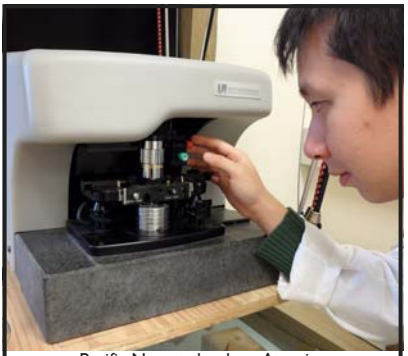

Photo Active
Nanoscale
Systems
(PANS)
A Research Collaborative

PANS—An Interdisciplinary, Multi-Institutional Partnership

The Photo Active Nanoscale Systems (PANS) Research Group was developed in response to the need for research and development in the area of novel materials and devices to address the energy challenge, and now constitutes the largest and most successful multi-disciplinary research collaborative in South Dakota.

Project participants are creating new materials and developing new devices in the area of photo-active nanoscale systems and addressing research challenges associated with photovoltaics, direct write for flexible electronics, and the use of nanostructured materials for converting solar energy into chemical fuels.

The group includes over 80 faculty, research staff, graduate and undergraduate students from Augustana College, Black Hills State University, South Dakota School of Mines & Technology, South Dakota State University, and the University of South Dakota. In collaboration, the PANS group has demonstrated the ability to bring higher education institutions together to build regional research facilities and STEM (Science, Technology, Engineering and Mathematics) infrastructure.



Pacific Nanotechnology Atomic Force Microscope

The activities of PANS will have a broader impact as we seek to engage diverse sets of stakeholders from both the public and private sectors. Although significant resources are devoted to scientific discovery, our programs include aggressive, yet culturally sensitive efforts, to attract Native Americans and students in grades K-12 to consider science as a career.

PANS Focus Areas

The PANS project is divided into three areas of research focus, each comprised of multi-institutional, interdisciplinary clusters of faculty and students with a unique vision for capitalizing on new developments in nanotechnology to create the next generation of photovoltaics, revolutionize the use of solar energy for fuel production, and create new industries for the application of direct-write electronics.

PANS includes efforts to develop a new class of solar cells that are capable of converting light in the near-infrared region to the visible region, thus recovering a portion of the energy that is currently lost. Efforts are also directed to the development of low cost fabrication technologies for solar cell production, including printing and roll-to-roll processing. Nanostructured materials are being developed to mimic photosynthesis as an additional approach to improve device efficiency.

Photovoltaics & Solar Energy

Researchers in this group focus on third generation photovoltaic materials and devices. The goal of this program is to develop and commercialize novel organic and inorganic materials, devices and systems that provide cost-effective solar cells.

Photovoltaics and Solar Energy Research Group Members

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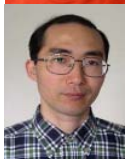

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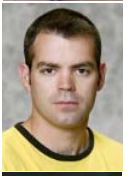

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Photovoltaics and Solar Energy Research Group Members (continued)

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Direct-Write Group for Flexible Electronics

The Direct Write Research Group has a focus on direct-write fabrication of electromagnetic devices. Another research area involves ink formulation for a variety of direct write technologies, most particularly for security applications and for electrodes on next-generation solar cells.

PixDro-Advanced R&D Inkjet Printer

Direct-Write Research Group Members

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Manufacture of nanoparticulates; surface chemistry of interfaces in direct write systems; adhesion and spreading of direct write printed nanoparticulate inks.
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Direct-write fabrication of loaded antennas and microwave/RF devices and the materials needed, ground penetrating radars, finite-difference time-domain (FDTD) method.
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Analysis, design and measurement of artificial electromagnetic materials; electromagnetic materials characterization; high impedance and textured surfaces; direct-write fabrication of antennas, microwave frequency devices, and solar cell collector networks; ultra-wideband antennas and wireless communications. Contact: Whites@sdsmt.edu

SDSMT Chemical & Biological Engineering & Chemistry Center

Catalysis Group

The South Dakota Catalysis Group was formed to address challenges in solar energy utilization with a focus on catalysis in energy conversion processes and environmental remediation. This group includes nine faculty, postdoctoral fellows, graduate students, undergraduate students and collaboratively engages U.S. National Laboratories.

Current endeavors include looking to biological materials as an inspiration for the creation of novel photoactive materials.

Catalysis Group Members

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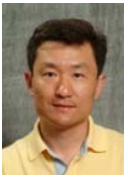

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PANS & Education

Central to the vision for PANS is an interdisciplinary research and education community that develops through collaborative peer-to-peer research and new modes of cyber-enabled educational content delivery based on high-performance computing, remote access to instrumentation and high definition, immersive video conferencing.

Integrative Graduate Education & Research Traineeship (IGERT)

The South Dakota IGERT Program is a new multi-institutional model for interdisciplinary, integrative graduate education and training with the unifying theme of Nanostructured Solar Cells: Materials, Processes, and Devices.

Funded by a grant from the National Science Foundation, the SD IGERT is centered within the Photo-Active Nanoscale Systems (PANS) research collaborative and provides students with financial support and an opportunity to work within a broadly interdisciplinary group of scientists and engineers engaged in a coordinated effort to solve problems with tremendous societal impact. Students may choose from among over 30 faculty members on the three campuses and from dozens of different approaches to improving the cost and efficiency of capturing solar energy.

The group vision is to leverage the combined research infrastructure of South Dakota in the physical sciences and engineering to create a program in research and graduate education that takes full advantage of complementary areas of expertise across the State within a unifying interdisciplinary theme.

Key elements of the IGERT model include:

- interdisciplinary, cross-campus research rotations for graduate students
- advanced thematic coursework
- a student-guided seminar series and symposium
- internships at the National Renewable Energy Laboratory (NREL)
- internships in the solar-energy private sector
- educational outreach to K-16 students, with particular emphasis on Native American students

IGERT students pursue research with a major advisor on their home campus and a collaborating advisor on a second campus in an alternate discipline. The intention of the SD IGERT is to train professionals with broad interdisciplinary backgrounds, uncompromised depth of knowledge in their chosen fields, and an expectation, based on their own experience, of engaging in large-scale research projects in a collaborative and interdisciplinary environment.

Outreach Partners

- The University of South Dakota: Institute for American Indian Studies: Patrice Kunesh, Director (IGERT Advisory Board)
- Sinte Gleska University:
  Academic Affairs: Leland Bordeaux, Vice President
  Department of Chemistry: Subodh Singh, Assistant Professor (Outreach Host Institution)
- Nebraska Indian Community College:
  Dawn Hair (Outreach Host Institution)

Internship Partners

- Governor's Office of Economic Development: (Dakota Seeds), Melvin Ustad, Director.
- National Renewable Energy Laboratory: National Center for Photovoltaics: Lawrence Kazmerski, Director.

For more information on the SD IGERT visit our website at http://www.sdigert.org

Collaboration

Partnerships are a core strategy of the PANS initiative and the ability to connect stakeholders through the science and engineering activities of PANS is evident in the broad engagement of public and private higher education, the private sector, and all of South Dakota's tribal colleges and universities. Collectively leveraged resources provide enhanced opportunities for focused research and development, infrastructure growth, commercialization of intellectual property and a highly developed workforce.

The PANS group is actively seeking new private sector collaboration and opportunities for student internships in industry. For more information please contact Jan Koehn, 605-677-7235, e-mail Janet.Koehn@usd.edu, or any of the project principals listed below.

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website: http://www.sdepscor.org/pans.html