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UNIVERSITY OF MIAMI
College of Engineering

MIAMI INSTITUTE FOR CLEAN ENERGY (MInCE)

Quarterly Newsletter
March 2025, Issue 3

OVERVIEW

The Miami Institute for Clean Energy (MInCE) is building collaborative partnerships across the College of Engineering, the University of Miami, and local industry to advance cutting-edge energy research. The institute continues to drive innovation through interdisciplinary efforts, while expanding its impact with new initiatives like student awards, seed grants, and collaborative research opportunities. Focused on renewable integration, energy production, storage, and smart grid technologies, MInCE aims to attract funding, foster innovation, and position the university and its partners as leaders in the global energy transition. The Center aims to attract increased research funding and broaden its network of collaborators by aligning with national clean energy priorities and forging strategic partnerships. MInCE continues to engage the broader academic community through ongoing seminars, special events, and its flagship annual Future of Energy Summit, to be held this year on April 21.

WHAT'S INSIDE THIS ISSUE:

https://cleanenergy.coe.miami.edu

https://www.coe.miami.edu

Hydrogen Energy: A New Pillar in MInCE Research Initiatives

Hydrogen Energy has been officially added as one of the eight verticals within MInCE, the clean energy innovation hub housed in the University of Miami's College of Engineering. This inclusion highlights the growing academic and research focus on hydrogen as a key pillar of the clean energy transition. As a clean, high-density energy carrier, hydrogen holds promise for decarbonizing sectors like transportation, manufacturing, and power storage. Its integration into MInCE underscores the initiative's commitment to advancing next-gen energy solutions through research, collaboration, and education.

Highlights of Current Research in MInCE Related to Hydrogen Energy

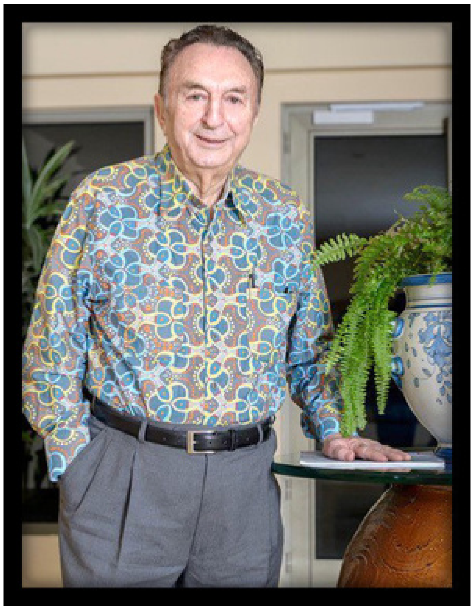
- Achieving net-zero carbon emissions by 2050 is imperative for mitigating the global climate crisis, necessitating a transition to sustainable energy sources. Hydrogen, recognized for its high energy density, is a promising sustainable fuel; however, its production, purification, storage, and transportation present significant challenges, requiring the development of more effective, stable, and scalable materials. **Dr. Ali Rownaghi**, the PI of the Membrane & Catalysis Research Lab at the University of Miami, has been working on various classes of catalytic materials for hydrogen production from both renewable and fossil resources through thermal and photocatalytic processes. His team also focuses on designing and fabricating scalable membrane materials and methods to achieve the necessary purity for targeted applications in the hydrogen economy.

- **Dr. Fateme Rezaei**, the PI of the Adsorption & Separation Research Lab at the University of Miami, has been working at the interface of chemical, materials science, and environmental engineering. The primary goal of her group is to develop advanced materials and processes for clean energy, including hydrogen (H2), and sustainable chemical processes. H2 faces challenges in becoming a reliable energy carrier due to issues related to energy density, ease of storage, and compatibility with existing infrastructure. Her team is focused on designing and screening nanoporous materials and processing them through additive manufacturing (3D printing) to create structured adsorbents for hydrogen purification via pressure swing adsorption (PSA) process, as well as H2 storage and transportation.

- Ceramic Matrix Composites for Hydrogen Combustion: This DoE funded project aims to develop new generation of high temperature resisting materials that can sustain the unique harsh environment of hydrogen powered gas turbine combustors. Teaming with two UCF professors, Dr. Jan Gou who is a leading expert on polymer derived ceramics, and Dr. Kareem Ahmed who is an expert on hydrogen combustion characterizing, **Dr. Qingda Yang**'s group is working to develop and test a novel YSZ/Si(B)CN based CMC that can potentially sustain combustion chamber temperature higher than 1500 ^{o}C.

DR. T. NEJAT VEZIROGLU ENDOWED FELLOWSHIP FOR MECHANICAL AND AEROSPACE ENGINEERING, HYDROGEN ENERGY AND RELATED FIELDS

- Dr. Ayfer Veziroglu is making this generous gift in memory of her beloved husband, Dr. Turhan Nejat Veziroglu, a pioneer in hydrogen energy whose groundbreaking work and unwavering dedication to the scientific community has left an indelible mark for generations to come. **The Dr. T. Nejat Veziroglu Endowed Fellowship for Mechanical and Aerospace Engineering, Hydrogen Energy and Related Fields** will honor Dr. Veziroglu's remarkable contributions to hydrogen energy by supporting the next generation of researchers in this vital field. The fellowship aligns with Dr. Veziroglu's vision of a sustainable energy future and will foster innovative research by providing financial support to outstanding graduate students and researchers who demonstrate exceptional promise in developing hydrogen energy technologies. The fellowship will also inspire other donors to make contributions to this important field of research, which could lead to a future naming gift that would pay tribute to Dr. Veziroglu and his extraordinary accomplishments.



Dr. Turhan Nejat Veziroglu had been a long time valuable faculty member of the Department of Mechanical and Aerospace Engineering (MAE) of the University of Miami from 1962 to 2009. During the time, he contributed tremendously to the MAE Department as a faculty and as a Department Chair (1971-1975), to the College of Engineering as Associate Dean of Graduate Studies (1955-1979), and to the University of Miami. He was the funding director of the University of Miami Clean Energy Research Institute (CERI), which he established in 1974 and served as the Center director until he retired in 2009. CERI has now evolved into one of the CoE's major research Centers, the Miami Institute for Clean Energy (MinCE). Dr. Veziroglu was a world renowned researcher who, not only pioneered research in hydrogen energy, but also had passionately promoted hydrogen economy since 1970s. His more detailed legacy can be found at

https://en.wikipedia.org/wiki/Turhan_Nejat_Veziro%C4%9Flu

MIAMI ENERGY SUMMIT (APRIL 21, 2025)

Date
April 21, 2025

Time
8.30 AM - 5.00 PM

Location
Lakeside Village Expo Center

Join us at the University of Miami Energy Summit as we bring together leading experts from industry, government, and academia to explore the Future of Energy. The event will focus on cutting-edge technological advancements, emerging opportunities, and key challenges shaping the energy sector. Hosted by the Miami Institute for Clean Energy (MInCE), housed within the College of Engineering, this summit promises insightful discussions and networking opportunities with top professionals in the field.

MARK YOUR CALENDAR AND BE PART OF THE CONVERSATION ON THE FUTURE OF ENERGY!

Register

Call for Poster

SUMMIT HIGHLIGHTS

- INDUSTRY/COMMUNITY & CXO PANELS
- POSTER SESSIONS
- NETWORKING Opportunities

PANEL HIGHLIGHTS

The Future of Energy Panel

Moderator: Pratim Biswas, Dean, College of Engineering, University of Miami
- Tim Ash, Head of Hardware Products, GM Energy
- Pamela Rauch, Vice President, Florida Power & Light
- Meagan Canon Ruttkay, Global HD/LDPE Optimization Manager, ExxonMobil

Smart Energy Use Panel

Moderator: Esber Andiroglu, Director, Murphy Construction Program, University of Miami
- Ryan Colker, Executive Director, Energy, Resilience & Innovation, ICC
- Mark Fasel, Director PMG Technical Resources, ICC
- Mark Schumacher, EVP North American Business Development, FSC Technologies
- Jason Grant, Senior Energy Resilience Program Manager, Miami-Dade County

MEAMI Panel

Moderator: Qingda Yang, Chair, Mechanical and Aerospace Engineering, University of Miami
- Antonio Campello, Director, MEAMI
- Mohamed Al-Qattan, Assistant Vice President of Research and External Relations, AIU
- Sean Borman, CEO, Aeroauto LLC
- Keith Carswell, Director of Economic Innovation & Development, City of Miami
- Megha Bhatia, Chief Commercial Officer, Eve Air Mobility

Hydrogen Energy & Applications

Moderator: Ayfer Veziroglu
- Qingda Yang, Chair, Mechanical and Aerospace Engineering, University of Miami
- David Blekhman, Professor, California State University
- Rommel Oates, Founder, Chairman and CEO, Refinery Calculator
- Bora Timurkutluk, Director, Dr. T. Nejat Veziroglu Clean Energy Research Center

See Full Agenda Here!

MInCE Student Award
Submission Due Date: April 13, 2025

Call for PhD Students in the College of Engineering

University of Miami Institute for Clean Energy is excited to announce the MInCE Student Award, designed to support research projects that foster collaboration among PhD students from different departments within the College of Engineering. This initiative encourages interdisciplinary research and aims to integrate diverse verticals of clean energy studies. Projects must be related to at least one of the MInCE research verticals.

AWARD DETAILS

- Amount: $5,000 per team (for one year, to be divided between two PhD students).
- Eligibility: Each team must include two PhD students from distinct departments (with approval from advisors)
- Start Date: May 2025
- Duration: 1 Year

PROJECT PROPOSAL REQUIREMENTS

- Proposal Format: 3 pages, using 11 pt font and single-spacing including all references.
- Content: The proposal should outline the research objectives, methodology, expected outcomes, and a detailed plan and timeline showing how the project will lead to:
  - At least one peer-reviewed publication and a potential presentation at a reputable conference.
  - Possible collaborative grant proposal.

HIGH LEVEL TOPIC AREAS

- Environmental Benign Energy Production
- Climate Engineering
- Energy Storage and Utilization
- Energy Environment Nexus
- Energy Analytics
- Autonomous Mobility
- Supply Chain Innovation & Resilience
- Hydrogen Energy

EVALUATION CRITERIA

- Proposals will be judged (by a committee of faculty from non-participating teams) based on their innovative approach, feasibility, and potential impact on the field of clean energy.
- Extraordinary projects may receive additional funding depending on the quality of submissions.

USE OF FUNDS

- Cover travel, personnel (in addition to RA salary), or project-related expenses

SUBMISSION DEADLINE

- Proposals must be submitted by April 13, 2025. Please submit your proposal, along with the CVs of the students involved, as a single PDF to: ramin@miami.edu. PhD student advisors should be cc'd.
- The subject line should be **MInCE Student Award**.

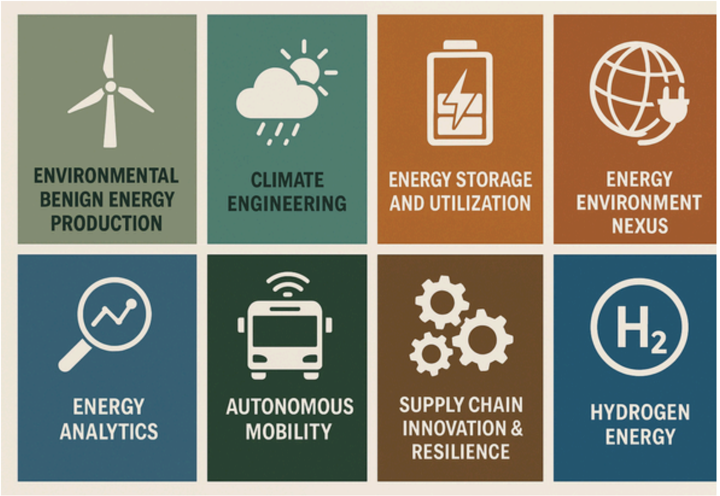
Winners will be announced during the Annual Miami Energy Summit.

RESEARCH NEWS

RECENT GRANTS

- **Title**: Extraction of Lithium
- **Amount**: $50,000
- **Recipients**: Xiangyang Zhou (xzhou@miami.edu)
- **Notes**: NSF I-Corps

- **Title**: Assessment Tool for Pump and Motor Efficiencies of Pumping Systems to Identify Degraded Pumps and Motors and Detect Faulty Operations
- **Amount**: $771,351
- **Recipients**: Gang Wang (g.wang2@miami.edu)
- **Notes**: DoD ESTCP



SELECTED PUBLICATIONS

- Mishra N.K., Biswas P., Patel S.m Future of clean energy for cooking in India: A comprehensive analysis of fuel alternatives (2024) Energy for Sustainable Development, 81, art. no. 101500.
- Sahwell P.J., Bejar D., Kim D.M., Solo-Gabriele H.M., Non-traditional abiotic drivers explain variability of chlorophyll-a in a shallow estuarine embayment (2024) Science of the Total Environment, 919, art. no. 170873.

SEMINAR SERIES ACTIVITIES

- Date: Sept 17, 2024, 11:00 am; Speaker: Dr. Campello, Advanced Air Mobility Association
- Date: Oct 14, 2024. 1:00 p.m.; Speaker: Dr. Shawn Sheng, NREL
- Date: Feb 14, 2025. 12:00 p.m.; Speaker: Dr. Deep Jariwala, University of Pennsylvania
- Date: March 27, 2025. 2:00 p.m.; Speaker: Dr. Dario R. Dekel,Technion, Israel Institute of Technology

For more information on the College of Engineering News, please visit here!

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FACULTY SPOTLIGHT

Dr. Chao Luo, Associate Professor
Chemical, Environmental, and Materials Engineering

Dr. Chao Luo is an Associate Professor in the Department of Chemical, Environmental, and Materials Engineering at the University of Miami. His research focuses on developing organic materials, polymers, carbon/sulfur composites, and electrolytes for high-energy and sustainable batteries. Chao obtained B.S. degree from Wuhan University in 2008 and Ph.D. degree at the University of Maryland, College Park in 2015. He was a process development engineer at the Lam Research Corporation in 2016, and then worked as a postdoctoral research associate at the University of Maryland, College Park until 2019. From 2019 to 2023, he was an Assistant Professor in the Department of Chemistry and Biochemistry at the George Mason University. He received tenure promotion to Associate Professor in 2023.

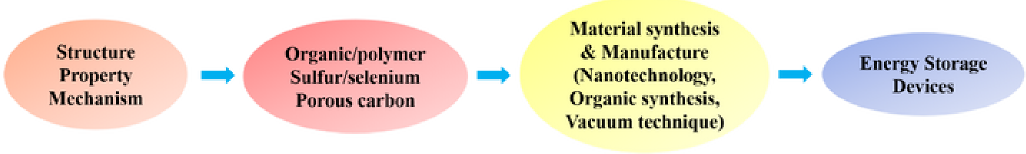

Figure 1. Functional organic/inorganic materials: fundamentals, materials synthesis, and energy storage devices.

My research involves in using organic/inorganic materials and new fabrication techniques to develop novel organic electrodes, porous carbon, nanostructures, and their hybrid composites to address energy and sustainability challenges. The research activity (Figure 1) includes design and synthesis of novel electrode materials, investigation of reaction mechanism, kinetics, and structure-property correlations, as well as development of functional structures and devices.

We are especially interested in developing organic Na/K-ion batteries (NIBs/KIBs), Li-S batteries (LSBs), and organic redox-flow batteries (RFBs) as alternatives to Li-ion batteries (LIBs) due to low cost, abundance, and high sustainability of organic, sulfur, sodium, and potassium resources. We investigated the electrochemical performances and reaction mechanisms of organic electrode materials in NIBs and KIBs. We discovered that the electrochemical performance of polymer cathode materials with an extended conjugated structure such as a naphthalene backbone structure is better than that with benzene and biphenyl structures due to faster kinetics and lower solubility in the electrolyte.1 It unravels the rational design principle of extended π-conjugation aromatic structures in redox-active polymers to enhance the electrochemical performance. When coupling with a low-concentration electrolyte, the battery showed high performance at -50oC, demonstrating a promising organic NIB as shown in figure 2a.

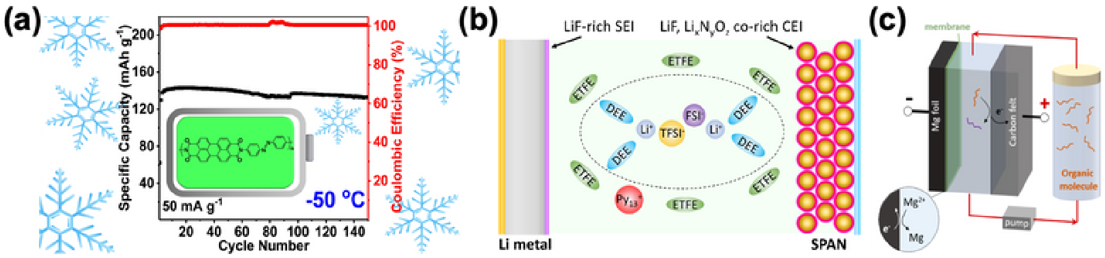

Figure 2. Schematic illustrations for (a) low-temperature NIBs; (b) electrolyte and interphase structures for high-energy LSBs; (c) high-power organic RFBs.

For LSBs, we developed a localized high concentration electrolyte (LHCE) with an ionic liquid additive to generate a coordinated-anion-enriched solvation structure for the in-situ formation of a robust LiF-rich SEI layer on the Li metal anode and a $LiF/Li_xN_yO_z$ coenriched CEI layer on the SPAN cathode (Figure 2b). The formed LiF-rich interphases with weak bonding to the Li anode and SPAN cathode effectively suppress Li dendrite growth and stabilize the SPAN cathode. This work offers a reliable approach to electrolyte design for the commercialization of low-cost, long-lifetime, and high-energy LSBs. We also demonstrated a novel flow battery based on a Mg anode, a porous membrane, and a polymer solution catholyte in figure 2c, which validates the feasibility of nonaqueous flow batteries based on the Mg redox chemistry and opens a unique direction for energy storage technology research.[3,4] Through rational molecular engineering, polymer catholytes using NTCDA as the redox-active moiety and PEG chain as the supporting moiety for tuning the solubility are designed and synthesized. The correlation between the supporting moiety chain length and the performance of the carbonyl-based polymer catholyte in non-aqueous Mg hybrid flow batteries was systematically studied. Our results provide a valuable guideline for the design principle of high-capacity and stable materials and electrolytes for sustainable energy storage.

Please share your research stories and news with us for the opportunity to be featured in our next newsletter.