Exploring new directions and insights into electrocatalytic CO2 reduction

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Electrochemical CO_2 and NO_3^- reduction are promising technologies for the net-zero and sustainable production of chemicals. If powered by renewable energy, this can also be a valuable method for storing renewable energy in the form of chemical fuels. In this talk, we will discuss our recent works, where we reveal important new insights into the reaction mechanisms. Here, we use isotope labelling studies to offer new perspectives into catalyst design strategies and computational modelling of pathways. Furthermore, we show how the catalyst and reaction system can be appropriately designed for the direct conversion of dilute CO_2 or simulated flue gas streams into value-added products. For instance, we designed a zero-gap electrolyzer system that can transform simulated flue gas into urea. Finally, we move beyond the catalyst and demonstrate how systems engineering can also be an important tool to improve overall performance. One example is the development of a ‘reversed’ gas diffusion electrode, which can output high purity synthesis gas without needing product separation.