Jakkraphun Kitmanacharounpong 2012: Methane Cracking Over Nickel Loaded on Bimodal Porous Silica Supports. Master of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Associate Professor Metta Chareonpanich, D.Eng. 89 pages.

In this research, methane cracking reaction (MCR) was studied over nickel loaded on bimodal porous silica supports. The supports used in this study were bimodal porous silica (BS) consisting mesopore and macropore of two different pore sizes (BS-1 and BS-2 for prepared by using pH value of 3 and 5, respectively). These supports were synthesized by a simple sol-gel method and chitosan template was used to create the macropore structure in the mesoporous silica frameworks. After that, 5 wt.% nickel was loaded onto bimodal porous silica supports via incipient-wetness impregnation method. The monomodal porous silica supports (MS-1 and MS-2 for prepared by using pH value of 3 and 5, respectively) were also synthesized for comparison. The obtained catalysts were analyzed by using N_2-sorption, X-ray diffraction (XRD) and Scanning Electron Microscopy (SEM). The performances of MCR of these catalysts were tested under atmospheric pressure and the operating temperatures of 500, 550, 600 and 650°C using methane flow rate of 20 ml/min. The outlet gases were analyzed by using gas chromatography while the used catalysts and solid carbon products were examined by using thermogravimetric analysis (TGA). The results showed that CH_4 conversion and H_2 yield of Ni/BS-1 and Ni/BS-2 were higher than those of Ni/MS-1 and Ni/MS-2. It could be explained that the interconnected, relatively large pore of monomodal porous silica supports would not be appropriate for methane cracking reaction, leading to the lower CH_4 conversion and H_2 yield. CH_4 conversion and H_2 yield from MCR did not depend on operating temperatures for Ni/MS as the negative activation energies were obtained while Ni/BS obtained, which provide the positive activation energy, were depended on operating temperature.

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