Chan Tanggarnjanavalukul 2014: Effect of Meso-Macroporous Silica Supports on Deactivation of Nickel Catalyst in Methane Cracking Reaction. 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, bimodal porous silica with different pore sizes (MCM-41 and BPS-5) and monomodal porous silica supports (SBA-15 and Xerogel-5) were synthesized in order to investigate the effect of pore characteristic on life time of the catalysts in methane cracking reaction. These supports were synthesized by sol-gel technique and were loaded with 5 wt.% nickel by incipient wetness impregnation method. The physicochemical properties of the obtained catalysts were examined by using N_2-sorption, X-ray diffraction (XRD), X-ray absorption spectroscopy (XAS) and temperature programmed reduction (TPR). The catalytic performance was investigated under atmospheric pressure in the temperature ranges of 500-650 °C with CH_4/N_2 molar ratio of 1:4 and total flow rate of 100 ml/min. It was found that life times of the catalysts significantly depended on the pore characteristic of supports. The largest pore size Ni/BPS-5 (174 nm) exhibited the longest life time, which was of 250 min time on stream and the highest initial methane conversion (~75%). The life time of catalysts was affected from the pore blockage of deposited carbon nanofibers which abruptly deactivated the smallest pore size Ni/Xerogel-5 (6.5 nm) within 20 min. Moreover, the higher operating temperature enhanced the graphitic order of carbon nanofibers as evident by Raman spectroscopy result.

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