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Northwestern | CENTER FOR ENGINEERING SUSTAINABILITY AND RESILIENCE

CESR Newsletter, December 13th, 2024

ANNOUNCEMENTS and ACCOMPLISHMENTS of CESR FACULTY AFFILIATES

RECENT PUBLICATIONS

Bin Chen, Research Assistant Professor of Chemistry

Ted Sargent, Lynn Hopton Davis and Greg Davis Professor of Chemistry; Professor of Electrical and Computer Engineering; Co-Executive Director, Paula M. Trienens Institute for Sustainability and Energy

Title: **"Solution-processed tungsten diselenide as an inorganic hole transport material for moisture-stable perovskite solar cells in the n-i-p architecture"**
Authors: Sujan Aryal, Anand B. Puthirath, Brendan Jones, Abdulaziz S.R. Bati, Bin Chen, Thomas Mather, Pulickel M. Ajayan, Edward H. Sargent, Anupama B. Kaul
Publication: *Solar Energy Materials and Solar Cells*, November 30, 2024

Gianluca Cusatis, Professor of Civil and Environmental Engineering and (by courtesy) Mechanical Engineering

Title: **"Mesoscale Mechanical Discrete Model for Cementitious Composites with Microfibers"**
Authors: Lei Shen, Linfeng Hu, Giovanni Di Luzio, Maosen Cao, Lei Xu, Gianluca Cusatis
Publication: *Engineering*, November 29, 2024

Vinayak Dravid, Abraham Harris Professor of Materials Science and Engineering; Founding Director, Northwestern University Atomic and Nanoscale Characterization (NUANCE) Center; Founding Director, Soft and Hybrid Nanotechnology Experimental (SHyNE) Resource, an NSF-NNCI Node

Title: **"Non-Aqueous Electrochemical CO2 Reduction to Multivariate C2-Products Over Single Atom Catalyst at Current Density up to 100 mA cm-2"**
Authors: Rajan R Bhawnani, Rohan Sartape, Vamsi V Gande, Michael L Barsoum, Elias M Kallon, Roberto Dos Reis, Vinayak P Dravid, Meenesh R Singh
Publication: *Small*, December 8, 2024

Daniel Horton, Associate Professor of Earth and Planetary Sciences and (by courtesy) of Civil and Environmental Engineering

Title: **"Impacts of Post-Fire Debris Flows on Fluvial Morphology and Sediment Transport in a California Central Coast Stream"**
Authors: Olsen, Telemak; Pfeiffer, Allison M; Finnegan, Noah J; Li, Chuxuan; Horton, Daniel E
Publication: *NSF Public Access Repository*, December 1, 2024

Ted Sargent, Lynn Hopton Davis and Greg Davis Professor of Chemistry; Professor of Electrical and Computer Engineering; Co-Executive Director, Paula M. Trienens Institute for Sustainability and Energy

Title: **"Atomic-level Cu active sites enable energy-efficient CO2 electroreduction to multicarbon products in strong acid"**
Authors: Lizhou Fan, Feng Li, Tianqi Liu, Jianan Erick Huang, Rui Kai Miao, Yu Yan, Shihui Feng, Cheuk-Wai Tai, Sung-Fu Hung, Hsin-Jung Tsai, Meng-Cheng Chen, Yang Bai, Dongha Kim, Sungjin Park, Panos Papangelakis, Chengqian Wu, Ali Shayesteh Zeraati, Roham Dorakhan, Licheng Sun, David Sinton & Edward Sargent
Publication: *Nature Synthesis*, November 26, 2024

Randall Snurr, John G. Searle Professor of Chemical and Biological Engineering

Title: **"Computational Chemistry and Machine Learning-Assisted Screening of Supported Amorphous Metal Oxide Nanoclusters for Methane Activation"**
Authors: Xijun Wang, Kaihang Shi, Anyang Peng, and Randall Q. Snurr
Publication: *ACS Catalysis*, December 8, 2024

G. Jeffrey Snyder, Professor of Materials Science & Engineering

Title: **"Unlocking Ultralow Thermal Conductivity in α-CuTel via Specific Symmetry Breaking in Cu Sublattice"**
Authors: Shunda Yang, Chensheng Lin, Xiu He, Jiajing Huang, Gerald Jeffrey Snyder, Yue Lin, Min Luo
Publication: *Advanced Functional Materials*, November 27, 2024

Title: **"Grain Boundary Engineering Enhances the Thermoelectric Properties of Y2Te3"**
Authors: Jamil Ur Rahman, Shuping Guo, Nicolás Pérez, Kyuseon Jang, Chanwon Jung, Pingjun Ying, Christina Scheu, Duncan Zavanelli, Siyuan Zhang, Andrei Sotnikov, Gerald Jeffrey Snyder, Jeroen van den Brink, Kornelius Nielsch, Ran He
Publication: *Advanced Energy Materials*, December 1, 2024

FUNDING OPPORTUNITIES

Department of Energy National Energy Technology Laboratory
HARMONY: Human-Centric Analytics for Resilient & Modernized Power sYstems
Amount: $1,250,000
Deadline: March 20, 2025

This NOFO aims to enhance grid reliability and resilience in the face of growing uncertainties and in the age of big data to accelerate pathways towards DOE grid modernization goals. Successful implementation of projects will enable rigorous quantification of risks and uncertainties and their communication to decision-makers and human operators for enhanced grid visibility and resilience.

The objective of this project is to advance the state of the art for power system uncertainty and risk metrics to help human operators receive actionable information to better understand, predict, prevent, and mitigate cascading failures in power grids.

CONFERENCES and SEMINARS

Battery Innovation Through In Situ Spectroscopy and Metrology- from Materials Design to Manufacturing
Speaker: Dr. Feng Wang, Senior Materials Scientist, Argonne National Laboratory
Host: NUANCE Center
Wednesday, December 18, 11:00 AM – 12:00 PM
Ryan Hall, Room 4003

Batteries are among the key energy storage technologies for powering electronics, transportation, and grids. The demand for lighter devices and safer, longer-duration storage continues to fuel the need for battery innovation. This, in turn, necessitates designing new battery materials, understanding how they function and, ultimately, developing scalable processes to manufacture them. However, making battery materials with the required capacity,

power, lifespan, and safety for practical use is nontrivial, often due to the limitations in predictive synthesis and processing.

In this seminar, I will overview the research needs and latest developments in battery materials development and engineering. Examples from our latest research will be provided to demonstrate how in situ spectroscopy and metrology can facilitate materials design and the process design, optimization and scale-up for large-scale manufacturing, closing the loop from lab discovery to scalable production. Key highlights include:

- In situ and operando spectroscopy-guided battery materials design [1-4];
- In situ spectroscopy for predictive synthesis/processing of next-generation cathodes [5-7];
- In situ metrology boosted by automated data analysis for real-time process monitoring and control in battery manufacturing [8].

The talk will conclude with a discussion on alternative battery chemistries and emerging opportunities for collaboration among national laboratories, universities, and industry to drive the next wave of battery innovation.

JOB OPPORTUNITIES

Assistant Professor of Electrical Engineering and Renewable Energy
Oregon Institute of Technology
Deadline: January 6, 2024 (review begins)

Oregon Institute of Technology, a premier public polytechnic university in the Pacific Northwest, and the Electrical Engineering and Renewable Energy Department (EERE) invite applications for the position of Assistant Professor. Oregon Tech is one of the top public regional universities in the western United States and is consistently ranked among the top public colleges in the nation by US News & World Report. Oregon Tech offers innovative and rigorous degree programs.

Primary responsibilities will include teaching introductory and advanced courses in broad areas including analog and digital circuits, digital systems, microprocessors and microcontrollers, electromagnetics and power. Candidates should be enthusiastic about curriculum innovation and student engagement. The successful candidate is expected to develop research programs and projects involving students on applied research. Other responsibilities include advising students, directing student projects, and participating in continuous professional development, as well as other departmental and institutional service activities.

Assistant Professor of Civil and Environmental Engineering
University of Central Florida
Deadline: Open Until Filled

The Department of Civil, Environmental, and Construction Engineering (CECE) at the University of Central Florida (UCF) in Orlando, Florida, invites applicants for multiple full-time, 9-month, tenure-earning assistant professor positions with an anticipated start date of August 8, 2025. CECE is looking for candidates that would strengthen the department's research and teaching portfolio across the subdisciplines in Civil and Environmental Engineering. Some focus areas of research interest to the department are listed below. The successful candidates may work within or at the interface of these focus areas, or in other applied research areas with funding potential. Candidates with primarily experimental, field, analytical, or computational strengths will all be considered.

The focus areas are:

1. Smart buildings, multi-scale modeling for extreme events, hybrid simulation and substructure simulation beyond seismic, offshore and on-shore wind and wave energy structures.

2. Concrete or geomaterials for sustainable infrastructure, soil-foundation-structure interaction under flooding, erosion conditions, or subjected to geoenvironmental hazards.

3. Infrastructure component and systems design, monitoring, maintenance and life cycle-management considering climate change, emergency management and community resilience under extreme events.

4. Environmental engineering systems to include water and wastewater infrastructure, physical-chemical processes such as advanced water and wastewater treatment processes (such as but not limited to oxidation, adsorption, aeration, membrane filtration and desalination), corrosion, residuals management, and waste to energy systems.

5. Coastal and water resources engineering, surface and subsurface hydrology/hydraulics in urban/coastal areas, hydroinformatics, decision making under deep uncertainty in the water/coastal sector, water policy.

6. Decision making frameworks and systems engineering for smart and resilient community/city operations based on sensor fusion, disaster metrology, physics-based models, machine learning, and user data.

7. Electric vehicle charging infrastructure, network optimization, emerging mobility systems (including TNC and micromobility), smart city applications related to transportation and infrastructure (e.g., connected/autonomous vehicle applications).

STUDENT FELLOWSHIP AND INTERNSHIP OPPORTUNITIES

Equitable Community Solar and Energy Assistance Fellowship

Department of Energy
Eligibility: Undergraduate, graduate, and postgraduate students
Deadline: December 30th, 2024

The Equitable Community Solar and Energy Assistance Fellowship (ECSEAF) offers fellows the opportunity to learn and collaborate with state organizations on the pilot test of the Clean Energy Connector. This online tool, developed by the U.S. Department of Energy (DOE), U.S. Department of Health and Human Services (HHS), and National Renewable Energy Laboratory (NREL), aims to make community solar subscriptions that include verified savings and strong consumer protections more accessible to households participating in government-run low-income support programs, beginning with the Low-Income Home Energy Assistance Program (LIHEAP).

The fellowship will enable talented candidates from diverse backgrounds to spend up to two years embedded within host organizations in participating pilot regions for an immersive learning opportunity.

Under the guidance of a mentor, fellows will learn and engage with community solar and LIHEAP program offices on the pilot phase of the Connector, which may include: (1) Liaising between the community solar and LIHEAP programs to increase state capacity, collaboration, and coordination in order to pilot the Connector; (2) learning to create and provide education and outreach materials for income-verified household enrollment in low-income community solar subscriptions, (3) learning to engage with community solar subscription managers to encourage their participation on the Connector, and (4) participating in the growth and expansion of the Connector as opportunities arise.

Flathead Lake Bio Station Summer Session 2025
University of Montana
The online application portal for FLBS Summer Session 2025 is now open!

Bio Station summer courses are field based and experiential. Students spend the summer gaining hands-on ecological experience in the beautiful outdoors of Northwest Montana. This is a fantastic opportunity for college students (undergraduates and graduates) to learn something new or grow their knowledge. This experience helps student be more competitive for internships and the post college workforce.

Why the Flathead Lake Bio Station?
Gain skills in: scientific equipment, research projects, field work, and communication
Place based learning includes field trips and overnight camping trips throughout the Flathead Valley and Glacier National Park
Collaborate with world class scientists (instructors and Station staff) and students from across the country
Round out traditional lecture courses with field experience to broaden your collegiate experience

Get your foot in the door with gained experience to open future career opportunities
Low student-faculty ratio, great facilities, live on the shores of Flathead Lake
Credits transfer easily to universities across the country

How to Apply
Visit our website at: **flbs.umt.edu/education** and make an account
Complete all sections of the online application including a Medical History Form and Transcripts
Submit your application before February 2 for a $100 discount

To subscribe, please send your name and email to engineeringsustainability@northwestern.edu

Center for Engineering Sustainability and Resilience
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