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Engineering Solutions for CO_2 Conversion

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About this book

A comprehensive guide that offers a review of the current technologies that tackle CO2 emissions

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Survey of Heterogeneous Catalysts for the CO_2 Reduction to CO via Reverse Water Gas Shift

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12.1 Introduction

Increasing amounts of CO_2 in our atmosphere is a major concern for the entire planet, which motivated significant research efforts in recent times to capture and/or utilize it. There are many prospective ways to utilize CO_2 including mineralization and conversion to chemicals and fuels. Indeed, CO_2 is a promising C1 feedstock of chemicals and fuels because it is renewable and cheap and also the conversion processes will be overall carbon neutral. One of the options to utilize CO_2 as a chemical feedstock is to convert it to CO because CO or syngas is already the basis of production of many chemicals. Conversion of CO_2 to CO using H_2, thus producing H_2O as a by-product, is known as the reverse water gas shift (RWGS) reaction. If economical and stable conditions for RWGS can be developed, it can be coupled with the existing CO-based industry, thus making the existing processes overall carbon neutral. The RWGS reaction is endothermic and requires high reaction temperature for obtaining significant conversions. Thus, the catalysts should be highly thermally stable. This review chapter summarizes the performance of different catalysts reported so far in the literature for RWGS.

12.2 RWGS Catalysts

Studies are still ongoing to find a high-performance catalyst, which is highly active and selective for the CO formation and also stable for long periods of continuous operation. Because methane and methanol are possible products at high $H_2 : CO_2$ ratios, the catalysts should be able to produce CO selectively. Structural and chemical properties of active metal species and supports, activity toward CO_2 activation, hydrogen dissociation, and relatively moderate strength with the adsorption of reaction intermediates are decisive factors for CO formation. According to the type

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