

Title:

Synergistic CO₂ Reduction with Coccolith-Supported Metal Oxide Nanoparticles

Abstract:

The growing concentration of atmospheric CO₂ represents one of the most pressing environmental challenges, driving the need for efficient catalytic strategies to convert CO₂ into value-added chemicals and fuels. Heterogeneous CO₂ conversion catalysts, particularly those based on metal oxide nanoparticles, have shown great promise due to their tunable surface properties, stability, and reusability. However, the performance of these catalysts strongly depends on the nature of their support materials. This seminar presents the development and characterization of a novel renewable support material, coccoliths, for stabilizing and enhancing the performance of metal oxide nanoparticles in catalytic applications. Derived from the shells of coccolithophores, a species of phytoplankton, coccoliths demonstrate exceptional surface area and thermal stability, providing a sustainable alternative to conventional synthetic supports. Through facile synthesis, cobalt oxide was uniformly dispersed across the surface of the coccoliths, leading to improved nanoparticle formation and CO₂ conversion compared to other CaCO₃ based supports. Characterization using *in situ* scanning transmission electron microscopy, X-ray microscopy, and X-ray absorption spectroscopy confirmed the active catalyst species of the coccolith-supported cobalt oxide and further showed the thermal stability of coccoliths. The favourable characteristics of coccoliths as a support material position this renewable support as a promising platform for next-generation CO₂ conversion nanomaterials.