

Preparation and Characterization of a Nickel-Based Catalyst Supported by Silica Promoted by Cerium for the Methane Steam Reforming Reaction

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Abstract : Natural gas currently represents a raw material of choice for the manufacture of a wide range of chemical products via synthesis gas, among the routes of transformation of methane into synthesis gas. The reaction of the oxidation of methane by gas vapor 'water. This work focuses on the study of the effect of cerium on the nickel-based catalyst supported by silica for the methane vapor reforming reaction, with a variation of certain parameters of the reaction. The reaction temperature, the H_2O / CH_4 ratio and the flow rate of the reaction mixture (CH_4-H_2O). Two catalysts were prepared by impregnation of Degussa silica with a solution of nickel nitrates and a solution of cerium nitrates [$Ni(NO_3)_2 \cdot 6H_2O$ and $Ce(NO_3)_3 \cdot 6H_2O$] so as to obtain the 1.5% nickel concentrations. For both catalysts and plus 1% cerium for the second catalyst. These Catalysts have been characterized by physical and chemical analysis techniques: BET technique, Atomic Absorption, IR Spectroscopy, X-ray diffraction. These characterizations indicated that the nitrates had impregnated the silica. And that the NiO and Ce_2O_3 phases are present and Ni⁰(after reaction). The BET surface of the silica decreases without being affected. The catalytic tests carried out on the two catalysts for the steam reforming reactions show that the addition of cerium to the nickel improves the catalytic performances of the nickel. And that these performances also depend on the parameters of the reaction, namely the temperature, the rate of the reaction mixture, and the ratio (H_2O / CH_4).

Keywords : heterogeneous catalysis, steam reforming, Methane, Nickel, Cerium, synthesis gas, hydrogen

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