

Syngas production from glycerol-dry (CO₂) reforming over La-promoted Ni/Al₂O₃ catalyst

ABSTRACT

A 3 wt% La-promoted Ni/Al₂O₃ catalyst was prepared via wet co-impregnation technique and physicochemically-characterized. Lanthanum was responsible for better metal dispersion; hence higher BET specific surface area (96.0 m² g⁻¹) as compared to the unpromoted Ni/Al₂O₃ catalyst (85.0 m² g⁻¹). In addition, the La-promoted catalyst possessed finer crystallite size (9.1 nm) whilst the unpromoted catalyst measured 12.8 nm. Subsequently, glycerol dry reforming was performed at atmospheric pressure and temperatures ranging from 923 to 1123 K employing CO₂-to-glycerol ratio from zero to five. Significantly, the reaction results have yielded syngas as main gaseous products with H₂:CO ratios always below than 2.0 with concomitant maximum 96% glycerol conversion obtained at the CO₂-to-glycerol ratio of 1.67. In addition, the glycerol consumption rate can be adequately captured using power law modelling with the order of reactions equal 0.72 and 0.14 with respect to glycerol and CO₂ whilst the activation energy was 35.0 kJ mol⁻¹. A 72 h longevity run moreover revealed that the catalyst gave a stable catalytic performance.

Keyword: Glycerol; Dry reforming; Lanthanum; Nickel catalyst; Syngas