

SYNTHESIS OF Ni/SBA-15 FOR CO₂ REFORMING OF CH₄: UTILIZATION OF PALM OIL FUEL ASH AS SILICA SOURCE

N. Abdullah¹, C.C. Chong¹, 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

In this study, Ni/SBA-15 was synthesized using Palm Oil Fuel Ash (POFA) as the silica source and was applied in the CO₂ reforming of CH₄ (CRM). The preparation of POFA sodium silicate (POFA-Na₂SiO₃) was carried using sodium hydroxide (NaOH) fusion method under several parameters including NaOH/POFA mass ratio, fusion temperature and NaOH-fused POFA/H₂O mass ratio. The optimum condition was achieved at NaOH/POFA mass ratio of 2:1, fusion temperature of 550 °C and NaOH-fused POFA/H₂O mass ratio of 1:4, with maximum silica content of 40570 ppm. POFA-Na₂SiO₃ was used as the silica source for the synthesis of Ni/SBA-15(POFA), and its properties and catalytic performance were compared with Ni/SBA-15(TEOS). The physicochemical properties of the catalysts were characterized using XRD, BET and FTIR, meanwhile the catalytic performance of the catalyst was carried out in a fixed bed reactor at 800°C, atmospheric pressure and CO₂/CH₄ feed ratio of 1/1. The characterization results revealed that the physicochemical properties of Ni/SBA-15(POFA) were comparable with Ni/SBA-15(TEOS), except for the size of Ni and the strength of metal-support interaction. The catalytic performance results showed that Ni/SBA-15(POFA) has comparable CO₂ conversion (around 82%), but lower in CH₄ conversion (differences around 27%) and stability, which might be due to the larger Ni size and weak metal-support interaction in Ni/SBA-15(POFA) as compared to Ni/SBA-15(TEOS). Although Ni/SBA-15(POFA) showed lower CH₄ conversion in CRM, POFA can be considered as an alternative silica source to synthesis Ni/SBA-15 owing to the fact that the deficiency observed in the present catalyst can be improved via metal loading method.

Keywords: POFA, alkali fusion method, H₂/CO ratio, CO₂ dry reforming

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