

Title: Process Intensification of CCU Technologies: Integration of CO₂ Capture with Electrochemical CO₂ Conversion towards added value products.

Valorisation of CO₂ via electrochemical conversions is a sustainable alternative for the production of fine chemicals and commodity chemicals. This topic has gained a lot of attention in the past decades and major research efforts have been put into it. Key advances has been achieved in the field of material development, where, novel catalysts have been synthesized, developed and have demonstrated to increase the efficiency and selectivity towards the targeted products. Relatively to the large number of studies focused on material development, limited studies are focused on process development, reactor optimisation and product separation. Although material development is of paramount importance to achieve an adequate electrochemical reaction performance, it is only the first step needed in order to develop a competitive technology. Process development offers the possibility of enhancing the overall performance of the technology by looking not only at the reaction level, but finding engineering solutions to overcome critical limitations. Process development is essential in order to accelerate the technology towards its envisioned application and advance towards commercial realization. In this talk, we will present some process intensification strategies (beyond material development) that helped increase the overall performance of CO₂ conversion processes, as well as the economic profitability of the complete system. These strategies are based on integration of different units of operation. More specifically, integration of the CO₂ capture process with the CO₂ electrochemical conversion towards several products, integration of CO₂ electrochemical conversion with product separation, and integration of CO₂ electrolysis with fermentation process where the electrochemically produced chemical will be used as feedstock. With this examples, we will show the importance of considering the entire value chain when advancing in the TRL ladder of a certain technology, in order to accelerate its implementation in the industry.