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CO2 CONVERSION TO FUELS AND CHEMICALS USING MARTIAN ATMOSPHERE SIMULANTS

Abstract

Mars' atmosphere is over 95% CO_2, offering a unique opportunity to utilize this abundant resource for synthesizing fuels and other chemicals required for prolonged human missions. Studies have shown that technologies such as the Sabatier reaction, photocatalysis, and electrocatalysis can convert CO_2 into methane, oxygen, and other useful compounds. By using Martian atmosphere simulants, this research will investigate the effectiveness of these processes under Mars-like conditions.

The goal of this research is to develop and optimize processes for converting CO_2 from Martian atmosphere simulants into usable fuels and chemicals. Given Mars' CO_2-rich atmosphere, this research aims to provide sustainable solutions for in-situ resource utilization (ISRU) to support human activities on Mars.

This research provides a comprehensive methodology for studying CO_2 conversion into fuels and chemicals using Martian atmosphere simulants. By employing nickel and iron catalysts and using LED lighting for photocatalytic trials, it effectively simulates key aspects of Mars' CO_2-rich environment. Simplified analytical techniques, including CO_2 detection kits, enable the measurement of conversion efficiencies, generating essential data on in-situ resource utilization (ISRU) processes applicable to Mars missions.

The expected findings will offer detailed insights into how efficiently CO_2 can be converted under Mars-like conditions, identifying optimal reaction parameters and catalyst performance. This data could reveal promising, scalable pathways for generating methane and other useful compounds directly on Mars, reducing the need for Earth-supplied resources. Such results would significantly advance ISRU technology, contributing to more sustainable, long-term human exploration.