

Heterogeneous catalytic hydrogenation of CO₂ to methanol: recent advances and prospects

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Abstract

Carbon dioxide is the main source of the greenhouse effect, causing global warming and climate change. In this regard, in order to avoid more dangerous consequences, the United Nations Conference on Climate Change has emphasized the need to reduce carbon dioxide emissions by at least half their current value by 2050, aiming to limit the global increase in average temperature to a maximum of 2 °C. Carbon dioxide is emitted mainly from power plants (e.g., coal-based) and vehicles, and other industrial sources contribute to an increase in CO₂ emissions. In recent years, the scientific community has begun to view CO₂ not as a costly waste, but mainly as a potential carbon alternative to fossils. Therefore, future prospects for reducing carbon dioxide emissions will concern not only the development of more efficient carbon dioxide storage technologies, but also the development of new strategies for CO₂ processing in the energetical direction and in chemical intermediate products. In this regard, the conversion of CO₂ to methanol has received increased attention, since methanol (CH₃OH) is a key raw material for industrial chemicals, which can later be converted to high molecular weight alternative liquid fuels.

The review considers works published over the past 10 years on the heterogeneous catalytic conversion of CO₂ to methanol. The characteristics of the used catalysts, reaction mechanisms, key technologies and problems of industrial use, prospects for the application of heterogeneous catalytic conversion of CO₂ to hydrocarbons are discussed.

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