

CO₂ reforming of CH₄ over Ni/SBA-15 catalyst: Effect of Nickel Loading

H.D. Setiabudi, N. Ainirazali, S.F.R.M. Suhaimi, F.N. Pauzi, K.H. Lim, S.Y. Chin

Faculty of Chemical and Natural Resources Engineering, Universiti Malaysia Pahang,

26300 Gambang, Kuantan, Pahang, Malaysia.

Tel: +609-5492836, Fax: +609-5492889, E-mail address: herma@ump.edu.my

Abstract

CO₂ reforming of CH₄ has recently attracted considerable attention due to the simultaneous utilization and reduction of two greenhouse gases, into the synthesis gas (syngas) with low H₂/CO ratio than those available industrial processes. CO₂ reforming of CH₄ has been studied extensively using variety of supported metal catalysts. Regarding to the choice of catalyst, Nickel (Ni) supported on mesoporous material shows good catalytic activity and selectivity. This study investigates the effects of Ni loading (0-10 wt%) on the properties and catalytic performance of Ni/SBA-15 towards CO₂ reforming of CH₄, owing to the fact that metal has a significant influence on the properties and catalytic performance of the catalyst. Characterization using XRD, BET, FTIR and TG/DTA revealed that the amount of Ni content plays an important role in controlling the properties and catalytic performance of Ni/SBA-15. The activity of CO₂ reforming of CH₄ followed the order of 5wt%Ni/SBA-15 > 10wt%Ni/SBA-15 > 3wt%Ni/SBA-15 > SBA-15. The superior catalytic behaviour of 5wt%Ni/SBA-15 towards CO₂ reforming of CH₄ was related with the interaction of Ni with SBA-15, which altered the properties of catalyst towards an excellent catalytic performance. The conversion of CH₄ and CO₂ over 5wt%Ni/SBA-15 was about 88.2% and 91.4%, respectively with CO₂/CH₄ ratio of 1. This study provides new perspectives on the Ni-based catalyst, particularly on the effects of Ni on the properties and catalytic performance of Ni/SBA-15 towards CO₂ reforming of CH₄.

Keywords: Ni/SBA-15, CH₄ reforming, Syngas, Nickel loading.