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PROPERTIES OF Al-Ce MIXED OXIDES PREPARED MECHANOCHEMICALLY

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Ceria containing catalysts play an essential role in heterogeneous catalytic processes. Pure ceria has been subject of numerous investigations because of its wide applications in catalysis [1,2]. However, ceria shows poor thermal stability and low specific surface area and therefore, many studies have been done to improve ceria properties by combination with other oxides like TiO_2, ZrO_2, Al_2O_3 and other [3].

Mixtures of alumina and different quantities of CeO_2 (1-18 wt.%) were synthesized by simple mechano-chemical method from aluminum nitrate, cerium nitrate and ammonia bicarbonate. Properties of the prepared precursors and the calcined samples were investigated by SEM, TG-DTA, IR and Raman spectroscopy, N_2 adsorption at -195 °C, TPR, NH_3-TPD, CO_2-TPD, determination of PZC and XPS.

Aluminum ammonium carbonate hydroxide $NH_4Al(OH)_2CO_3$,was found to be main product in the dried Al precipitate, while cerium carbonate hydroxide $CeCO_3OH$ was prevailing in the dried Ce precipitate. After calcination at 500 °C, amorphous structure of alumina and cubic fluorite crystallites of ceria with preferred orientation along (1 1 1) direction were detected by X-ray diffraction. XPS spectrum confirmed the existence of Ce^{4+} oxidation states in cerium oxide nanoparticles. Surface acidity of the mixed oxides prepared mechanochemically is lower than that observed at oxides prepared by other methods because of presence of adsorbed ammonia on the surface. This was confirmed by IR spectroscopy results and gradual increase of PZCs with increasing CeO_2 amount in the mixed Al_2O_3-CeO_2. Addition of CeO_2 to alumina slightly decreased the surface area and mesopore volume of resulting mixed oxides.

Mechanochemical procedure of mixed oxide preparation is relatively simple and facile. It does not produce large quantities of waste waters, which negatively influence the life environment. The products are suitable as supports of heterogeneous CoMo catalysts for hydrodesulfurization reactions or directly as catalysts for total oxidation reactions.

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