

Hydrogenation / Hydrogenolysis of benzaldehyde over CaTiO_3 based catalysts

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ABO_3 perovskite-type mixed oxides with alkaline-earth (Ca, Ba) and/or rare earth (La, Ce, ...) on A site and a transition metal (Co, Zr or Ni...) on the B site, are of important interest as catalysts for various reactions such as oxidation, oxidative dehydrogenation and combustion of light hydrocarbons.

The studies of selective catalytic hydrogenation of benzaldehyde to benzyl alcohol have been largely devoted to the liquid phase system whereas relatively few studies have been reported for the gas phase system. Such reactions are currently catalyzed by systems involving supported noble metals, such as Pt, Pd, Ru and other supported metal oxides, including transition metal oxides like Ni and Cu [1,3]. Some works on benzaldehyde hydrogenation by alkaline-earth oxides have been also reported [4]. It was found that the reactivity of catalysts strongly depended on both the reducibility and surface acid-base properties that depend on their composition and the treatment conditions [5]. The reaction of benzaldehyde reduction is often considered as valuable catalytic test for the characterisation of both metal oxide surfaces and acid-base and/or redox properties of heterogeneous catalysts like metal oxides. It is admitted that benzaldehyde is reduced to benzyl alcohol or toluene by the Cannizzaro reaction which required hydroxyl groupings and its hydrogenolysis to benzene acid sites.

In this context, the objective of this work is to prepare various perovskites of $\text{Ca}_{1-x}\text{Mg}_x(\text{Ti}_{1-x}\text{Li}_x)\text{O}_{3-3x}\text{F}_{3x}$ formula, with $0 \leq x \leq 0.15$ and to compare their acid-base, redox and catalytic properties in the hydrogenation of benzaldehyde and to examine how the substitution affects these properties. The perovskite catalysts were prepared by ceramic method and analyzed by BET method, IR spectroscopy and X-Ray diffraction.

Our results showed that the hydrogenation of benzaldehyde over perovskite catalysts depended on the experimental conditions and chemical compositions. CaTiO_3 is more active than the substituted perovskites. Benzene is the main product formed over CaTiO_3 whereas its selectivity depends of the reaction temperature in the case of the substituted perovskites. Toluene, hydrogenation product, is favoured at higher reaction temperature over substituted perovskites. In conclusion, the perovskite oxides can be used as catalysts in reduction reaction and their catalytic properties depend of their composition and experimental conditions.

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