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Progressive Loading Effect of Co Over SiO2/Al2O3 Catalyst for Cox Free Hydrogen and Carbon Nanotubes Production via Catalytic Decomposition of Methane

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Abstract : Co metal supported on SiO2 and Al2O3 catalysts with a metal loading varied from 30 of 70 wt.% were evaluated for decomposition of methane to CO/CO2 free hydrogen and carbon nano materials. The catalytic runs were carried out from 550-800 oC under atmospheric pressure using fixed bed vertical flow reactor. The fresh and spent catalysts were characterized by BET surface area analyzer, TPR, XRD, SEM, TEM, and TG analysis. The data showed that 50% Co/Al2O3 catalyst exhibited remarkable higher activity and stability up to 10 h time-on-stream at 750 oC with respect to H2 production compared to rest of the catalysts. However, the catalytic activity and durability was greatly declined at a higher temperature. The main reason for the catalytic inhibition of Co containing SiO2 catalysts is the higher reduction temperature of Co2SiO4. TEM images illustrate that the carbon materials with various morphologies, carbon nanofibers (CNFs), helical-shaped CNFs, and branched CNFs depending on the catalyst composition and reaction temperature, were obtained. The TG data showed that a higher yield of MWCNTs was achieved over 50% Co/Al2O3 catalyst compared to other catalysts.

Keywords : carbon nanotubes, cobalt, hydrogen production, methane decomposition
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