Catalytic steam reforming of glycerol over cerium and palladium-based catalysts for hydrogen production

ABSTRACT

In this work, catalytic steam reforming of glycerol for hydrogen production was performed over Ce/Al2O3 and Pd/Al2O3 catalysts prepared via the impregnation method. The catalysts were characterized by scanning electron microscopy (SEM-EDX), transmission electron microscopy (TEM), BET surface area, and X-ray diffraction (XRD). Two sets of catalytic reactions were conducted, one comparing 1% Pd/Al2O3 to 1% Ce/Al2O3 and the second comparing 1% Ce/Al2O3 loading to 10% Ce/Al2O3 loading. All catalytic reactions were performed using a fixed-bed reactor operated at 600 °C and atmospheric pressure. Aglycerol–water mixture at a molar ratio of 1:6 was fed to the reactor at 0.05 ml/min. In the first set of experiments, Pd/Al2O3 exhibited higher hydrogen productivity than Ce/Al2O3. A maximum hydrogen yield of 56% and a maximum selectivity of 78.7% were achieved over the Pd/Al2O3 catalyst. For the second set of experiments, the results show that the reaction conversion increased as the cerium loading increased from 1% to 10%. A total average hydrogen yield of 28.0% and a selectivity of 45.5% were obtained over 1% Ce/Al2O3, while the total average hydrogen yield and selectivity were 42.2% and 52.7%, respectively, for 10% Ce/Al2O3.

Keyword: Catalytic system; Glycerol; Hydrogen production; Reforming process.