Capture and Valorization of CO_2: Opportunities in Homogeneous Catalysis with Metal Complexes

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Abstract

The rapid increase in atmospheric carbon dioxide (CO_2) levels and its detrimental effects on the environment have spurred a global drive to mitigate CO_2 emissions. One promising approach to address this challenge is the capture and valorization of CO_2 using homogeneous catalysis with metal complexes. By activating and transforming CO_2 into valuable products, this approach not only contributes to environmental sustainability by reducing greenhouse gas emissions but also offers economic opportunities by generating useful chemicals and materials. Homogeneous catalysis has paved the way for diverse and sustainable routes in the conversion of CO_2 into value-added products, encompassing processes such as hydrocarboxylation, hydrogenation, carbonylation, ammonium carbamate formation, carbonate synthesis, methanation, and catalytic transformation to methane. Among these, the transformative potential of photocatalysis shines prominently, as it leverages light-driven reactions mediated by transition metal complexes to orchestrate CO_2 reduction, unlocking a novel and environmentally conscious avenue for harnessing CO_2 as a valuable resource across industries. In this presentation, my main goal is to introduce the audience to the primary homogeneous photocatalytic systems used for CO_2 reduction, particularly in the generation of CO. By providing an overview of these essential processes, the intention is to spark an interest and curiosity among attendees, encouraging them to consider potential research endeavors in this field. Through this informative session, I aim to contribute to a deeper understanding of CO_2 valorization and its implications for a more sustainable future.