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Influence of Catalyst Support and Reaction Gas on Decomposition of Methane over Ni Catalysts

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Nickel-catalyzed decomposition of methane into carbon and hydrogen was examined using a thermogravimetric apparatus. The Ni catalyst supported on zirconia synthesized by the glycothermal method gave hydrogen and a high yield of multi-walled carbon nanotubes. The initial rate of methane decomposition increased with increasing reaction temperature at 400-680°C, but decreased with reaction temperature > 700°C. Raman spectroscopy suggested that carbon nanotubes formed at higher temperatures had more graphite like structure than those obtained at lower temperatures. Feed gas containing methane and hydrogen caused slow deactivation of the catalyst. As a result, carbon yield increased with increasing partial pressure of hydrogen in the feed gas. Mechanisms for the deactivation of the catalysts are discussed.

Keywords: Methane decomposition, Nickel catalyst, Carbon nanotube, Glycothermal method, Zirconia support

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