Characterization of La-promoted Ni/Al2O3 catalysts for hydrogen production from glycerol dry reforming

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ABSTRACT

In the current paper, dry (CO_2)-reforming of glycerol, a new reforming route, was carried out over alumina (Al_2O_3)-supported, non-promoted and lanthanum-promoted nickel (Ni) catalysts. Both sets of catalysts were synthesized via a wet co-impregnation procedure. Physicochemical characterization of the catalysts showed that the promoted catalyst possessed smaller metal crystallite size, hence higher metal dispersion compared to the virgin Ni/Al_2O_3 catalyst. This was also corroborated by the surface images captured by the FESEM analysis. From temperature-programmed calcination analysis, the derivative weight profiles revealed two peaks, which represent a water elimination peak at a temperature range of 373 to 473 K followed by nickel nitrate decomposition from 473 to 573 K. In addition, BET surface area measurements gave 85.0 $m^2 \cdot g^{-1}$ for the non-promoted Ni catalyst, whilst the promoted catalysts showed an average of 1% to 6% improvement depending on the La loadings. Significantly, reaction studies at 873 K showed that glycerol dry reforming successfully produced H_2. The 2%La-Ni/Al_2O_3 catalyst, which possessed the largest BET surface area, gave an optimum H_2 generation (9.70%) at a glycerol conversion of 24.5%.

KEYWORDS: Ni catalysts; dry reforming; lanthanide promotion; reaction kinetics

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