Effect of preparation methods on the thermal stability of rare earth modified transition alumina

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Generally transition aluminas are used as catalyst supports, because of their high specific surface areas, surface property and crystalline structures. Although the surface areas of alumina supports significantly decrease and the catalysts loss the catalytic activity at high temperatures. Therefore, it is necessary to improve thermal stability of alumina supports. It has been reported that rare earth additives were improving the thermal stability of the catalysts. We investigated the thermal stability of rare earth modified γ-alumina powders. The rare earth cations, (La^{3+}, Pr^{3+}, Nd^{3+}, Sm^{3+}, Gd^{3+}, Y^{3+}, and Ce^{4+}) were added by the homogeneous precipitation, using appropriate nitrate solutions with hexamethylenetetramine. The effect of rare earth modification on the thermal stability and morphology of alumina powders at elevated temperatures were examined by BET surface measurement, X-ray powder diffraction (XRD), differential thermal analysis (DTA) and transmission electron microscope (TEM).

The rare earth cations with larger ionic radius except Ce^{4+} could improve the thermal stability of γ-alumina more effectively. Especially La^{3+} retarded the surface loss of alumina the most. On the other hand, Ce^{4+} modified alumina showed less effect than any other rare earth cations modified alumina.

In order to compare the effect of preparation processes, we also prepared rare earth modified samples by usual impregnation process, using nitrate solutions. The observation of transmission electron micrograph of each sample, homogeneous precipitation could disperse the rare earth additives more highly than the impregnation process. At various temperatures, the surface areas of samples prepared by homogeneous precipitation were higher than those of the impregnation process.

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