

CO₂ REFORMING OF CH₄ OVER Ni/SBA-15 PREPARED BY SURFACTANT-ASSISTED IMPREGNATION METHOD: COMPARATIVE STUDY OF SURFACTANT TYPES

C.C. Chong¹, A.H.K. Owgi¹, N. Ainirazali¹, S.Y. Chin^{1,2}, H.D. Setiabudi^{1,2,*}

¹ Faculty of Chemical and Natural Resources Engineering, Universiti Malaysia Pahang, 26300 Gambang, Kuantan, Pahang, Malaysia.

² Centre of Excellence for Advanced Research in Fluid Flow, Universiti Malaysia Pahang, 26300 Gambang, Kuantan, Pahang, Malaysia.

*Corresponding author: herma@ump.edu.my (H.D. Setiabudi)

*Contact: +60-9-5492836

Abstract

This research focused on the influence of surfactant types of surfactant-assisted impregnation method on the properties and catalytic activity of Ni/SBA-15 towards CO₂ reforming of CH₄ (CRM). Three types of surfactant were used which are nonionic surfactant (poly(ethylene glycol)-poly(propylene glycol)-poly(ethylene glycol), P123), cationic surfactant (cetyltrimethylammonium bromide, CTAB) and anionic surfactant (sodium dodecyl sulfate, SDS) to synthesize Ni/SBA-15(P123), Ni/SBA-15(CTAB) and Ni/SBA-15(SDS), respectively. The synthesized catalysts were characterized using X-ray Diffractometer (XRD), Brunauer-Emmett-Teller (BET) and Fourier-Transform Infrared (FTIR) to study the physical and chemical properties of synthesized catalysts. The CRM was carried out in a stainless steel fixed bed reactor at 800°C and CO₂/CH₄ ratio = 1/1. The obtained results indicated that the types of surfactant greatly influence the properties and catalytic activity of Ni/SBA-15. The activity of catalysts followed the order of SBA-15 < Ni/SBA-15(SDS) < Ni/SBA-15(CTAB) < Ni/SBA-15 < Ni/SBA-15(P123) with the conversion of CH₄ and CO₂ over Ni/SBA-15(P123) were about 92% and 82%, respectively and H₂/CO ratio of 1.22. The superior catalytic performance of Ni/SBA-15(P123) might be related with the well dispersion of Ni particles which enhanced the stabilization of the active metal sites on SBA-15 and ameliorated the properties of catalyst towards an excellent catalytic performance. This study provides a new perspective on the preparation of Ni/SBA-15, particularly in the influence of surfactant types of surfactant-assisted impregnation method towards an excellent CRM.

Keywords: Ni/SBA-15; CO₂ dry reforming; surfactant; Ni dispersion.

Area of research: Materials Science & Engineering

Suitable Journal: Materials Today: Proceedings