Prasong Nakaew 2010: Effect of Cobalt Supported Mixed Phase Mesoporous Silica on Fisher-Tropsch Synthesis Products. Master of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Associate Professor Metta Chareonpanich, D.Eng. 104 pages.

Bimodal porous materials with different pore sizes exhibit several potential applications including catalysis, adsorption, and selective separation due to the fact that their small pores can interact with reactant molecules whereas large pores provide high-speed pathways for the transport of gas and liquid molecules. In this work, the mixed-phase bimodal mesoporous silicas (BMS) were synthesized via sol-gel technique using rice husk ash as the silica source under strong acidic condition, and Pluronic P123 and cetyltrimethyl ammonium bromide (CTAB) as the dual pore structure-directing agent. The molar ratio of $SiO_2$: Pluronic P123: CTAB: $H_2O$: HCl of 1: 0.088: 0.088: 4: 2 was used. It was found that the phase separation among SBA-15, SBA-3-like porous silica and xerogel was found when the gel solutions of SBA-15 and SBA-3-like were prepared separately in the primary stage, whereas the mixed-phase uniformly infiltrated SBA-3-like in SBA-15 bimodal porous silica was successfully synthesized when CTAB was added into the SBA-15 gel solution and the secondary micelle structure was formed inside the primary SBA-15 framework. When CTAB and P123 were mixed together in the primary stage, large cluster of aggregation of pseudo-spherical mesoporous primary nanoparticles were synthesized. The obtained bimodal porous silicas were used as the cobalt catalyst supports and tested for the performance of Fischer-Tropsch synthesis reaction. The results were compared to those of monomodal porous silica supports. It was found that the cobalt supported bimodal porous silica presented the higher CO conversion, especially with Co/BMS-1. These catalysts with mixed-phase morphologies significantly promoted the selectivity towards long chain hydrocarbons ($C_{5+}$). The undesired methane product occurred over monomodal cobalt catalyst was significantly reduced, resulting in the two sizes of cobalt particle occurred in different pore diameters of the bimodal porous silica catalysts.

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