MIXED XEROGELS TiO_2-CeO_2 AS CATALYSTS FOR A GREEN LIQUID PHASE OXIDATION

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One of the most important properties of titanium dioxide (TiO_2-titania) is its used in catalysis. It seeks a non stoichiometry in the oxide for such purposes. The sol-gel technique is one way to prepare titania not stoichiometry. This technique is also used to incorporate metallic atoms in the crystalline network or as small particles to deposit on the glass surface. The physical and chemical properties of materials obtained by this method may vary according to temperature, operating conditions and precursors selected. Moreover, the most significant among the oxide lanthanides in industrial catalysis is the CeO_2. This presents a potential use for removal of organic wastewater (oxidation catalyst), catalytic combustion additive and redox reactions. The particularity of CeO_2 lies in its behavior as oxygen reservoir, storing and releasing oxygen through their redox couple Ce^{+3}-Ce^{+4}.

According to this, mixed ceria-titania xerogels were prepared with a load of 10% (w / w) of CeO_2 and three different pH values: 2, 3 and 4, during the sol-gel process. The gels were dried in air at 50° C for 24 h and calcined in air at 200 °C and 800 °C for 4 h, respectively. Moreover a sample without cerium, 100% (w / w) TiO_2, was prepared so as to keep as reference material. The sol-gel synthesis of this was carried out at pH=3, with a subsequent heat treatment similar to previous ones.

The prepared solids were characterized by means of XRD, SEM and DRS. Their textural properties were determined by adsorption-desorption isotherms of N_2 at 77 K.

The xerogels were tested as catalysts in the liquid phase oxidation of 2,6-dimethylphenol at 20 °C, using ethanol as solvent and aqueous hydrogen peroxide as a clean oxidizing agent. The best performance was achieved by the xerogel synthesized at pH=4 and calcined at 200 °C; 100 % of conversion and 96 % of yield in 2,6-dimethyl-p-benzoquinone were obtained in this case after 6 hours. of reaction. Mixtures of ethanol-water (50:50; 35:65 %(v/v)) were also good solvents to perform this reaction, a conversion of 100% and a yield of 40% were obtained in 4 h.

This study pretends to contribute to the search for heterogeneous catalysts to carry out oxidation of organic compounds in a sustainable way with the environment (low temperature, cleaner oxidizing agent and safer solvents).