

Distinguished Lecture Series

presents

"How to make Carbon Capture Smarter: A Deep Dive into Materials Chemistry for Integrated Carbon Capture and Utilization"

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Abstract

The conventional carbon capture and utilization (CCU) process involves separating CO₂ from waste streams, transporting it through a pipeline, and then converting it into fuels and chemical commodities. On the other hand, Integrated Carbon Capture and Utilization (ICCU) or thermocatalytic reactive capture offers a more efficient approach with lower energy requirements. This method directly transforms captured CO₂ into methanol, synthesis gas, and carbon monoxide.

At the heart of an ICCU scheme are dual-functional materials comprised of a catalyst affixed to a solid sorbent, enabling the selective capture and conversion of CO₂ within the same reactor. This seminar will delve into efforts to enhance these materials, beginning with the example of Zr-modified Ni/CaO DFMs, which exhibit improved CO₂ capture and conversion capabilities. Additionally, there will be a discussion on multifunctional materials such as self-regenerative Ni-doped CaTiO₃/CaO nanocomposites, explored for CO₂ capture and subsequent dry reforming of methane (ICCDRM). These materials have demonstrated stable CO₂ capture capacity and syngas productivity over multiple cycles, with reduced coke deposition due to small exsolved Ni nanoparticles and their strong interaction with the host material.

Biography

Dr. Kandis Leslie Gilliard-AbdulAziz is an Assistant Professor of Civil and Environmental Engineering. She joined the USC faculty in January 2024. Before joining the Viterbi School of Engineering, Dr. Gilliard-AbdulAziz was an Assistant Professor of Chemical and Environmental Engineering at the University of California, Riverside, where she directed the Sustainable Lab at the University of California, Riverside, between 2018 – 2023. She earned her Ph.D. in Chemistry from the University of Illinois at Urbana-Champaign in 2017 and was a Provost postdoctoral fellow at the University of Pennsylvania from 2017-2018. She worked previously as a Forensic scientist for the Philadelphia police department and as a Refinery chemist at Sunoco Chemicals in Philadelphia. She currently directs the Sustainable Lab, which primarily focuses on developing novel materials for sustainable catalytic processes for low-carbon chemical production. Her primary research focus is novel materials development for CO₂ sequestration and utilization using an interdisciplinary toolset from bioengineering, chemistry, material science, chemical, and environmental engineering. Dr. Gilliard-AbdulAziz is the recipient of several awards and recognitions, including the Material Science of Extreme Environments Young Investigator Award (2022), the National Science Foundation Career Award (2022), the Department of Energy Early Career Award (2023), and the Sloan Research Fellowship (2024).

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