Volume 12, Issue 1 FALL 2010

INTERFACES

The Newsletter of the Nebraska Center for Materials and Nanoscience at the University of Nebraska–Lincoln

from the Director...

It is a great pleasure to introduce this issue of Interfaces and to outline several significant events that have happened in the last year in materials and nanoscience research and education. Most exciting is that we have moved our NCMN offices to the new Jorgensen Hall which will house the Physics Department along with several NCMN Central Facilities. We moved our offices and labs in June and by now have found almost all of our files, books and records! The design of Jorgensen Hall is quite attractive with open spaces, wood ceilings and paneling, and multi-floor artwork on the upper floors. We are especially pleased to report that we obtained a highly competitive grant of $6.9 M from the National Institute of Standards and Technology to construct a $14 M Nanoscience Metrology Facility adjacent to Jorgensen Hall. A news release on this development appears on p. 3 of this issue. Construction is underway with completion scheduled for about November, 2011.

Dr. David Sellmyer

Our research funding has accelerated rapidly in the past year. Office of Sponsored Programs data indicate that research grants in FY 09/10 have jumped to about $19.6 M. In addition to the growing quality and activity of our faculty and their programs, we were helped by large grants associated with stimulus funding, the Department of Defense, and the Department of Energy.

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Nanoscience Metrology Facility Grant Awarded, Construction Plans go Forward!

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Transitional MOVE for NCMN

photo by Brian Farleigh

In This Newsletter...

http://www.unl.edu/ncmn

University of Nebraska Lincoln

from the Director...

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In the latter case, we and our partners have obtained a most competitive grant from ARPA-E on new magnetic materials for hybrid vehicles and other energy systems. In this case, our award was one of thirty-seven total grants chosen from 3700 proposals! An article on this grant also appears elsewhere. This grant complements several other grants from DOE and NSF, including one through the Ames Lab entitled "Beyond Rare Earth Magnets" that focuses on the concern that rare-earth metals and magnets may become increasingly scarce.

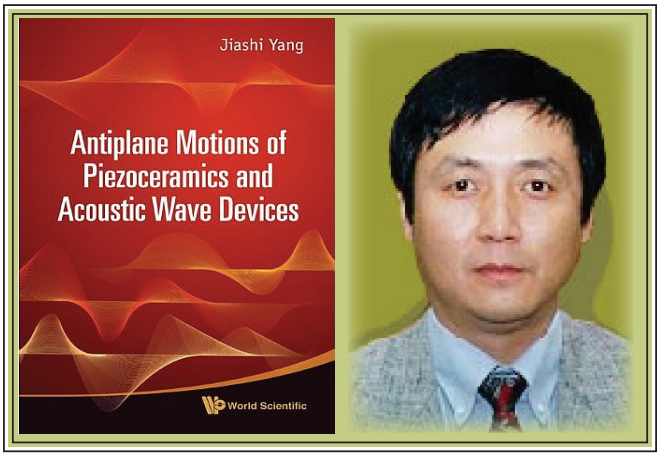
We are pleased that several other well-funded collaborative research programs and teams are continuing or beginning. These include the NSF-supported Materials Research Science and Engineering Center: QSPINS, a DOD-funded group on Nanomaterials for Information, Sensing and Energy Systems, and an NSF-EPSCoR-supported team on Nanoscale Hybrid Materials. We also have obtained an NSF-MRI grant for a high-resolution TEM and a DOD grant for equipment for the Nanoscience Metrology Facility.

Several new faculty have joined NCMN recently. These include Lucia Fernandez-Ballester (EM/ME), Linxia Gu (EM/ME), Tino Hofmann (EE), Jinsong Huang (EM/ME), Rebecca Lai (Chem.), Yusong Li (Civil Eng.), Shadi Othman (Bio. Syst. Eng.), Hector Palencia (UNK), and Angela Pannier (Bio. Syst. Eng.). A new hire in Physics, Dr. Xia Hong, will arrive in January. We also note with sadness the passing of Professor Adrian George in Chemistry.

All of our professors are working extremely hard on their individual and group grants, teaching, and service work for national professional organizations and the university. They are a terrific group and a major resource for our university and state.

David J. Sellmyer

In Memory of
NCMN Valued Member
T. Adrian George,
UNL Chemistry Professor
who passed away February 4 after a courageous battle with pancreatic cancer. A Celebration of Life Service was held in his honor on Saturday, February 27, 2010



Jiashi Yang's Latest Book Published August, 2010

Summary by "World Scientific Books"

This book focuses on dynamic antiplane problems of piezoelectric ceramics. It presents relatively simple theoretical solutions to many such problems, and attempts to use these solutions to demonstrate the operation and design of several acoustic wave devices. Some of the solutions are able to show the underlying physics clearly without the need for numerical computation. The problems treated include the propagation of plate waves, surface waves, interface waves, Love waves, gap waves, and vibrations of finite bodies of various shapes with applications in resonators, mass sensors, fluid sensors, interface sensors, phononic crystals, piezoelectric generators or power harvesters, piezoelectric transformers, power or signal transmission through an elastic wall, and acoustic wave excitation and detection for nondestructive evaluation.

CONTENTS: *Basic Equations, Static Problems, Simple Dynamic Problems, Surface and Interface Waves, Waves in Plates, Waves in a Layer on a Substrate, Free Vibrations in Cartesian Coordinates, Free Vibrations in Polar Coordinates, Forced Vibrations in Cartesian Coordinates, and Forced Vibrations in Polar Coordinates.* ***ISBN-13: 9789814291446***

Dr. Zeng received the 2010 UNL Outstanding Research and Creative Activity Award (ORCA). He has discovered a new form of ice, which was created in high-pressure nanotubes.

Square-Octagon Ice Clathrate With Argon (green) Atoms Inside Octagonal Openings

NIST grant will cover half the $13.8 million cost to construct the Nanoscience Metrology Facility

Released on 1/08/2010 by Office of Communications, University of Nebraska–Lincoln

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The University of Nebraska–Lincoln has received $6.9 million of federal stimulus funding from the National Institute of Standards and Technology to help fund construction of a new nanoscience research facility.

The grant will cover half the $13.8 million cost to construct the Nanoscience Metrology Facility. It will be adjacent to the north end of the new Physical Sciences Building, now under construction north of 16th and Vine streets. Private funds raised by the University of Nebraska Foundation through its Campaign for Nebraska and internal university funds will cover the rest of the construction cost. The National Institute of Standards and Technology is a non-regulatory agency within the U.S. Department of Commerce; the funding comes from the American Recovery and Reinvestment Act of 2009.

"This grant reflects our faculty's success and our strength in nanotechnology and materials science," said UNL Chancellor Harvey Perlman. "We are especially pleased to be able to leverage the state's deferred maintenance investment in the new Physical Sciences Building with this new building."

The 32,000-square-foot Nanoscience Metrology Facility will provide state-of-the-art laboratories, shared research facilities and administrative space in a central location. Core facilities, equipment, labs and faculty currently are located in several buildings across campus.

"It will provide modern central facilities for nanofabrication, electron microscopy, and other synthesis and characterization laboratories," said David Sellmyer, director of the Nebraska Center for Materials and Nanoscience. "Also, it will permit new collaborative research that cannot be pursued in our present obsolete departmental buildings and laboratories that are scattered across campus."

The building will feature flexible, multi-use research space designed to facilitate interdisciplinary collaboration. It will provide a low-vibration, temperature-controlled, low-electromagnetic field environment and clean rooms necessary for world-class research and measurements.

UNL has a growing and nationally recognized research program in nanotechnology and materials science. More than 70 physics, chemistry, engineering and other faculty members from the College of Engineering, College of Arts and Sciences and the Institute of Agriculture and Natural Resources collaborate through the Nebraska Center for Materials and Nanoscience. The university also is home to a National Science Foundation-funded Materials Research Science and Engineering Center focused on nanomagnetics.

"This facility will provide the much needed research space for an interdisciplinary and highly collaborative program of research excellence at UNL," said Prem S. Paul, vice chancellor for research and economic development. "We're grateful to Sen. Ben Nelson and Rep. Jeff Fortenberry for the support they have provided in helping us build our research capacity in nanoscience that addresses important challenges in Nebraska and nationally."

The Nanoscience Metrology Facility is "shovel ready," meaning its design is complete. Bids are expected to be let in February 2010 construction beginning in April and completion slated for summer 2011. The Physical Sciences Building was designed and is being built to accommodate the facility addition. Physics and astronomy faculty will move into the new 121,000-square-foot Physical Sciences Building this spring.

The new facility "will give a tremendous boost to the research capabilities" of UNL's nanoscientists and materials engineers, Sellmyer said. "Research funding is expected to double from its present $11 million per year, with many new discoveries, measurement methods, applications and economic development."

INTERFACES - The Newsletter of the Nebraska Center for Materials and Nanoscience
is published periodically. Information, Announcements and Research Updates should be sent to:
NCMN, Attention: Cindia Carlson-Tsuda, e-mail: *ccarlson-tsuda2@unl.edu*
093 T. Jorgensen Hall, Lincoln, NE 68588-0298

Research Spotlights

Prof. Yongfeng Lu & Dr. Yunshen Zhou

Nano-technology is the science of engineering functional systems and building devices at a subatomic level, and is expected to revolutionize future manufacture technology by bringing products lighter, stronger, greener, cost effective and more precise. Carbon nanotubes (CNTs), including single-walled carbon nanotubes (SWNTs) and multi-walled carbon nanotubes (MWNTs), are ideal building blocks for fabricating nanoscale devices due to their exceptional properties and unique structures. However, to consider the extremely tiny material volume, it is exceedingly challenging to achieve controllable synthesis, manipulation, integration and assembly of CNTs.

By using a home-built laser-assisted chemical vapor deposition (LCVD) system, Dr. Zhou and his colleagues achieved parallel integration of SWNTs into pre-designed micro/nano-architectures through a single-step in-situ growth process. Figure 1(b) shows a schematic diagram of the LCVD growth process. By making use of sharp metallic tips to focus and enhance optical fields, SWNTs would grow selectively at the electrode tips, the highest temperature regions, as shown in Figs. 1(b) and 1(c). By tuning the laser beam polarization, SWNTs could be wired between electrode tips parallel to the laser beam polarization, as shown in Figs. 1(d) to 1(e). Parallel integration of SWNTs into multiple sites was achieved by expanding the laser beam to cover interested regions.

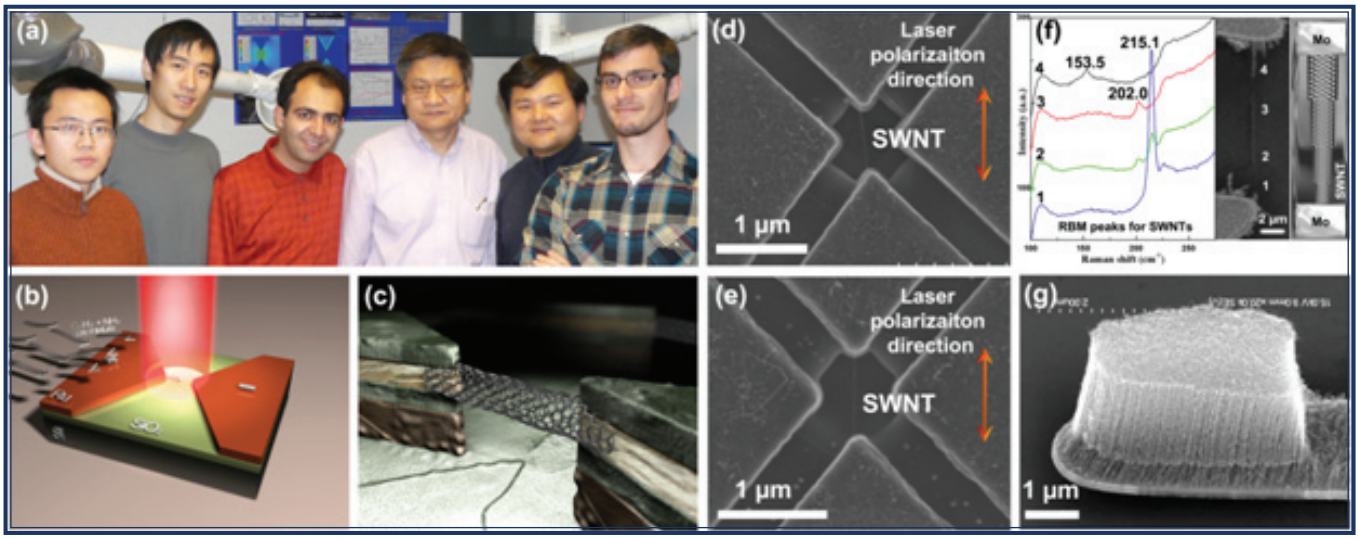


Fig.1: (a) Research team, left to right, Yang Gao, Wei Xiong, Masoud Mahjouri-Samani, Prof. Yongfeng Lu, Dr. Yunshen Zhou, and Matt Mitchell; (b) a schematic diagram of the LCVD fabrication process; (c) a schematic diagram of a SWNT-integrated bridge structure; (d) and (e) SEM micrographs of SWNT-integrated bridge structures; (f) from left to right are Raman spectra, a SEM micrograph and a schematic diagram of a diameter variable SWNT; (g) a SEM micrograph of a vertically aligned carbon nanotube forest grown on a negatively charged electrode.

Band-gaps of semiconducting SWNTs are inversely proportional to their diameters. Forming intra-junctions within individual SWNTs, which is also called band-gap engineering of SWNTs, will provide basic electronic units, such as diode and rectifier, within each tube at a subatomic scale. Based on the temperature sensitive growth of SWNTs, Dr. Zhou and his co-workers successfully synthesized diameter variable SWNTs through the LCVD process, in which laser provides an instant temperature variation at a short time span of several seconds. Figure 1(f) demonstrates Raman spectra of a diameter variable SWNT prepared by quickly adjusting environmental temperature during the growth process. Each section of the SWNT, from 1 to 4, exhibits different Raman shifts, corresponding to gradually increased diameters, as shown in Fig. 1(f). This technique will provide a convenient and cost-effective approach to achieve band-gap engineering of SWNTs and fabrication of in-tube devices.

CNTs of different alignments, such as surface-bounded and vertically aligned tubes, yield applications in different fields. Therefore, growth of CNTs with

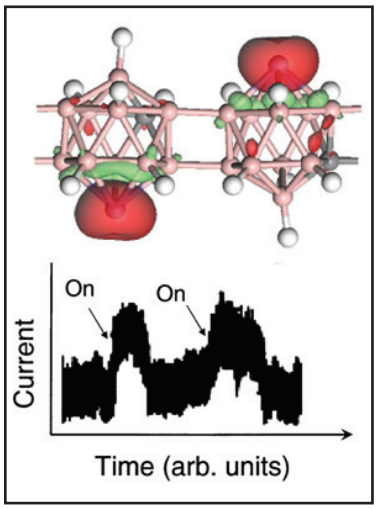
...continued on page 5

controlled alignments is one of the key prerequisites for developing CNT-based devices. Dr. Zhou and his work-fellows achieved an easy approach to control CNT alignments by applying electrical biases of different polarities on metallic electrodes during the LCVD growth process. Surface-bounded CNTs were found to crawl out from the anodes, while vertically aligned CNTs were found to dominate the cathodes, as shown in Fig. 1(g). The alignment control was ascribed to the movement of positively charged catalyst nano-particles in the external electric fields.

Profs. Peter Dowben, Wai-Ning Mei and Jennifer Brand Collaborate

A New Look at Boron Based Semiconductors

Semiconducting boron carbides have been discussed as suitable materials for solid state detectors of slow neutrons for 50 years, but success has only been observed in the last decade. Using plasma-enhanced chemical vapor deposited films, based on a C2B10Hx icosahedra-like building blocks, detection of slow neutrons and neutron-voltaic (similar to photovoltaics, except with neutrons, not light) properties have been demonstrated. These successes may prove important to high efficiency pixilated solid state detectors for neutron scattering, and inexpensive low power monitoring of fissile materials and reactor neutron production.

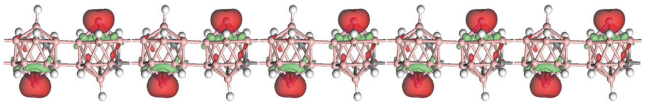


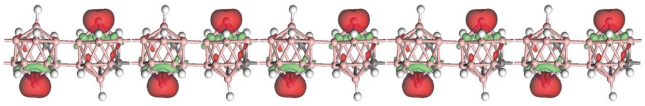
Top: The optimized structure spin distributions of Fe_2-$C_2B_{20}H_{14}$ of the stable ferromagnetic high spin schematic of the co-joined icosahedra structure. As determined from the EXAFS results, the transition metal atoms sit on opposite sides in the apical sites on the adjacent icosahedra. Bottom: The first observation of current generated at zero bias from incident neutrons by a semiconducting boron carbide device.

Key to further development of boron carbide devices is the controlled introduction of impurities to alter the electronic properties (doping). Recently, the successful transition metal (Mn, Fe, Co, Ni) doping of semiconducting boron carbides has proved to be a route to making successful homojunction diodes, and also the means to obtain detailed local structural information about this important but complex material with many polytypes via extended X-ray absorption fine structure (EXAFS) studies. Success in previous attempts to determine the local structure of the undoped semiconducting boron carbides by extended X-ray absorption fine structure (EXAFS) studies has been elusive. Because the transition metal atoms provide a suitable strong scattering center, the local structure has now been obtained for some semiconducting boron carbides using EXAFS at the K-shell of the doping 3d transition metal. Some questions about the local electronic structure of the various boron carbide polytypes can now be addressed.

Peter Dowben with Undergraduate Research Group Members from the University of Puerto Rico *Research titled: "Interface Induced Electron Spin Polarization in Organic and Metal Organic Adsorbates"* is ongoing in collaboration with the research groups of Professors Axel Enders and Alexi Gruverman.

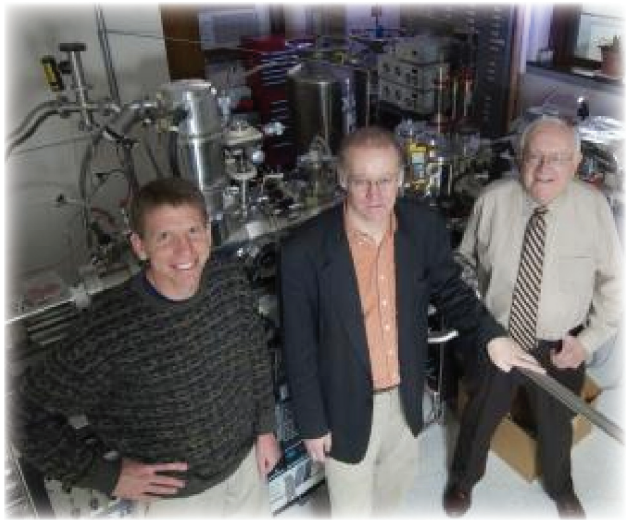
The 3d transition metals dope semiconducting boron carbides in an unusual manner: pair-wise substitution at the apical sites of adjacent icosahedra (Figure). Because of the favored sites, there is a large local magnetic moment associated with the transition metal atoms dimer pairs. Thus semiconducting boron carbides may be have application not only in fabrication of solid state devices with slow neutron detection applications, but in devices with spintronic applications as well.





DOE Grant - *Funds Innovative Nanotechnology Research at UNL*

Released on 12/22/2009 by Office of University Communications



Sellmyer and his UNL colleagues, physicist Ralph Skomski and materials engineer Jeff Shield, are developing materials with stronger magnetic properties that do not contain rare earth metals. They are part of a collaborative team led by the University of Delaware to develop better ways to power hybrid cars, wind turbines and computer discs, among many other applications.

This team, which includes several universities, a federal laboratory and a private company, recently received a three-year, nearly $4.5 million Advanced Research Projects Agency-Energy grant from the U.S. Department of Energy funded by the American Recovery and Reinvestment Act. UNL's share of the grant is $675,000.

Stronger magnets produce more energy for powering wind turbines and hydroelectric generators. They also reduce the size and power consumption of everything from hybrid and electric cars to computer memory storage devices. Lighter-weight vehicles increase gas efficiency and reduce exhaust emissions.

To better manipulate the magnetic properties of materials, the researchers are using nanotechnology to build material at the atomic scale.

The ability to precisely position every atom in a nanoparticle allows full control of the material's magnetic properties.

Collaborators at the University of Delaware, Northeastern University, Virginia Commonwealth University, the Department of Energy's Ames Laboratory and the Electron Energy Corp. also are developing new magnetic nanomaterials, concentrating on techniques that use smaller concentrations of rare-earth metals or composite materials.

Sellmyer said the UNL center's undertaking is the kind of high-risk, high-reward project the Department of Energy is looking for.

NCMN Education and Outreach Update 2010

Dr. Eva Schubert ***Terese Janovec*** ***Dr. Stephen Ducharme***

NCMN now offers many different supportive services for NCMN faculty members related to outreach. Outreach support provides creative options and administrative help to members in fulfilling the Broader Impacts outreach component in NSF grants. A new Education and Outreach Committee was also formed to offer direction and expertise to outreach acitivities. Members are Professors Roger Kirby (PHY), Committee Chair, Wonyoung Choe (CHEM), Stephen Ducharme (PHY), Eva Franke-Schubert (EE), Jeff Shield (ME), and David Sellmyer (PHY), NCMN Director. NCMN participated in a variety of outreach activities this year such as the Big Red Road Show, Sunday Afternoon with a Scientist at the University of Nebraska Museum, Bright Lights Summer Adventures during Engineering Camp, Women in Science Conference, WoPhy09, LPS Professional Development Workshop for science teachers, Osher Lifelong Learning Institute, and many more. Other exciting outreach plans are in the works for the future. We want to thank all faculty who have contributed significantly to our outreach efforts which include Professors Eva Franke-Schubert, Steve Ducharme, Christian Binek, Youngfeng Lu, and Axel Enders.

Recent Achievements of Center Researchers

Outstanding Publications

E. Tsymbal, Karolina Janicka, Julian Velev,-"Quantum nature of two-dimensional electron gas confinement at LaAlO3/SrTiO3 interfaces," was featured on a cover page of Physical Review Letters.
Tan L.-Jiang J., Lima O., Pei Y., **Zeng X**., Forsythe E.-"Dipole-Induced, Thermally Stable Lamellar Structure by Polar Aromatic Silane," J. Am. Chem. Soc., 2009, 131, 900. **Tan L**.-Yan J., Chen Z., **Jiang J**., **Zeng X**., "Free-Standing All-Particle Thin Fibers: A Novel Nanostructure Bridging One- And Two-Dimensional Nanoscale Features," Adv. Mater., 2009, 21, 314.
Tan L.-Guo Z., "Fundamentals and Applications of Nanomaterials", Artech House: Boston, ISBN 978-1-59693-262-3, June 2009 (249 Pages).
S. Ducharme- "Start the Presses," **A. Gruverman**, Nature Materials 8, 9-10 (2009). Invited "News and Views" article.
S. Ducharme-"Dielectric Nanocomposites: An Inside-Out Approach," S. Ducharme, ACS Nano 3 (9), 2447-50 (2009). Invited Perspective article.
D. Berkowitz & Blum-4/19/09 issue of C&EN "Primordial Path to Painkillers." Thanks to an enzyme from an ancient microbe, new options for making optically pure precursors to familiar painkillers have been found.
R. B. Billa, **T.Hoffmann**, **M. Schubert**, and **B.W. Robertson**, "Annealing Effects on the Optical Properties of Semiconducting Boron Carbide," Journal of Applied Physics, 106 (2009), 033515.
G. Harbison's recent paper on 65Cu NMR of a protein was published in Spectroscopy Now.
X. Zeng's paper (with former UNL student *Soohaeng Yoo*) was selected as Editor's Choice of 2009 in the JCP and made the Top 20 Most Downloaded Articles list for March 2010.
X. Zeng's article "Isomer Identification and Resolution in Small Gold Clusters" was highlighted on the The Journal of Chemical Physics home page.
X. Zeng's research on hydrophobicity featured by NSF, e!Science, UNL, Science360, CCN.
X.Z. Li "PCED2.0-A computer program for the simulation of polycrystalline electron diffraction pattern," Ultramicroscopy, 110(2010).
C. Binek - in Frankfurt Germany at the 4th Seeheim Conference on Magnetism "Robust isothermal electrical switching of interface magnetization: a route to voltage-controlled spintronics" (Invited Talk).
Y. Lu - "Self-aligned growth of single-walled carbon nanotubes using optical near-field effects" was highlighted in the Nanotechnology as a cover-image paper, and included in the Highlights 2009 of the Nanotechnology journal.
S. Ducharme -"An Inside-Out Approach to Storing Electrostatic Energy," ACS Nano 3 (9), 2447-2450 (2009).
S. Dowben - Celebrating 20 years of Journal of Physics: Condensed Matter—in honour of Richard Palmer, edited by David Ferry, Peter Dowben, and John Ingelsfield, J. Phys. Cond. Matter 21 (2009).
S. Dowben - J. A. Colón Santana, R. Skomski, V. Singh, V. Palshin, A. Petukhov, Ya. B. Losovyj, A. Sokolov, P. A. Dowben, and I. Ketsman, "Magnetism of Cr-Doped Diamond," J. Applied Physics 105 (2009) 07A930.

Promotions & Tenure

Ruqiang Feng - promotion to Professor, tenured 2010
Mehrdad Negahban - promotion to Professor, tenured 2010
Anuradha Subramanian - promotion to Professor, tenured 2010
Christian Binek - promoted to Assoc.Professor, tenured 2009
Li Tan - promotion to Assoc. Professor, tenured 2010

Faculty Awards and Honors

S. DiMagno recognized by American Chemical Society for noteworthy contributions.
A. Rajca-received a UNL Bessey or Cather Professorship.
E. Schubert-NSF Early Faculty CAREER Award 2009.
Sitaram Jaswal-UNL's Professor Emeritus with the Department of Physics & Astronomy, one of 360 journal reviewers receiving the American Physical Society's Outstanding Referee designation 2009, a lifetime honor. APS has 47,000 physicist members worldwide .
P. F. Williams, UNL's Lott Distinguished Professor Emeritus with the Department of Electrical Engineering, is one of 360 journal reviewers receiving the American Physical Society's Outstanding Referee designation in 2009, a lifetime honor.
Y. Lu - elected as Fellow, Laser Institute of Americal (LIA).
Y. Lu - named the Lott Professor of Electrical Engineering.
X. Zeng received the 2010 UNL Outstanding Research and Creative Activity Award (ORCA). He has discovered a new form of ice (dubbed "Nebraska Ice"), which was created in high-pressure nano-slits.
D. Berkowitz received the 2010 Arts & Sciences Outstanding Research and Creative Activity Award.
W. Choe received the Dean's Award for Excellence in Graduate Education.
R. Lai received an NSF CAREER Award - proposal title: "Ligand-induced Folding in Peptides for Biosensing Applications**".**
Li Tan - 2009 Journal Review Recognition (by frequency and quality): Top 10% reviewer for ACS Nano and Top 20% for Journal of Physical Chemistry.

Invited Talks and Presentations

S. Ducharme "Polarization and Dynamics in Ferroelectric Polyvinylidene Fluoride and Related Copolymer and Oligomer Compounds," S. M. Nakhmanson, J. T. Johnston, R. Korlacki, L. Kobryn, **J. M. Takacs**, *Int'l Symposium on Ferroelectrics and Functionalities*, Colorado Springs *9/27 to 10/1/09* - Invited Talk.
S. Ducharme "Progress in Understanding Ferroelectric Polymers," S. Ducharme, Materials Research Society Fall Meeting, *11/29 to 12/3/10*, Boston - Invited Talk.
S. Ducharme "Ferroelectric Polymers, Their Nanostructures, and Nanocrystals," *V. M. Fridkin, International Symposium, Edinburgh, Scotland*, *8/10* - Plenary Talk, **S. Ducharme** "Probing Ferroelectric Polymers at the Nanoscale," *Microscopy and Microanalysis Aug 1-5, 2010* Portland, OR - Invited Talk.

New Jobs and Promotions

Jie Xiao *- Placement as a Post-Doctoral Associate with Hans-Peter Steinrück at the University of Erlangen, Germany.*
Ning Wu *- Placement as a Post-Doctoral Associate at UNL.*
Srinivas Polisetty *- Placement as a Post-Doctoral Associate at UNL.*
Andrew Baruth *- Placement as a Post-Doctoral Associate with Christopher Leighton at the University of Minnesota.*
Aleksander Wysocki *- Placement as a Post-Doctoral Associate at UNL.*
Christina Othon, *(PhD 2005) has been appointed Asst. Prof. at Wesleyan University in Storrs, Connecticut effective Fall 2010.*
Arosha Goonesekera *(PhD 1998) has joined Carl Zeiss SMT Semiconductor Metrology Systems in Santa Clara, CA.*
Shin Moteki, PhD *- Asst.Prof.at Kyoto University (Aug 09) -* ***Takacs***
Hector Palencia, PhD *- Asst. Prof. at UNK (Aug 09) -* ***Takacs***

Recent Achievements of Center Researchers

Student Awards and Honors

***Joan Dreiling**, a grad. student in Physics, under **Dr. Gay** has been selected to attend the Lindau Nobel Laureate Meeting in Germany this summer 2010.*

***Karolina Janicka** has received the Fling Fellowship for 2010-11*
EE** grad. students **Chad Kamler** and **Craig Zuhlke** were awarded **Woollam Fellowships** for the 2009-10 along with one graduating senior, **Bahar Laderian
Jie Xiao**, PhD* - PHYS and ASTR, *UNL Aug, 2009 Folsom Distinguished Doctoral Dissertation Award Honorable Mention 2010, Humbolt Post-doctoral Fellowship 2010 - **Dowben
Ning Wu**, PhD* - PHYS and ASTR-*UNL, Aug 2009; Post-Doctoral Associate at UNL and Frank and Marie Wheeler Fellowship, UNL 2007-08 - **Dowben
Nan Shao** received the Outstanding Graduate Research Assistant Award Honorable Mention in 2010 - **X. Zeng
Roberto Fabio Delgadillo Moralles** won the departmental outstanding graduate student research award May, 2009 - **Parkhurst
***Robert Jacobberger,** CHME (UNMC) awarded the prestigious Barry M. Goldwater Scholarship 2010 - **Namavar** & Cheung*
Paul Goodman**, Electrochemical Research, SMART program scholarship - **Redepenning

***BS Graduates** (Aug 09- Dec 09):*
Travis Johnston**, BS May, 09 - Math Grad.,USC - **Ducharme
Ben Hage**, BS May 09 - PHYS Grad.,UNL - **Ducharme

NCMN-affiliated Graduates (Aug 09 - Dec 09)

***PhD Graduates:** (May 2009)*
***Andrew Baruth, PhD** - PHYS - **Adenwalla** Thesis: "Exchange Coupling at Cobalt/Nickel Oxide Interfaces"*
***Hao Wang, PhD** - EE - **Y. Lu** Thesis: "Fabrication, Characterization, and Simulation of Photonic Bandgap Structures"*

***PhD Graduates:** (August 2009)*
***Jie Xiao, PhD** - PHYS - **Dowben** Thesis: "The Study of Molecular Band Offsets at the Heteromolecular Interface"*
***Ning Wu**, **PhD**- PHYS - **Dowben** Thesis: "The Electronic Band Structure of CoS2(100)"*
***Xiaokang Shen, PhD** - EE - **Y. Lu** Thesis: "Laser-Induced Breakdown Spectroscopy with Improved Detection Sensitivity, Selectivity, and Reliability"*
***Chad William Killblane, PhD** - CHEM - **X. Zeng** Thesis: Investigations into the structural and electronic properties of small clusters of silicon, gold and carbon"*
***Jack William Maseberg, PhD** - ENGR - **Gay** Thesis: "Fluorescence polarization of atomic, dissociated atomic, and molecular transitions induced by spin-polarized electron impact"*

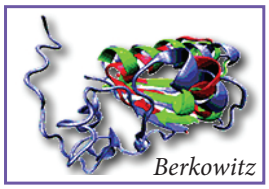
***MS Graduates** (August 2009):*
Celine Marie Hayot, MS** - EM - **Negahban
Joshua Rueben Machacek, MS** - PHYS & ASTR - **Gay
Lucie Denise Rupert, MS** - EM - **Negahban
Phani Kiran Vabbina, MS** - EE - **M. Schubert

***PhD Graduates:** (October 2009)*
***Srinivas Polisetty, PhD** - PHYS - **Binek** Thesis: "Exchange Bias Training Effect in Magnetically Coupled Bilayers"*

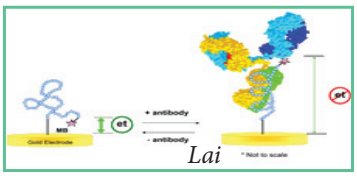
***PhD Graduates:** (December 2009)*
***Ravi Babu Billa, PhD** - ME - **Robertson** Thesis: "Optical Properties of Semiconducting Boron Carbide for Neutron Detection Applications"*
***Roberto Fabio Delgadillo Moralles, PhD** - CHEM - **Parkhurst** Thesis: "Acceptor Detected Fluorescence Resonance Energy Transfer for Measurementsup to 250Å and Biophysical Studies on Core TATA Binding Protein-DNA Complex"*
***Ashwani Kumar Goel, PhD** - ENGR - **Negahban** Thesis: "Thermodynamically Consistent Large Deformation Constitutive Model for Glassy Polymers"*
***Alexey V. Kamenskiy, PhD** - ENGR - **Dzenis** Thesis: "Coupled Hemodynamics and Mechanics of the Repaired Human Carotid Artory"*
***Ocelio V. Lima, PhD** - ENGR **- Li Tan** Thesis: "Self-Organized Nanolayers of Conjugated Organosilane Molecules"*
***Sandra Edith Noriega, PhD** - ENGR - **Subramanian** Thesis: "Role of Scaffold Topography and Stimulation via Ultrasound on the Biosynthetic Activity of Chondrocytes Seeded in 3D Matrices"*
***Srinivas Polisetty, PhD** - ENGR - **Binek** Thesis: "Exchange Bias Training Effect in Magnetically Coupled Bilayers"*
***Chaojun Wang, PhD** - ENGR - **Feng** Thesis: "Multiscale Modeling and Simulation of Nanocrystalline Zirconium Oxide"*
***Aleksander Ludomir Wysocki, PhD** - PHYS - **Belashchenko** Thesis: "Finite Temperature Effects in Magnetic Materials: Model "and ab initio Studies"*

***MS Graduates** (December 2009):*
Lingmei Kong, MS** - PHYS & ASTR- **Gay
Niklas Carl Petter Lingesten, MS** - EM - **Chandra
Chase William Nielsen, MS** - ME - **Shield
Xu Zhang, MS** - CHEM - **Takacs

***PhD Graduates:** (December 2008)*
***Kaijun Yi, PhD** - EE - **Y. Lu**, Dec 2008 Thesis: "Nano-Raman Spectroscopy and Surface Nanostructuring Using Near-Field Optics"*



Berkowitz



Lai

NCMN MEMBER NEWS BRIEFS

Collaborative Research & Grants

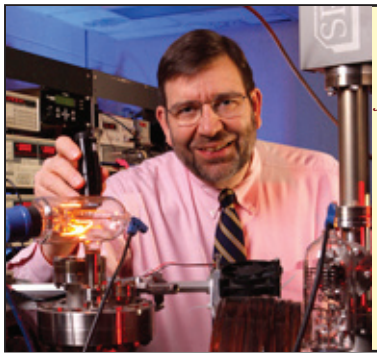
"Nanoscience is on the move at UNL" reports Kevin Abourezk in his Lincoln Journal Star article on Sunday, February 28, 2010. Certainly, it would be hard not to notice that something BIG is going on here amongst members of the Nebraska Center for Materials and Nanoscience. One might even say there's been a "chain reaction" in collaborative research and grant funding, which occurs when one great success challenges another!

Dr. David Berkowitz is collaborating with Columbia University and Stockbridge Pharmaceuticals, Inc. for a new cancer treatment. The licensed technology is the result of a "unique approach molecule-based approach for the targeted treatment of various cancers" was developed in collaboration between the laboratories of Dr. Argiris Efstratiadis, Professor of Genetics & Development at Columbia University, and Dr. Berkowitz, Professor of Chemistry at the University of Nebraska.

Mathias Schubert & 8 UNL co-PIs -NSF: "MRI: Development of an Optical Hall Effect Instrumentation for non-contact Nanostructure Electrical Characterization". 10/1/09-9/30/11
Peter Dowben, Brand, Losovyj, Belashchenko-DTRA Grant: "Novel rare earth semiconductors to enriched lithium borate semiconductor heterojunctions for next generation solid state neutron detectors". 12/15/09-6/14/11
Stephen Ducharme, James M. Takacs, Shireen Adenwalla, David Sellmyer, Alexei Gruverman, Jinsong Huang-*Research Theme:* "Study and Application of Ferroelectric Polymer and Oligomer Thin Films and Nanostructures." ongoing

Dr. Gay Aims to Build a Better Light Bulb

...excerpt from UNL Office of Research Website 2/22/10

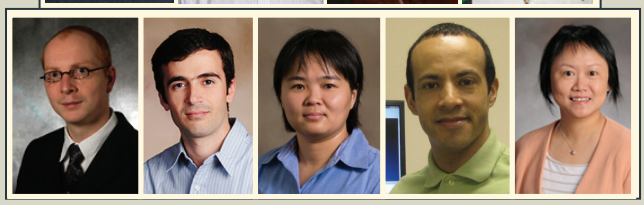


Building a better light bulb, harnessing nuclear fusion or even researching the beginning of life on Earth requires magnetized electrons. To date, creating these special "spin-polarized electrons" is difficult and time-consuming.

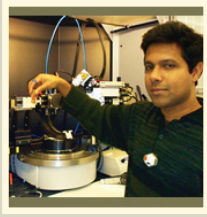
UNL physicist Tim Gay is developing a turnkey source of spin-polarized electrons with a $610,000 grant from the National Science Foundation funded by the American Recovery and Reinvestment Act (ARRA).

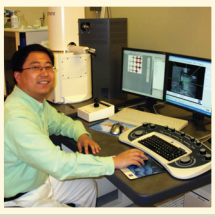
Dr. Dennis J. Diestler has retired with Prof. Emeritus status from the Department of Agronomy and Horticulture this year.

NCMN Welcomes New Faculty Members and FacilitySpecialists



Lucia Fernandez-Ballester (EM/ME), Jinsong Huang (EM/ME), Rebecca Lai (Chem.), Angela Pannier (Bio. Syst. Eng.), Tino Hofmann (EE), Shadi Othman (Bio. Syst. Eng.), Linxia Gu (EM/ME), Hector Palencia (UNK), and Yusong Li (Civil Eng.).





Shah Valloppilly X-Ray, Mat Prep, and Cryogenics and Jiong Hua Nanofabrication

Harnessing Nanotechnology's Potential

...excerpt from College of Arts & Sciences website

*Physicist **Christian Binek** studies magnetism for use in spintronics, which exploits the spin of electrons in addition to their conventional electrical charge. This could lead to exponentially smaller, faster and more powerful computers and electronic devices.*

Multidisciplinary collaboration is essential, Binek said. "We are combining materials that don't happen in nature, which might be causing a chemical reaction that produces unwanted results.

Dr. Jody Redepenning has discovered a one-step process that creates synthetic bone. The process involves an amonomer, L-lactide, made from the ethanol refining process & heated.

Dr. Mathias Schubert announces that Asst. Prof. Tino Hofmann received the 2010 Paul Drude Award at the 5th Intl Conference in Spectroscopic Ellipsometry-Albany, NY on May 22-26.

Dr. Yiqi Yang is hoping medical uses for tiny nanoparticles and nanofilters made from a corn ethanol by-product will be part of the next big thing for the state's biggest crop. The hollowed out particles, made from the corn protein called zein, show potential to deliver cancer-fighting drugs to the brain. Also made from zein, the filter material is about .001 the thickness of a human hair. Pulling zein out of distillers grain, it is a dry, yellowish powder potentially cheap to produce.

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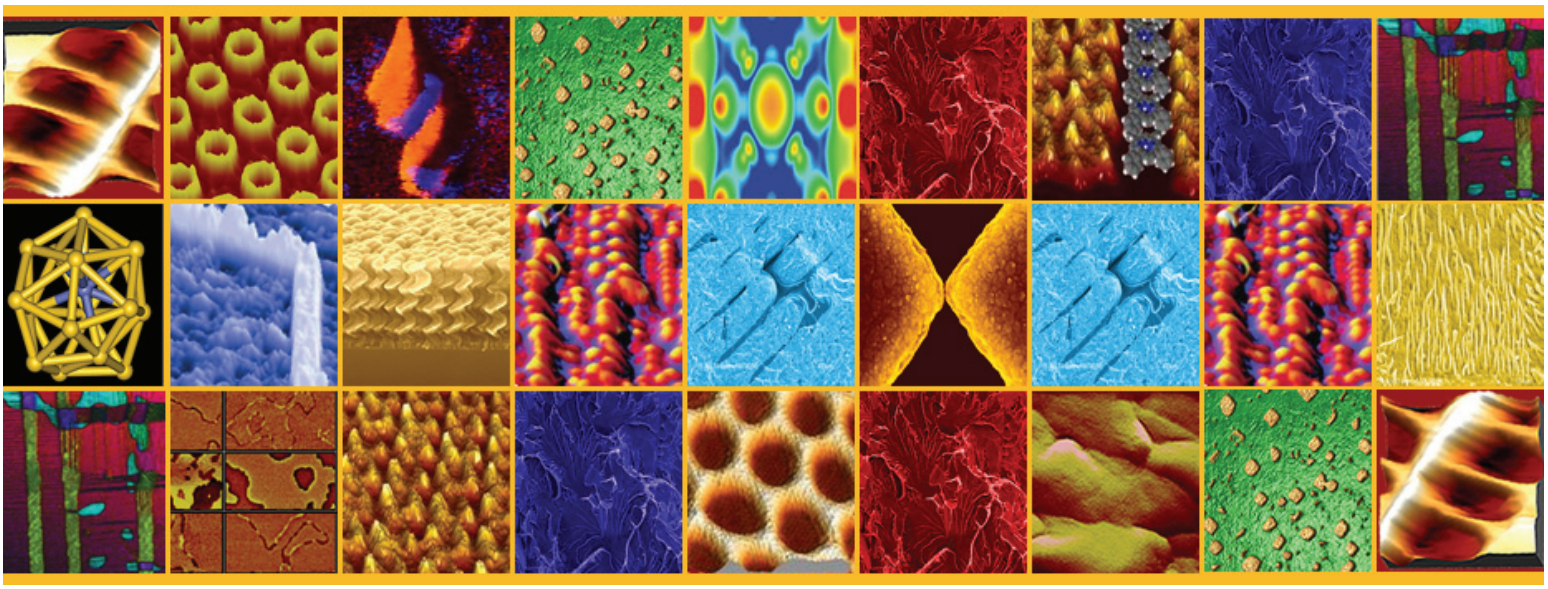
NCMN MEMBERS CELEBRATE MANY RECENT RESEARCH BREAKTHROUGHS IN NANOSCIENCE

....at the Nebraska Center for Materials and Nanoscience



The TEXTURED Images of NANOSCIENCE...