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Metal-promoted Mesoporous ZSM5 for CO Methanation to Produce Synthetic Natural Gas (SNG)

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In recent years, enormous emissions of carbon oxide (CO and CO_2) by combustion of fossil and fuel have contributed to the increase in global temperatures and climate changes due to the 'greenhouse effect' [1]. In order to solve this problem, production of synthetic natural gas (SNG) from synthetic gas (CO and H_2) via methanation process is one of the essential alternatives [2]. Therefore, developing an efficient catalyst formethanation reaction is indispensable. Mesoporous zeolites have been reported to have superiorcatalytic performance with respect to their conventional (purely microporous) zeolites due to the combination features of intrinsic microporosity with an auxiliary mesopore network of inter- or intracrystalline nature [3, 4]. In this study, mesoporous ZSM5 (mZSM5) and a series of metal-promoted mZSM5 for CO methanation were prepared by dual templating and impregnation methods, respectively. The physical properties of the catalysts were characterized with X-ray diffraction (XRD), nitrogen physisorption and Field Emission Scanning Electron Microscopy (FESEM). The catalytic CO methanation was performed on metal-promoted mZSM5 at 423-723 K under atmospheric pressure in the presence of H_2. The result showed that the catalytic performance of CO methanation followed the order: Rh/mZSM5 >Co/mZSM5 > Pd/mZSM5 > Zn/mZSM5 at 723 K. The highest activity was observed on Rh/mZSM5 with conversion and selectivity of 94.7% and 86.6%, respectively. This study showed that the addition of metal on mZSM5 can significantly improve the catalytic activity on CO methanation.

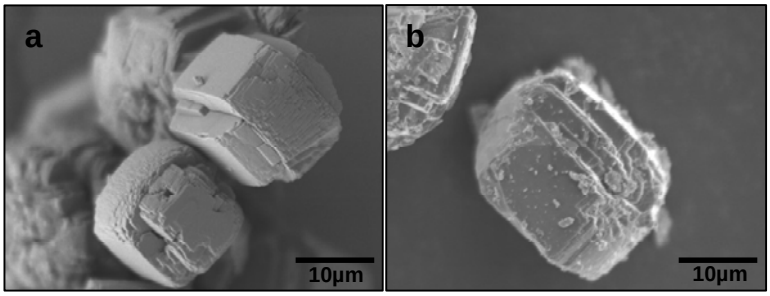

Figure 1 FESEM images of (a) mZSM5 and (b) Rh/mZSM5

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