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Authors: Peiyi Liao, Chen Zhang, Lijun Zhang, Yanzhang Yang, Liangshu Zhong, Hui Wang, Yuhua Sun



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Higher alcohol synthesis via syngas over CoMn catalysts derived from hydrotalcite-like precursors

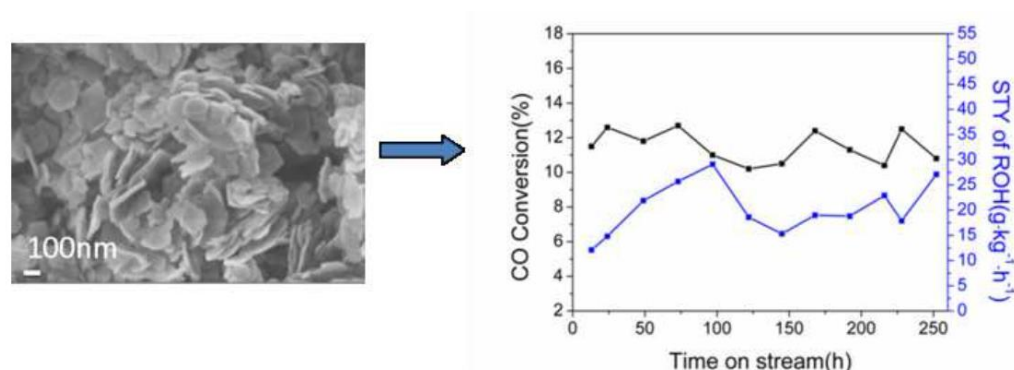
Peiyi Liao ^{a,b}, Chen Zhang ^{a,b}, Lijun Zhang ^a, Yanzhang Yang ^a, Liangshu Zhong ^a, Hui Wang ^{a,*}, Yuhan Sun ^a

^a CAS Key Lab of Low-Carbon Conversion Science and Engineering, Shanghai Advanced Research Institute, Chinese Academy of Sciences, Shanghai 201210, China

^b School of Environmental and Chemical Engineering, Shanghai University, Shanghai 200444, China

*Corresponding author. Tel.: +86-021-20608002; Fax: +86-021-20350867. E-mail address: wanghh@sari.ac.cn.

Graphical abstract



Highlights:

- CoMn catalysts derived from hydrotalcite precursor were prepared.
- The CoMn catalysts derived from hydrotalcite precursor improved the activity and yield of alcohol.
- Co/Mn molar ratios have great impact on the regularity of layered structure.
- When the Co/Mn ratio is 2, the highest yield of alcohol was obtained and the catalytic performance was stable during long time evaluation.

Abstract

A series of CoMn catalysts derived from hydrotalcite precursors with different Co/Mn molar ratios were prepared and applied for higher alcohols synthesis (HAS) via syngas. The physical and chemical properties of as-prepared catalysts were investigated by various characterization methods such as BET, XRD, TPR, TG, SEM, HRTEM and EDS. The results showed that the proper Co/Mn molar ratio can increase the specific surface area, improve the reducibility, and form regular layered structure to provide more uniform distribution of active sites, thereby enhancing the catalytic activity and alcohol selectivity. When the Co/Mn ratio of catalyst reached 2, the highest space time yield (STY) and selectivity of alcohol were obtained. Moreover, the CoMn catalyst with layered structure showed higher activity and yield of alcohol under high reaction temperature than that without layered structure. Characterization results indicated that the layered structure catalyst can provide larger surface area, smaller particles size, and stronger interaction between Co and Mn, as well as resist the separation of Co, Mn and prevent the aggregation, thus improving the catalytic performance of CoMn catalysts for higher alcohols synthesis. In addition, the CoMn catalyst obtained derived from hydrotalcite precursors presented great stability for keeping active site highly disperse on the layer during the long reaction time.

Key words: Higher alcohol, syngas, CoMn, Co content, hydrotalcite-like precursors

1 Introduction

Due to higher alcohols can be used as clean fuels, fuel additives and intermediates of many important chemical products[1-4], higher alcohols synthesis (HAS) via syngas, which is derived from coal, natural gas or renewable biomass, is a potential way to alleviate

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