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Hydrodeoxygenation of phenol over Ni/Ce_{1-x}Nb_xO₂ catalysts

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Abstract: This work investigated the effect of different niobium concentration on the performance of Ni/Ce_{1-x}Nb_xO₂ catalyst for hydrodeoxygenation of phenol in gas phase at 300 °C. Also, the structural modification promoted by Nb addition was studied by several techniques. In situ X-ray diffraction and Raman analyses indicated that high niobium concentration lead to Nb₂O₅ oxide with hexagonal structure, while in situ X-ray photoelectron spectroscopy (XPS) experiments indicated an enrichment of the surface with Nb. In general, the incorporation of niobium changed the lattice parameter of ceria and promoted the formation of oxygen vacancies as observed by XPS and X-ray absorption near edge structure (XANES) analyses, which favored the activity of the sample. Increasing Nb content increased the selectivity to deoxygenated products (benzene). The superior benzene selectivity is likely due to the higher interaction between the oxygen of phenol molecule and the oxophilic sites represented by the Nb⁵⁺ cations of the support that promotes the hydrogenation of carbonyl group.