Hydrogen production by thermo-catalytic conversion of methane over lanthanum strontium cobalt ferrite (LSCF) and αAl_2O_3 supported Ni catalysts

Bamidele V. Ayodele[a,b], Mohamed Yazrul Mohd Yassin[a,b,] Rosmawati Naim[a,b], Sureena Abdullah[a,b]

[a] Faculty of Chemical & Natural Resources Engineering, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang Kuantan, Pahang Malaysia

[b] Center of Excellence for Advanced Research in Fluid Flow, Lebuhraya Tun Razak, 26300 Gambang Kuantan, Pahang Malaysia

ABSTRACT

This study investigates hydrogen production by thermo-catalytic steam methane reforming over lanthanum strontium cobalt ferrite supported Nickel (Ni/LSCF) and commercial $Ni/\alpha Al_2O_3$ catalysts. The Ni/LSCF catalyst was synthesized using wet impregnation method and characterized by XRD, TEM, SEM, EDX, N_2-physisorption analysis, and H_2-TPR. The characterization analyses show that Ni/LSCF and $Ni/\alpha Al_2O_3$ possess the required physicochemical properties to catalyze the steam methane reforming reaction. The activity of the Ni/LSCF catalyst in steam methane reforming at 750 °C, 800 °C, and 850 °C resulted in CH_4 conversions of 73.46%, 78.67%, and 87.56%, respectively. In addition, hydrogen (H_2) yields of 64.34%, 72.57%, and 82.56% were obtained from the steam methane reforming at 750 °C, 800 °C, and 850 °C, respectively over the Ni/LSCF catalyst. The Ni/LSCF catalyst was found to have higher activities in term of CH_4conversion and H_2 yield compare to the commercial $Ni/\alpha Al_2O_3$. However, the stability test conducted at 480 min time on stream (TOS) revealed that the commercial $Ni\text{-}\alpha Al_2O_3$ was more stable in the steam methane reforming than the Ni/LSCF catalyst. The characterization of the used catalysts by TEM, XRD and TGA shows evidence of carbon deposition mostly on the used Ni/LSCF catalyst.

KEYWORDS

Steam methane reforming; Syngas; Lanthanum strontium cobalt ferrite; Hydrogen; Ni-catalysts

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