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Nickel, ceria and niobium catalysts are supported on alumina in the steam reforming of ethanol to obtain hydrogen

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Heterogeneous catalysts of nickel, niobium and cerium supported on alumina were prepared by the co-precipitation method in different chemical compositions. After the synthesis of the catalysts, the samples were calcined at 800 °C for 4 hours in a muffle furnace. Then, the obtained samples were analyzed by different characterization methods, such as X-ray Diffraction (XRD), X-ray Dispersive Spectrometry (EDS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Programmed Temperature Reduction (TPR), and Thermogravimetric Analysis (TG). The characterized catalysts were evaluated in catalytic tests using steam reforming of ethanol to produce hydrogen. A quartz fixed-bed catalytic reactor with an internal diameter of 6 mm was used. The catalytic reactor was filled with 100 mg of catalyst, and then the catalyst was activated using a hydrogen flow of 30 mL.min⁻¹. After activating the catalyst, ethanol was steam reformed under the following operating conditions. Water/ethanol molar ratio equal to 3:1, Reaction temperature of 600 °C. The synthesis gases obtained in the reaction, such as hydrogen, carbon monoxide, carbon dioxide and methane, were analyzed in a gas chromatograph, coupled online to the catalytic reactor. The chromatograph used is equipped with two detectors, a thermal conductivity detector (TCD) and another for ionic conductivity (FID), in addition to two gas separation columns, a molecular column serving 5 Å and another Porapak column.