

Title: Liquid-Metal Catalytic Reactors for Continuous Chemical Manufacturing

Abstract:

Chemical manufacturing is entering a transformative era, driven by the urgent need for sustainability, electrification, and process intensification. Traditional catalytic systems based on static solid surfaces have enabled remarkable industrial progress; however, they are increasingly constrained by deactivation, limited adaptability, and poor performance under dynamic reaction environments. In this context, liquid metals offer a fundamentally new catalytic paradigm. Unlike conventional catalysts, liquid-metal systems possess fluid, self-renewing interfaces, enabling continuous reconfiguration of active sites with resistance to coking and fouling. More importantly, they open a pathway toward integrated catalytic–reactor systems, where mass transfer, reaction kinetics, and interfacial chemistry can be co-designed in ways not accessible in traditional reactors. This talk will explore how liquid-metal catalytic systems can enable continuous chemical manufacturing, bridging the gap between lab discoveries and scalable, industrially relevant processes. I will discuss recent advances in interface engineering, vortex-driven transport, and electrochemically coupled systems, highlighting their potential for applications such as carbon conversion, hydrogen production, and sustainable energy production.