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**Catalytic Conversion of Carbon Dioxide**

Ocean acidification and climate change are expected to be two of the most difficult scientific challenges of the 21<sup>st</sup> century. Converting CO<sub>2</sub> into valuable chemicals and fuels is one of the most practical routes for reducing CO<sub>2</sub> emissions while fossil fuels continue to dominate the energy sector. The catalytic reduction of CO<sub>2</sub> by H<sub>2</sub> can lead to the formation of three types of products: CO through the reverse water-gas shift (RWGS) reaction [1], methanol via selective hydrogenation [2], and hydrocarbons through combination of CO<sub>2</sub> reduction with Fischer-Tropsch (FT) reactions. Our research approaches involve the combination of DFT calculations and surface science studies over single crystal surfaces, evaluations over supported catalysts, and in-situ characterization under reaction conditions. In the current talk we will present some of

our recent results in CO<sub>2</sub> conversion via both heterogeneous catalysis [3] and electrocatalysis [4]. We will also discuss the generation of CO<sub>2</sub>-free H<sub>2</sub> [5,6], which is critical for net CO<sub>2</sub> reduction. We will conclude by discussing challenges and opportunities in this important research field [7].

**References:**

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