Advancing CO_2 Capture from Air and Electrochemical Conversion to Value-Added Materials

Maryam Abdinejad, Technical University of Denmark, Department of Energy Conversion and Storage- Section Electrochemical Materials

Carbon dioxide (CO_2) is one of the most significant contributors to climate change, with its excessive production far surpassing that of other greenhouse gases (GHGs). As the effects of climate change become more evident, reducing atmospheric CO_2 levels has become central to mitigating fossil fuel emissions. However, beyond simply curbing emissions, we must also ask: "Can we reuse any of this?" How can we transform this abundant resource from a harmful pollutant into a valuable asset? Electrochemical technologies utilizing renewable energy for direct CO_2 capture from air under isothermal conditions offer a promising solution. Rather than simply releasing the captured CO_2, converting it into value-added materials could be a key part of the solution.

In this talk, I will present our efforts to expand the transition to renewable energy sources, focusing not only on CO_2 capture from both concentrated point sources and ambient air, but also exploring its conversion into valuable materials such as ethanol. These processes play a crucial role in CO_2 capture and conversion, ultimately supporting sustainable energy solutions and advancing our goal of reducing atmospheric CO_2 levels while producing valuable materials. Moreover, our work highlights the potential scalability of these technologies, facilitating large-scale implementation in both industrial and environmental contexts.

Biography

Dr. Maryam Abdinejad recently joined DTU as an Assistant Professor in the Department of Energy Conversion and Storage. She earned her PhD in Molecular Science and Organic Chemistry, specializing in renewable energy applications. Dr. Abdinejad holds two MSc degrees—one from the UK and the other from Canada—in Molecular Science & Renewable Energy, with a focus on dye-sensitized solar cells. After completing her doctoral studies at the University of Toronto, Canada, she pursued postdoctoral research at Delft University of Technology in the Netherlands, where she focused on CO_2 electroreduction and conversion. She then joined the Massachusetts Institute of Technology (MIT) in the United States as an Associate Postdoctoral Fellow in the Department of Chemical Engineering, contributing to pioneering research on photo- and electrochemical direct CO_2 capture technologies for an additional two years. Her cross-disciplinary, collaborative approach integrates fundamental catalytic processes with scalable industrial applications to drive the global transition toward sustainable energy solutions.