NC STATE UNIVERSITY

NC STATE NANOTECHNOLOGY INITIATIVE

Annual Report FY 2009-2010

In This Report:

- Raleigh named top five “nano metro” cluster
- Center for Molecular Spintronics is launched
- 2,000 K-12 students, parents, and educators participate in NanoDays 2010

"NC STATE CONTINUES TO STRENGTHEN ITS POSITION AS AN EMERGING LEADER IN THE FIELD OF NANOTECHNOLOGY."

Dr. Gregory Parsons, NC State Nanotechnology Initiative Director
and Alcoa Professor of Chemical and Biomolecular Engineering

Note from the Vice Chancellor for Research & Graduate Studies & the Nano Initiative Director	3
About the Nano Initiative	4
Nano Research Activity	5
New Nano Research Centers	6
New Nano-Toxicology Projects	7
Nano Forum & Industry Outreach	8
Nano Education	9
NC State Nano in the News	10
Other Nano Initiative Activities	11
Nano Faculty List	12

From the Vice Chancellor for Research & Graduate Studies

This past year was a period of tremendous growth for nanotechnology activities at NC State. Recognizing the accomplishments of our university and many others in the city, the Project on Emerging Technologies named Raleigh a top-five nano metro cluster in August 2009. The next month, NC State's NSF Center for Molecular Spintronics launched with the goal to develop smaller, faster, and more energy-efficient electronic devices. A new US Department of Education-funded program focusing on nanoscale electronic and energy materials offered its first fellowship awards to NC State graduate students in January 2010. In the spring, the Nano Initiative's faculty forum promoted cross-disciplinary collaborations.

These accomplishments and activities reflect the university's strong commitment to the growth of its nanotechnology research and education programs, investing in state-of-the-art facilities, and attracting excellent faculty and students. The activities I described above, and many more nanotech efforts, are highlighted in this document—the NC State Nanotechnology Initiative's FY 09-10 Annual Report. We hope you enjoy learning more about our efforts, and we look forward to continuing to partner with you to promote nanotechnology education and research in the future.

Sincerely,

Terri L. Lomax

Dr. Terri L. Lomax

From the Nanotechnology Initiative Director

From the creation of research centers to flourishing education activities, The NC State Nanotechnology Initiative supported efforts in FY 09-10 that continue to strengthen the university's position as a leader in the field of nanotechnology:

- Assisted with more than 26 inter-disciplinary nanotech research proposals
- Hosted a NC State Faculty Nanotechnology Integration Forum to highlight new faculty's research as well as exciting cross-disciplinary collaborations
- Sponsored NanoDays 2010, an annual event that introduces nanoscale science to K-12 students, teachers, and the general public
- Received 86,000 page views on the Nano@NC State web site since its December 2007 launch
- Sponsored and actively participated in the 2009 Environmentally Responsible Development of Nanotechnology Conference and the 2010 NC Nanotechnology Commercialization Conference

We look forward to continue working with you to strengthen and expand our many nanotech efforts.

Sincerely,

GNParsons

Dr. Gregory N. Parsons

ABOUT THE NANO INITIATIVE

MISSION & VISION

NC State is an emerging leader in the field of nanotechnology. Cutting-edge, interdisciplinary efforts among more than 100 faculty are producing new and exciting discoveries at the nanometer level. To coordinate these expanding efforts, NC State created a Nanotechnology Initiative with these ***goals***:

- Foster interdisciplinary nanotechnology research and infrastructure
- Expand nanotechnology academic programs and educational outreach
- Support nanotechnology-focused collaborations with industry

Our ***mission*** is to address fundamental understanding of nanomaterials and nanoscale characterization and processing to solve problems and produce products of value to the people of North Carolina.

PARTICIPATION

Administration

Gregory Parsons, PhD	Director of NC State Nanotechnology Initiative, Alcoa Professor of Chemical & Biomolecular Engineering
Alison Stieglitz, MPA	Coordinator of NC State Nanotechnology Initiative

Colleges Represented

Agriculture & Life Sciences
Education
Engineering
Humanities & Social Sciences
Management
Natural Resources
Physical & Mathematical Sciences
Textiles
Veterinary Medicine

Nanotechnology Initiative Supporters

NC State Vice Chancellor for Research & Graduate Studies • William R. Kenan, Jr. Institute for Engineering, Technology & Science • NC State College of Engineering • NC State College of Physical & Mathematical Sciences

WEB PRESENCE: NANO@NC STATE

Since our web site (*www.ncsu.edu/nano*) launched in December 2007, it has had 86,000 page views from people in 108 countries looking for the latest information on NC State's nanotech research, education, and outreach. This past year, we worked with NC State's Environmental Health & Safety Center to add a "Nano Safety" section. The faculty database now features 70 faculty profiles. We also receive regular inquiries through the site from faculty at peer institutions; NC State students, faculty, and staff; and K-12 students and teachers on topics such as nano summer programs, classes, internships, and seminars.

NANO@NC STATE

Since Nano@NC State was created:

- 86,000 page views
- Most visited section: Faculty Profiles
- Top US states visiting site, after NC:
  1. California
  2. New York
  3. Texas
  4. Massachusetts
- Top countries visiting site, after US:
  1. India
  2. China
  3. United Kingdom
  4. Germany

NANO RESEARCH ACTIVITY

Raleigh named a top 5 "nano metro" area

In a 2009 study by the Project on Emerging Nanotechnologies (PEN), Raleigh has moved into the top five cities designated as "nano metro" clusters. North Carolina broke into the top 10 states in the nation with the highest concentration of nanotechnology companies, universities, research laboratories, and organizations. PEN is a partnership between the Woodrow Wilson International Center for Scholars and the Pew Charitable Trusts. PEN's study and interactive map (*right*) can be found at *www.nanotechproject.org*.

Proposal Submissions

The Nano Initiative actively promotes cross-disciplinary research efforts. Through June 2010, the Initiative led, sponsored, or leveraged proposals that brought more than $10.8 million in research funding to NC State. In FY 09/10, the Initiative offered assistance with more than 26 multi-disciplinary nanotechnology proposals in departments across campus:

Proposal/Program	Agency	Date Sent	Funded	Pending
Center for Lignocellulose Structure and Formation	DOE-EFRC	2009	X	
Center for Molecular Spintronics	NSF-CCI	2009	X	
Comparative In Vivo Biodistribution of Characterized Manufactured Nanomaterials	NIH-NIEHS	2009	X	
Lung Toxicity of Carbon Nanotubes in Models of Pre-Existing Respiratory Disease	NIH-RC2	2009	X	
Nanofiber Coating by ALD and MLD	DTRA	2009	X	
Nanomanufacturing using Atmospheric Pressure Processes	NSF	2009	X	
Nanoscale Electronic & Energy Materials GAANN Program (09-12) and (10-13)	ED-GAANN	2009	X	
Nanostructured Materials for Renewable Alternative Energy	DOE-EERE	2009	X	
Acquisition of Infrared Spectroscopic Ellipsometer (IRSE)	DURIP-DOD	2009		X
Chronic Lung Injury in Response to Nanomaterials	NIH	2009		X
Developing a Scientific Sense of Scale	NSF-NUE	2009		X
Rapid & Reliable Evaluation of Lignocellulosic Biomass Accessibility	NIS	2009		X
Acquisition of Extreme Resolution Scanning Electron Microscope	NSF-MRI	2010		X
Acquisition of Spin Polarized Photoelectron Spectroscopy System	NSF-MRI	2010		X
Connecting Research from Multiple Disciplines for Contextualized Ethics Education	NSF	2010		X
Dielectrics on GaN	DOD-MURI	2010		X
Engineering Research Centers for SAFE Systems	NSF-ERC	2010		X
Nanostructured Materials for Renewable Alternative Energy	DOE-EERE	2010		X
Properties Influencing Cellular Uptake and In Vivo Disposition of Nanomaterials	NIH-NIEHS	2010		X
RTP National Solar Fuels Laboratory	DOE	2010		X

NEW NANO RESEARCH CENTERS

DOE CENTER FOR LIGNOCELLULOSE STRUCTURE & FORMATION

Candace Haigler, a CLSF Principal Investigator, is shown with the Cressington CFE-60 freeze structure and etching system used in preparing plant cell samples before observation in a transmission electron microscope.

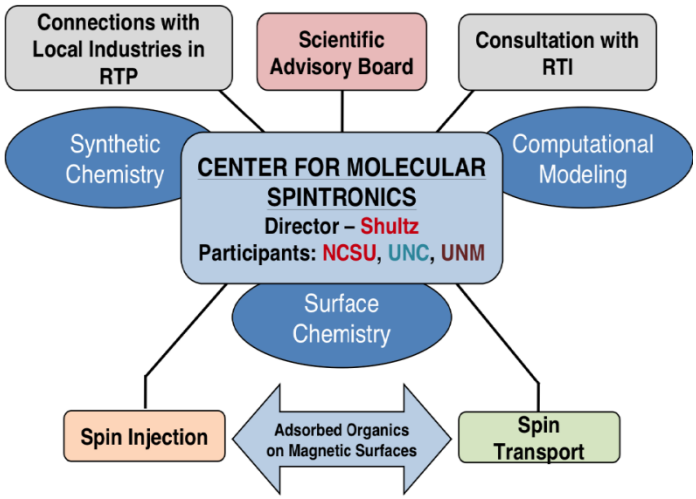
The US Department of Energy (DOE) Center for Lignocellulose Structure and Formation (CLSF) is an Energy Frontiers Research Center funded by a five-year, $21 million grant from DOE in August 2009. Penn State is the lead institution, partnering with NC State (receiving $2.8 million for the project period) and Virginia Tech.

The CLSF is focused on developing a detailed understanding of lignocellulose, the main structural material in plants, from cellulose synthesis and fibril formation to a mature plant cell wall, forming a foundation for significant advancement in sustainable energy and materials.

Dr. Candace Haigler—Professor of Crop Science and Plant Biology—is leading the effort at NC State with her colleagues Dr. Alexei Smirnov of the Department of Chemistry and Dr. Yaroslava Yingling of the Department of Materials Science and Engineering.

NSF CENTER FOR MOLECULAR SPINTRONICS

NC State researchers, partnering with UNC-Chapel Hill and the University of New Mexico, received a three-year, $1.2 million grant in Fall 2009 from the National Science Foundation(NSF)'s Center for Chemical Innovation Program to create a new NSF Center for Molecular Spintronics at NC State. The grant focuses on the emerging field of molecular spintronics, used to develop smaller, faster, more energy-efficient electronic devices with increased storage capacity.



The Principal Investigator (PI) is Dr. David Shultz (Chemistry). Co-PIs are Drs. Dan Dougherty, Marco Buongiorno-Nardelli, and Jack Rowe (Physics); Joe Tracy (Materials Science and Engineering), and Gail Jones (Math, Science, and Technology Education).

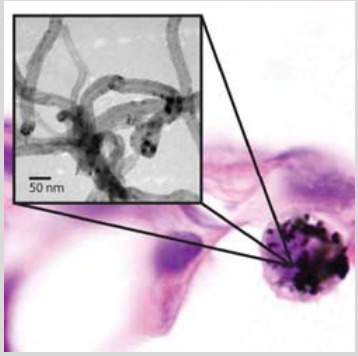
NEW NANO-TOXICOLOGY PROJECTS

LUNG TOXICITY OF CARBON NANOTUBES

In Fall 2009, NC State received a two-year, $773,000 grant from the National Institutes of Health for the project "Lung Toxicity of Carbon Nanotubes in Models of Pre-Existing Respiratory Disease."

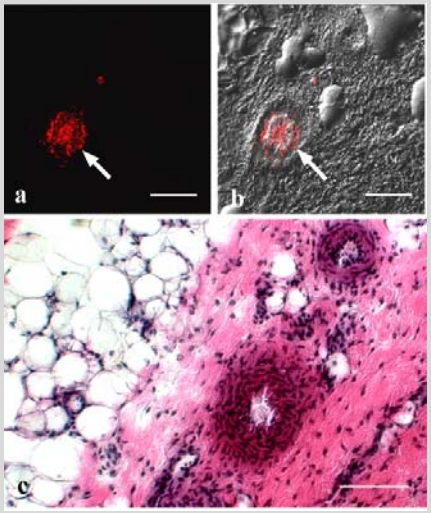
Dr. James Bonner, Associate Professor of Environmental and Molecular Toxicology, is the Principal Investigator (PI) with Co-PI Dr. Gregory Parsons, Alcoa Professor of Chemical and Biomolecular Engineering.

The project focuses on the molecular mechanisms through which engineered nanomaterials cause lung inflammation, fibrosis, and pleural diseases in established models of pre-existing lung inflammation.



In a recent study published in Nature Nanotechnology, Dr. Bonner and his co-authors demonstrated how inhaled carbon nanotubes accumulate within cells at the pleural lining of the lung as visualized by light microscopy.

COMPARATIVE IN VIVO BIODISTRIBUTION OF NANOMATERIALS



These pictures, obtained through Laser Scanning Confocal Microscopy, illustrate the distribution of quantum dot nanomaterials in perfused skin and were published in Nano Letters. (a) Confocal fluorescence image, (b) Differential interference contrast overlay depicting the capillary in the skin, (c) Light micrograph of same area stained with hematoxylin and eosin for orientation.

Dr. Nancy Monteiro-Riviere, Professor of Investigative Dermatology and Toxicology, was awarded a two-year, $658,000 grant in Fall 2009 from the National Institutes of Health for a project titled "Comparative In Vivo Biodistribution of Characterized Manufactured Nanomaterials."

The project objective is to characterize the physicochemical interactions between manufactured carbon nanomaterials and biological systems by studying where nanomaterials go in the body. Research will include oral, intravenous, and dermal exposures in rats and pigs with radiolabelled fullerenes. Dr. Monteiro-Riviere is part of the Center for Chemical Toxicology Research and Pharmacokinetics in the College of Veterinary Medicine.

NANO FORUM & INDUSTRY OUTREACH

SPRING 2010 NC STATE FACULTY NANO-TECHNOLOGY INTEGRATION FORUM

More than 40 NC State faculty attended this March 23rd event on Centennial Campus. Participants shared information on their nanotech research to spark new ideas for cross-disciplinary collaborations. This Nano Initiative event was sponsored by the Vice Chancellor for Research & Graduate Studies and the William R. Kenan, Jr. Institute for Engineering, Technology & Science.

NANO FACULTY JOINING NCSU 2007-2009

- Daniel Dougherty, "*Surface Science for Organic Spintronics*"
- Yaroslava Yingling, "*Modeling of Nucleic Acids-Based Materials*"
- David Berube, "*Social Science of Nanoscience*"
- Michael Dickey, "*A Micromoldable Liquid Metal for Ultra-Stretchable Electronics*"
- Thomas Ward, "*Droplet Production via Interfacial Chemical Reaction: A Route to Nano-Emulsions*"
- Owen Duckworth, "*Biogeochemistry of Natural and Anthropogenic Nanoparticles*"

CROSS-DISCIPLINARY NANO PROJECTS

- David Shultz, "*NSF Center for Chemical Innovation: Center for Molecular Spintronics*"
- James Bonner, "*Nanotechnology: A New Risk Factor for Occupational Lung Diseases?*"
- Jesse Jur, "*Nanotechnology Energy Laboratory*"
- Nancy Monteiro-Riviere, "*Do Sunscreens Containing Titanium & Zinc Nanoparticles Penetrate Normal and UVB Damaged Skin?*"

SHORT PRESENTATIONS

- Dieter Griffis, "*Analytical Instrumentation Facility Update*"
- Yong Zhu, "*Semiconductor Nanowires: Mechanics and Related Applications*"
- Elizabeth Loboa, "*Nanomaterials and Stem Cells*"
- Carl Koch, "*Research on Bulk Nanostructured Materials in the MSE Department*"
- Patricia McClellan-Green, "*Gender Specific Effects, Endocrine Disruption and Maternal Transfer of Engineered Nanoparticles*"
- Roger Narayan, "*Laser Processing of Micro- and Nanostructured Biomaterials*"

NANO COMMERCIALIZATION

Nano Technology Transfer

This past year, NC State had many commercialization successes in the field of nanotechnology:

- NC State was awarded 25 nano- and micro-technology patents.
- NC State researchers submitted 19 nano- and micro-technology patent applications, which are pending review.
- Two nano start-ups launched:
  -NanoSpin aims to be the cost leader in the production of custom nanofibers.
  -Ironwood is developing formable bioceramic nanocomposites to serve as anchors for dental implantation.

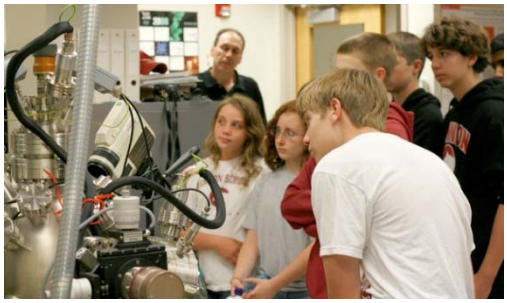
North Carolina Nanotechnology Commercialization Conference – Spring 2010

The Nano Initiative was a sponsor of this NC Department of Commerce conference, joined the steering committee, and hosted a booth in the Exhibitor Hall.

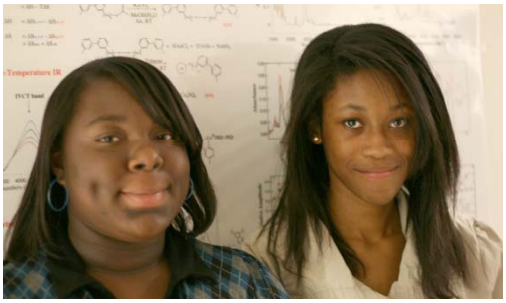
NC State presentations included: Dr. James Bonner: *Nanotech, safety, risk & the environment;* Dr. Jesse Jur: *Nanotech is everywhere, but what is it?;* Chris Cummings: *Media-savvy nano;* Dr. Blanton Godfrey*: Nano applications in military and defense;* and Michael Zapata III: *The "business" side of nanotechnology.*

NANO EDUCATION

NANODAYS 2010



NC State NanoDays, an annual event that opens the world of nanoscale science to K-12 students, educators, and parents throughout the state, was a huge success in 2010. Nearly 2,000 people from across North Carolina participated in the April 23rd event led by Dr. Gail Jones of the College of Education.



The Nano Initiative is a primary sponsor of NanoDays. Participants this year enjoyed a variety of activities, including:

- Nanotech demonstrations, such as photolithography and buckeyball assembly, led by College of Education students;
- A guest lecture by physicist Marco Buongiorno-Nardelli;
- Tours of research and microscopy labs in Physics, Chemistry, Materials Science and Engineering, and Textiles; and
- An exhibit by the NC Museum of Life & Sciences.

A highlight of the day was a "nano ice cream" demonstration and tasting led by Dr. Jones and her students. The ice cream is made with liquid nitrogen using nanoscale science techniques. A video slideshow of the day's activities can be found on the Nano @NC State web site (*www.ncsu.edu/nano/education).*

New Nano Graduate Fellowship Program

In July 2009 and April 2010, NC State was awarded fellowship slots for its Nanoscale Electronic and Energy Materials (NEEM) program from the US Department of Education's Graduate Assistance in Areas of National Need (GAANN) initiative. The program's goal is to prepare graduate students to engage in innovative research and teaching careers in nanoscale electronic and energy materials at state, regional, and national levels. Program contact: Dr. David Shafer (*david_shafer@ncsu.edu*).

Proposed Master of Nanoengineering Degree

Dr. Jay Narayan of Materials Science & Engineering is leading an effort to create a Master of Nano-engineering degree through NC State College of Engineering's Online Distance Education Network. Students in the program will specialize in one of three areas: (1) Materials Science in Nano-engineering, (2) Nanoelectronics & Nanophotonics, or (3) Biomedical Sciences in Nanoengineering. Program contacts: Dr. Narayan (*j_narayan@ncsu.edu*); Dr. Lew Reynolds (*lew_reynolds@ncsu.edu*).

Nano Course Listings on NANO@NC STATE

Dozens of NC State undergraduate and graduate courses related to nanotechnology in departments across campus are listed, by semester, on the Nano@NC State web site (*ncsu.edu/nano/education*).

NC STATE NANO IN THE NEWS

HIGHLIGHTS FROM FY 2009-2010

July 2009

NSF FREEDM Systems Center receives $1.3 million to study battery technology. The US Department of Energy awards NC State a grant to improve batteries that power plug-in hybrid electric vehicles.

August 2009

New technology cuts industrial odors and pollutants. Praveen Kolar, Asst. Professor of Biological & Agricultural Engineering, develops an inexpensive treatment process using a nanoscale film that significantly lessens odors from poultry rendering operations. (*Transactions of the American Society of Agricultural & Biological Engineers,* 08/09*)*

September 2009

Engineers create guide for controlling the structure of nanoparticles. The work of Asst. Professor Joe Tracy of Materials Science & Engineering and his co-authors serves as a "how-to" guide for others on controllably creating hollow, solid, and amorphous nanoparticles. (*Chemistry of Materials*, 09/16/09)

October 2009

Dr. Jay Narayan

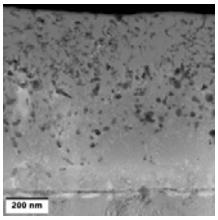
New material boosts data storage, saves energy. Engineers led by Jay Narayan, John Fan Family Distinguished Professor of Materials Science & Engineering, create a material that could allow a fingernail-size computer chip to store the equivalent of 250 million pages of text. (*Journal of the Minerals, Metals & Materials Society*, 06/09)

November 2009

Nanowires pave way for nanodevices. New research, led by Asst. Professor Yong Zhu of Mechanical & Aerospace Engingeering, shows that silicon nanowires are more resilient than their larger counterparts—paving the way for smaller nanoelectronics and nanosensors. (*Nano Letters*, 11/11/09)

February 2010

Gail Jones discusses nanoscience education with eGFI. Gail Jones, Professor of Math, Science & Technology Education, discusses nanoscience education in an article by eGFI, a newsletter and web site of the American Society of Engineering Education. (*http://teachers.egfi-k12.org/nano-in-the-classroom*)



Cross-sectional transmission electron microscope image of the functionally graded smart coating

Smart coating enables safer hip, knee, and dental implants. Afsaneh Rabiei, Assoc. Professor of Mechanical & Aerospace Engineering and Biomedical Engineering faculty member, and her co-authors create a "smart coating" (*image at left*) that helps surgical implants bond more closely with bone and ward off infection. (*ActaBioMaterialia*, 01/10)

March 2010

David Berube introduces new nano YouTube channel. The Public Communication of Science & Technology Project, directed by Professor of Communication David Berube, creates a YouTube channel to improve public communication on science and technology. (*www.youtube.com/user/PCOSTPROJECT*)

May 2010

Microneedle antimicrobial techniques spur innovation. Researchers, including Biomedical Engineering Professors Nancy Monteiro-Riviere and Roger Narayan, develop new approaches for adding antimicrobial properties to microneedles (*front cover image*). (First International Conference on Microneedles, 05/24/10)

Hiding risks can hurt support for nanotech. An ASU-funded national survey on attitudes toward medical applications using nanotechnology by Assoc. Professor of Political Science Michael Cobb and others shows support for the technology grows when the public is told of its risks and benefits.

OTHER NANO INITIATIVE ACTIVITIES

GUEST LECTURERS & VISITORS

This past year, the Nano Initiative sponsored several visits by nanotechnology-focused scholars and government officials to NC State:

Andrew Teplyakov. On September 23, 2009, Dr. Andrew Teplyakov, Associate Professor of Physical Chemistry at the University of Delaware, presented a seminar titled "Tuning the chemical properties of thin film surfaces: From solid inorganic films to biosensors." During his visit to NC State, Dr. Teplyakov met with faculty from the Chemical Engineering and Materials Science and Engineering Departments as well as with students in Dr. Gregory Parsons's research group.

John A. Rogers. On November 24, 2009, Dr. John Rogers, Lee J. Flory Founder Chair in Engineering Innovation and Professor of Chemistry at the University of Illinois-Urbana, presented "Materials for stretchable electronics: From hemispherical digital imagers to devices for cardiac electro-physiology." During his visit, Dr. Rogers toured the NCSU Nanofabrication Facility and Analytical Instrumentation Facility and met with faculty in Electrical and Computer Engineering, Chemical Engineering, and Materials Science and Engineering.

Randy K. Avent. On March 15, 2010, Dr. Randy Avent, Chief Scientist in the Department of Defense's (DOD) Basic Science Office, visited NC State to meet with faculty and top administrators around campus. Dr. Avent shared the DOD's strategic plan for defense investments with the Vice Chancellor for Research and Graduate Studies and with researchers and administrators from the Physics, Chemistry, Computer Science, and Materials Science and Engineering Departments.

NANO COLLABORATIONS

- The NC State Nano Energy Laboratory was featured in a Public Service Announcement produced by the NC State Sustainability Office in Spring 2010.
- Nano Initiative staff and other NC State faculty participated in the Environmental Health Collaborative's October 2009 Nano Summit. NC State faculty presented at the event and participated in creating a guidance document that highlights critical issues and provides recommendations on nano-enabled product development for businesses and policymakers.
- Nano Initiative Director Gregory Parsons gave a presentation introducing NC State's Nano Initiative and nanotechnology research to NC State Freshmen at the Faculty Conversations Scholars Forum in October 2009 and the Raleigh, NC Rotary Club in December 2009.

NANO FACULTY

This list includes the names of some of the NC State faculty involved in nanotechnology research. For more information on these faculty members, visit the Nano@NC State web site at ncsu.edu/nano.

Nina Strömgren Allen
Professor Emeritus
Plant Biology

David E. Aspnes
Distinguished University Professor; National Academy of Sciences Member
Physics

Ted Baker
Associate Professor
Management, Innovation & Entrepreneurship

Salah M. Bedair
Professor
Electrical & Computer Engineering

Jerry Bernholc
Drexel Professor; CHiPS Director
Physics

David M. Berube
Professor
Communication

James C. Bonner
Associate Professor
Environmental & Molecular Toxicology

Donald W. Brenner
Kobe Steel Distinguished Professor
Materials Science & Engineering

Marco Buongiorno-Nardelli
Professor
Physics

Ruben G. Carbonell
Kenan Distinguished Prof.; Kenan Institute & BTEC Dir.
Chemical & Biomolecular Engineering

Laura I. Clarke
Associate Professor
Physics

Michael D. Cobb
Associate Professor
Political Science

Karen E. Daniels
Assistant Professor
Physics

Joseph M. DeSimone
William R. Kenan, Jr. Distinguished Professor
Chemical & Biomolecular Engineering

Michael Dickey
Assistant Professor
Chemical & Biomolecular Engineering

Jingyan Dong
Assistant Professor
Industrial & Systems Engineering

Owen Duckworth
Assistant Professor
Soil Science

Kirill Efimenko
Research Asst. Professor
Chemical & Biomolecular Engineering

Michael J. Escuti
Assistant Professor
Electrical & Computer Engineering

Michael C. Flickinger
Professor; BTEC Assoc. Dir. of Academic Programs
Chemical & Biomolecular Engineering & Microbiology

Stefan Franzen
Professor
Chemistry

NANO FACULTY

Paul D. Franzon
Professor
Electrical & Computer Engineering

Jan Genzer
Celanese Professor
Chemical & Biomolecular Engineering

Tushar K. Ghosh
Professor
Textile Engineering, Chemistry & Science

Russell E. Gorga
Associate Professor
Textile Engineering, Chemistry & Science

Christopher B. Gorman
Professor & Director of Graduate Studies
Chemistry

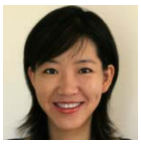
Dieter Paul Griffis
Research Associate Professor; Director of AIF
Materials Science & Engineering

Keith E. Gubbins
Clark Dist. University Prof.; Natl. Acad. of Eng. Member
Chemical & Biomolecular Engineering

Candace H. Haigler
Professor
Crop Science; Plant Biology

Hans Hallen
Professor
Physics

Ayman I. Hawari
Professor; Nuclear Reactor Program Director
Nuclear Engineering



Lin He
Assistant Professor
Chemistry

Mark Hoefer
Assistant Professor
Mathematics

Gail Jones
Professor
Mathematics, Science & Technology Education

Jesse S. Jur
Research Assistant Professor
Chemical & Biomolecular Engineering

Saad A. Khan
Alcoa Professor
Chemical & Biomolecular Engineering

Carl C. Koch
Kobe Steel Distinguished Professor
Materials Science & Engineering

Jacqueline Krim
Professor
Physics

Steven A. Lommel
Professor; Asst. Vice Chancellor for Kannapolis Campus
Plant Pathology; Genetics

Lucian A. Lucia
Associate Professor
Forest Biomaterials

Tzy-Jiun Mark Luo
Assistant Professor
Materials Science & Engineering

Jon Paul Maria
Associate Professor
Materials Science & Engineering

Patricia D. McClellan-Green
Research Assistant Professor
Environmental & Molecular Toxicology

Marian G. McCord
Associate Professor
Biomedical Engineering; Textile Engineering, Chemistry & Science

Anatoli Melechko
Associate Professor
Materials Science & Engineering

NANO FACULTY

Stephen Michielsen
Associate Professor
Textile Engineering, Chemistry & Science

Veena Misra
Professor
Electrical & Computer Engineering

Nancy Monteiro-Riviere
Professor
Biomedical Engineering; CCTRP; Veterinary Medicine

Jagdish Narayan
John C. Fan Distinguished Chair Professor
Materials Science & Engineering

Roger Narayan
Professor
Biomedical Engineering

Mehmet C. Ozturk
Professor; TNLC & NNF Dir.
Electrical & Computer Engineering

Gregory N. Parsons
Alcoa *Professor; Nanotech Initiative Director*
Chemical & Biomolecular Engineering

Melissa Pasquinelli
Assistant Professor
Textile Engineering, Chemistry & Science

Thomas P. Pearl
Assistant Professor
Physics

Behnam Pourdeyhimi
Associate Dean; William A. Klopman Distinguished Professor, Director of NCRC
Textile, Apparel Tech & Mgmt

Orlando J. Rojas
Associate Professor
Forest Biomaterials

Sharon Schulze
Director
Science House

Steven Shannon
Associate Professor
Nuclear Engineering

Bruce Sherwood
Professor Emeritus
Physics

Alex I. Smirnov
Professor
Chemistry

Richard J. Spontak
Professor
Chemical & Biomolecular Engineering; Materials Science & Engineering

Alan E. Tonelli
INVISTA *Professor of Fiber & Polymer Chemistry*
Textile Engineering, Chemistry & Science

Joseph B. Tracy
Assistant Professor
Materials Science & Engineering

Orlin D. Velev
INVISTA *Professor*
Chemical & Biomolecular Engineering

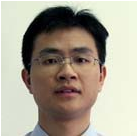
Glenn M. Walker
Assistant Professor
Biomedical Engineering

Thomas Ward
Assistant Professor
Mechanical & Aerospace Engineering

Yaroslava G. Yingling
Assistant Professor
Materials Science & Engineering

Xiangwu Zhang
Assistant Professor
Textile Engineering, Chemistry & Science

Yuntian Zhu
Professor
Materials Science & Engineering



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