

Comparative Study of Ni Catalysts Supported by Silica and Modified by Metal Additions Co and Ce for The Steam Reforming of Methane

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Abstract : The Catalysts materials Ni-SiO₂, Ni-Co-SiO₂ and Ni-Ce-SiO₂ were synthesized by classical method impregnation and supported by silica. This involves combining the silica with an adequate rate of the solution of nickel nitrates, or nickel nitrate and cobalt nitrate, or nickel nitrate and cerium nitrate, mixed, dried and calcined at 700 ° c. These catalysts have been characterized by different physicochemical analysis techniques. The atomic absorption spectrometry indicates that the real contents of nickel, cerium and cobalt are close to the theoretical contents previously assumed, which let's say that the nitrate solutions have impregnated well the silica support. The BET results show that the surface area of the specific surfaces decreases slightly after impregnation with nickel nitrates or Co and Ce metals and a further slight decrease after the reaction. This is likely due to coke deposition. X-ray diffraction shows the presence of the different SiO₂ and NiO phases for all catalysts—theCoO phase for that promoted by Co and the Ce₂O₃ phase for that promoted by Ce. The methane steam reforming reaction was carried out on a quartz reactor in a fixed bed. Reactants and products of the reaction were analyzed by a gas chromatograph. This study shows that the metal addition of Cerium or Cobalt improves the majority of the catalytic performance of Ni for the steam reforming reaction of methane. And we conclude the classification of our Catalysts in order of decreasing activity and catalytic performances as follows: Ni-Ce / SiO₂ > Ni-Co / SiO₂ > Ni / SiO₂ .

Keywords : cerium, cobalt, heterogeneous catalysis, hydrogen, methane, steam reforming, synthesis gas

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