

Autothermal reforming of methane over nickel catalysts prepared from hydrotalcite-like compounds

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1. Introduction

There has been substantial interest in recent years in alternative routes for conversion of natural gas (methane) to synthesis gas, a mixture of CO and H₂, which can be used to produce chemical products with high added values, such as hydrocarbons and oxygenated compounds.

Autothermal reforming (ATR), a combination of steam reforming and partial oxidation reactions, is an advantageous route for syngas production for both economical and technical reasons. It has low-energy requirements due to the opposite contribution of the exothermic methane oxidation and endothermic steam reforming. The combination of these reactions can improve the reactor temperature control and reduce the formation of hot spots, avoiding catalyst deactivation by sintering or carbon deposition. Moreover, ATR allows the production of syngas with a wider range of H₂/CO ratio by manipulating the relative concentrations of H₂O and O₂ in the feed [1,2]. All these advantages indicate that ATR should be the technology of choice for large-scale GTL (gas-to-liquid) plants [3]. In addition, a fuel processor based on autothermal reforming of methane could provide a low cost and compact system, with fast start-up and capability to follow load variations, more adequate for fuel cell electric vehicles [4].

Supported metal catalysts have been used in the reforming reactions of hydrocarbons and are conventionally prepared by wet impregnation of different supports. This method is not fully reproducible and may give rise to some heterogeneity in the distribution of the metal on the surface. Moreover, the fine