Department of Electrical and Computer Engineering

TEXAS TECH UNIVERSITY
Edward E. Whitacre Jr.
College *of* Engineering

Spring 2025 Seminar Series

Seminar Title: ***Green Functional Materials for Decarbonization and Energy Accessibility***

Time: 2:00-2:50 PM, Monday, Apr 7, 2025
Location: ECE 101

Speaker:
Abdelaziz Gouda
University of Toronto, Canada

Abstract:

As global demand for electronics continues to grow, so does the challenge of managing electronic waste (e-waste). The rapid transition from durable consumer electronics to short-lifecycle consumables generates massive waste streams while intensifying greenhouse gas (GHG) emissions from resource extraction, unsustainable manufacturing, and material scarcity. Addressing these environmental and societal challenges requires a paradigm shift toward nature-inspired, sustainable materials for energy storage and green electronics. In the first part of my talk, I will explore the fundamental understanding and tuning of the physicochemical properties of quinone-based materials, which are essential for engineering high-performance, biodegradable electronic devices. By enabling devices based on biosourced functional materials to be printed on biodegradable substrates, this approach not only reduces environmental impact but also raises societal and policy awareness of sustainable technology pathways.

Meeting the International Energy Agency's (IEA) net-zero carbon emissions target by 2050 demands a dramatic scale-up of CO_2 capture and conversion technologies. Specifically, we must increase the current removal rate to 6 million tonnes of CO_2 annually within the next five years. Solar energy is the most abundant renewable resource and offers a compelling solution. GHG conversion can be driven photocatalytically into valuable chemical commodities. However, one of the key challenges remains optimizing the solar-to-product efficiency, which is often hindered by isolated improvements to photocatalysts, photoreactor designs, or reaction pathways, rather than focusing on their integrated performance. In the second part of my talk, I will present a holistic strategy for designing functional materials and integrated systems for decarbonization. This includes developing synergistic photocatalyst-reactor platforms aimed at maximizing efficiency and scalability. By advancing these technologies beyond laboratory-scale Technology Readiness Levels (TRLs), this research seeks to bridge the gap between fundamental materials discovery and industrial implementation—paving the way for a low-carbon chemical industry and expanding global energy accessibility.

Speaker Bio:

Dr. Abdelaziz Gouda is a Postdoctoral Research Fellow in the Department of Applied Chemistry and Chemical Engineering at the University of Toronto, Canada, and the Co-founder and CEO of HyC Light Inc., a Toronto-based startup focused on sustainable energy solutions. He earned his B.Sc. in Physics from Ain Shams University in 2010, followed by an M.Sc. in Applied Physics from The American University in 2016. He then pursued his Ph.D. in Materials Engineering at École Polytechnique de Montréal and McGill University, completing his degree in 2021. Since then, he has held research positions as a Postdoctoral Fellow and Battery Research Scientist at Ford Motor Canada, working with Prof. Geoffrey Ozin and Prof. Mohini Sain at the University of Toronto. Dr. Gouda is a Lindau Nobel Laureate Meeting Alumnus, having presented his research at this prestigious event (read more: Lindau Nobel Laureate Blog). He currently serves as a reviewer for the Nobel Laureate Meeting in the area of sustainable materials for energy and decarbonization. His research focuses on developing sustainable materials and engineered photocatalysts, understanding their physicochemical properties using state-of-the-art techniques, and designing high-performance devices for energy accessibility and decarbonization. His work aims to bridge the gap between fundamental materials science and scalable clean energy technologies.