. Kennedy**, *Analytical and Bioanalytical Chemistry,* 384 (3): 631-637 (2006).

"Application of Europium (III) Chelate-dyed Nanoparticle Labels in a Competitive Atrazine Fluoroimmunoassay on an ITO Waveguide", C. M. Cummins, M. E. Koivunen, A. Stephanian, S. J. Gee, **B. D. Hammock**, and **I. M. Kennedy**, *Biosensors and Bioelectronics*, 21: 1077-1085 (2006).

"Enhancement of Ferromagnetic Coupling in MnGaAs Digital Ferromagnetic Heterostructure by Free-hole Injection", M.C. Qian, C.Y. Fong, and **W.E. Pickett**, *J. Appl. Phys.*, 99, 08D517 (2006).

"Laboratory Study of Simulated Atmospheric Transformations of Chromium in Ultrafine Combustion Aerosol Particles", M. Werner, Peter Nico, Bing Guo, **Ian M. Kennedy** and **Cort Anastasio**, *Aerosol Science and Technology*, 40: 544-556 (2006).

"The Formation of Cubic and Monoclinic Y_2O_3 Nanoparticles in a Gas-Phase Flame Process", Bing Guo, Ashley Harvey, **Subhash Risbud** and **Ian M. Kennedy**, *Transactions of the Philosophical Magazine*, 86 (7), 457-467 (2006).

"A Systematic Study of the Oxygen K Edge in the Cubic and Less Common Monoclinic Phases of the Rare Earth Oxides (Ho, Er, Tm, Yb) by Electron Energy Loss Spectroscopy", Ashley Harvey, Bing Guo, **Ian Kennedy**, **Sibhash Risbud** and **Valerie Leppert,** *J. Phys.: Condens. Matter*, 18: 2181-2189 (2006).

2007

"Magnetic/Luminescent Core/Shell Particles Synthesized by Spray Pyrolysis and Their Application in Immunoassays with Internal Standard", D. Dosev, M. Nichkova, R.K. Dumas, S.J. Gee, **B.D. Hammock, K. Liu** and **I.M. Kennedy**, *Nanotechnology* **18,** 055102-1-6 (2007).

"Search for Superconductivity in LiBC at High Pressure", A. Lazicki, C.-S. Yoo, W.J. Evans, H. Cynn, **W. E. Pickett**, J. Olamit, **Kai Liu**, and Y. Ohishi, *Physical Review B**, 75,*** 054507-1-6 (2007).

2007 NEAT BROWN BAG SEMINARS

March 7:	Jim Rustad – "Kinetics of Water and Hydroxide Exchange on Aluminum "Nanoparticles"
March 21:	Sangtae Kim – "Interfacial Effects on Electrical Conduction in Solid Electrolytes"
April 18:	Roland Faller – "Multiscale Modelling of Bio and Nano Materials"
	Warren Pickett – "Accommodation of Charge Mismatch at Insulator-Insulator Interfaces"
May 2:	Frank Osterloh – "Nanomaterials for Chemical Sensing and Photochemical Hydrogen Generation"
	Yayoi Takamura – " The Growth and Characterization of Complex Oxide Thin Films, Heterostructures, and Nanostructures"
May 16:	Sergey Ushakov – "Watching the Paint Dry: Calorimetric Approaches to Interfacial Energies"
June 13:	Alex Navrotsky – "NEAT, Energy, and Our Future, Personally, Locally, and Globally"