Northeastern University
College of Engineering

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Summer Sustainability Series: Distinguished Seminar Speaker

Chemical looping for sustainable production of chemicals

Prof. Ewa J. Marek

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Abstract: The chemical industry is centred on the processing of crude oil and is responsible for the lion's share of greenhouse gas emissions. Running industrial-scale installations requires huge energy inputs, employing high temperatures, pressures, and, often, explosive mixtures. The current industry is designed to work continuously, using cheap, petrochemical feedstock. Switching the starting point and moving from oil to renewable feedstock, whether it is bio-derived carbonaceous material, captured CO2, or renewable electricity, requires new decentralised and flexible operations, as all these resources are spatially distributed and available intermittently. Our work focuses on small-scale, dynamic processes, developing and employing new reaction and process pathways to produce key chemicals. This talk will present our work using a chemical looping approach where solid particles of metal oxides are the sole source of oxygen to catalytic reactions. In particular, I will discuss the chemical looping epoxidation (CL-E) of ethylene to produce ethylene oxide (EO) and chemical looping oxidative dehydrogenation (CL-ODH) of ethanol to produce acetaldehyde.

Biography: Dr. Ewa Marek is an associate professor at the Department of Chemical Engineering and Biotechnology, University of Cambridge and a fellow of Jesus College. She leads the Energy Reactions and Carriers Group, working on the production of value-added chemicals from intermittently available renewable feedstock and electricity, incorporating non-thermal plasma, ultrasounds and chemical looping to drive efficient, transient processes. This work led to 2021 Hinshelwood Prize and 2023 Energy&Fuels Rising Star Award for early-career academics. Before setting up her group, she was a post-doctoral associate in the Engineering Department, Cambridge, and earlier, she worked for six years on industrial R&D and advanced measurement methods in the UK, Netherlands and Poland. She studied energy and chemical processing (BEng, MSc) in Cracow and carbon capture (PhD) in Katowice (both in Poland).

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