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Reduction of carbon dioxide via catalytic hydrogenation over copper-based catalysts modified by oyster shell-derived calcium oxide

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Highlight

- Calcium oxide derived from oyster shell facilitated CO_2 to methanol production.
- Calcium oxide was composed in copper-based catalyst.
- CaO modification can improve surface base content of ZrO_2 supported copper catalyst
- The higher base and hydrogen adsorbing sites, the more active to produce methanol.

Abstract

This research aims to investigate the effects of CaO and modified CaO on copper-based catalysts for methanol synthesis. The CaO and modified CaO were derived from oyster shell and employed as an additive in a zirconia-supported copper catalyst (Cu/ZrO_2). The physical and chemical properties of the catalysts were characterized by XRD, BET, CO_2-TPD, H_2-TPD and XANES. The addition of oyster shell-derived calcium oxide promoters to the catalysts significantly improved their chemical properties and methanol synthesis possibly owing to impurities and defects in the crystal structure of natural calcium oxide.

Keywords: methanol synthesis; ; ; , calcium oxide, copper-based catalysts, basicity

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1. Introduction

The demand for fossil fuels has increased in the last few decades, especially in Asia. This results in the emission of carbon dioxide to the atmosphere, which accelerates global warming [1]. The capture and chemical transformation of this carbon dioxide into high-value products, such as methanol or dimethyl

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