



Hydrogenation of CO and CO₂, in presence of light hydrocarbons, over nickel catalysts

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Abstract:

Carbon oxides are often generated as undesirable by-products of higher hydrocarbon synthesis. A significant concentration of carbon oxides in a hydrocarbon stream can inhibit commercialization of synthetic hydrocarbon processes. Nickel is a highly active transition metal for CO_x hydrogenation and nickel-based catalysts are capable of complete conversion of carbon oxides and producing higher hydrocarbons. The relatively low cost of nickel, compared to precious metals that are also active for CO_x hydrogenation, suggests nickel as a good choice for complete removal of CO_x and producing light hydrocarbons. It is believed that the structural and electronic changes of the nickel catalyst have a direct influence on the performance of the catalyst in terms of both activity and selectivity during carbon oxides hydrogenation.

In this research, the effect of transition metals on the activity and selectivity of a Ni/Al₂O₃ catalyst for carbon oxides hydrogenation was studied. Based on analysis of catalyst activity and selectivity experiments, it is found that each transition metal has different and distinct promoting or inhibiting influence. To study the electronic states of the catalysts, in-situ FTIR technique was performed by using nitric oxide as a probe molecule. The presence of multiple sites, with different electronic properties, was observed. It is concluded that the addition of transition metals to Ni/Al₂O₃ markedly changed the electronic structure of the primary catalyst. Chemisorption and Temperature-Programmed-Desorption results confirmed the presence of different active sites on the catalysts.

Biographical Statement of speaker:

Vahid Shadravan received his Bachelor (2011) in Chemical Engineering from Bahonar University of Kerman, Iran. He commenced his Ph.D. studies (2013) in Chemical Engineering under the supervision of Prof. Michael Stockenhuber and Prof. Eric Kennedy at the University of Newcastle.

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