

Hydrogen production over partial oxidation of methane using NiMgAl spinel catalysts: A kinetic approach

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Description

NiMgAl-based catalysts were synthesized by coprecipitation, sol-gel, and impregnation methods, calcined at 700 °C for 4 h and tested in partial oxidation of methane in a temperature range of 500–800 °C. The fresh and used unsupported and supported samples were characterized by X-ray diffraction, nitrogen physisorption with Brunauer-Emmett-Teller (BET) analysis, and H₂-temperature-programmed reduction. X-ray diffraction analysis showed, for all samples, the formation of spinel phases MgAl₂O₄ and/or NiAl₂O₄ with crystallite sizes of 6–14 nm. H₂-temperature-programmed reduction analysis showed reduction of two Ni²⁺ species (in octahedral and tetrahedral sites of a spinel structure) into metallic nickel known to be responsible for the methane activation. The 10 wt % Ni/MgAl₂O₄ impregnated catalysts exhibited the highest activity and stability in the partial oxidation of methane reaction, which led mainly ...