

Activity of Ni/K₂Ti_xO_y-Al₂O₃ Catalysts for Hydrogen Production by Methane Steam Reforming

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There are several possible routes for hydrogen production from hydrocarbons, such as steam reforming, partial oxidation, auto-thermal reforming, and carbon dioxide reforming. Steam reforming is the most feasible given its production of hydrogen-rich gas. However, it suffers from catalyst deactivation, which can be overcome by using high steam-to-carbon feed ratios (>3.0). In this investigation, Ni/K₂Ti_xO_y-Al₂O₃ catalysts were prepared with a fixed 10 wt.% nickel loading, and varying amounts of potassium titanate, 11–50 wt.% of the support. Methane and steam feed was reacted in continuous flow fixed-bed reactors with steam to carbon ratios of 1.0–3.0, at 750–850 °C and atmospheric pressure for 10–100 hours. Among the catalysts having various content of potassium titanate, the catalyst with 20 wt.% potassium titanate had the highest activity in the reaction. Compared with the commercial catalyst, FCR-4, and a reference catalyst, Ni/Al₂O₃, the Ni/K₂Ti_xO_y-Al₂O₃ catalysts showed similar or better performances for the steam reforming of methane. Besides, the catalysts showed protection from deactivation due to sintering on the reaction.