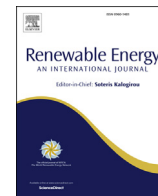




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# Catalytic pyrolysis of glycerol into syngas over ceria-promoted Ni/ $\alpha$ -Al<sub>2</sub>O<sub>3</sub> catalyst



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## ABSTRACT

This paper reports on the catalytic pyrolysis of glycerol into syngas over a 3 wt%Ce-20 wt%Ni/77 wt%  $\alpha$ -Al<sub>2</sub>O<sub>3</sub> catalyst and at reaction temperatures of 973 K, 1023 K and 1073 K. NH<sub>3</sub>- and CO<sub>2</sub>-TPD analyses have revealed that the as-synthesized catalyst was net acidic with acid-to-basic site ratio of 1.24. This provides ideal conditions for chemisorption of glycerol. In addition, the BET specific surface area was 2.89 m<sup>2</sup> g<sup>-1</sup>. The small surface area can be attributed to the thermally stable  $\alpha$ -Al<sub>2</sub>O<sub>3</sub> support. In addition, the average crystallite size was 40.22 nm. The catalytic glycerol pyrolysis produced gaseous products that were comprised of H<sub>2</sub>, CO, CO<sub>2</sub> and CH<sub>4</sub> only with H<sub>2</sub>:CO ratios that were consistently less than 2.0. This ratio is suitable for Fischer-Tropsch synthesis. The yields of CO<sub>2</sub> and CH<sub>4</sub> were several folds lower than the yields of H<sub>2</sub> and CO, indicating that the latter were from primary reaction, viz. glycerol decomposition whilst the former were from secondary competing reactions. In addition, the activation energy obtained via Langmuir-Hinshelwood model was 25.34 kJ mol<sup>-1</sup>. Used catalyst characterization showed that the carbonaceous deposit was in the forms of whisker-type. This type of carbon deposit would not physically deactivate the catalyst.