Platinum supported on alkaline and alkaline earth metal-doped alumina as catalysts for dry reforming and partial oxidation of methane


1. Introduction

The conversion of methane into syngas (CO and H2) or H2 is a very important and interesting route for the utilization of natural gas [1–4]. Syngas is an important feedstock for the chemical industry and H2 can be used as a clean energy source in both fuel cells and automobiles [5]. However, since natural gas reserves are larger than petroleum reserves, the economic aspect is also very favorable [6]. However, since natural gas deposits are frequently far away from the consumption centers [6,7], a good alternative may be its in situ processing into liquid products (gas-to-liquids, GTL), by first transforming the natural gas into syngas (CO + H2), the product is more appropriate for use in several chemical processes, such as the manufacture of higher hydrocarbons and oxygenates [16,17]. The main reactions in DR process are:

\[ \text{CH}_4 + \text{CO}_2 \rightleftharpoons 2\text{CO} + 2\text{H}_2 \quad (\Delta H^{\text{298 K}} = +247 \text{ kJ mol}^{-1}) \]  

\[ \text{CO} + \text{H}_2\text{O} \rightleftharpoons \text{CO}_2 + \text{H}_2 \quad (\Delta H^{\text{298 K}} = -41 \text{ kJ mol}^{-1}) \]  

The first reaction requires high temperatures to favor the thermodynamic equilibrium. However, the main problem of the DR is...