Waleeporn Donphai 2014: Synthesis of Carbon Nanotube-mesoporous Silica Composites for Hydrocarbon Conversion. Doctor of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Associate Professor Metta Chareonpanich, D.Eng. 134 pages.

In this research, the novel composite catalysts of nickel-carbon nanotubes (CNTs) over mesocellular silica (MS) support (Ni-CNTs/MS) and nickel-carbon nanofibers (CNFs) over mesocellular silica (MS) support (Ni-CNFs/MS) were synthesized and tested in dry reforming reaction and phenylacetylene hydrogenation reaction, respectively. Consequently, MS support was primarily prepared based on the synthesis of SBA-15 mesoporous silica with 1,3,5-trimethylbenzene (TMB) as a swelling agent. After that, nickel metal was loaded onto MS support by using an incipient-wetness impregnation method, followed by CNTs and CNFs synthesis via catalytic chemical vapor deposition (CCVD) technique through tip-growth mechanism. In dry reforming reaction, it was found that the existence of CNTs composite catalysts with nickel metal clusters on the tips of CNTs (Ni-CNTs/MS catalysts) could significantly improve the catalyst stability compared to that of Ni/MS catalyst. After 24 h time-on-stream, CO_2 and CH_4 conversions of Ni/MS catalyst were approximately 10% decreased, while those of Ni-CNTs/MS catalyst were 3% increased. This outstanding performance could be attributed to selective formation of carbon by-products as the tube-length extension of the existing CNTs. In phenylacetylene hydrogenation, Ni-CNFs/MS composite catalyst exhibited the highest TOF of which was approximately 3.2 times higher than that of Ni/MS due to the hydrophobic surface property of CNFs and unique composite structure of Ni-CNFs/MS catalyst. Moreover, the enhancement of photocatalytic performance of the composite catalyst of TiO_2 over different carbons types in the degradation of methylene blue was investigated. It was found that TiO_2-zeolite templated carbon was more efficient photocatalyst for degradation of methylene blue than that of TiO_2-activated carbon due to its large surface area, pore volume and hydrophobic surface property.

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