Synthesis of high surface area of hydrous zirconia and its catalytic activity for the dehydration of *iso*-propanol

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Zirconium oxide has been applied to various catalytic reactions such as α-olefins from alcohol, 1-butene from 2-butanamine, hydrogenation of carbon dioxide, olefins and dienes. In many cases, ZrO_2 showed better catalytic performance than Al_2O_3 which is a widely used support [1, 2].

In this study, hydrous zirconia was synthesized in aqueous solution of zirconium oxychloride by a precipitation method with different precipitants: KOH, NaOH and NH_4OH. The solution was aged at 100 ^oC for various aging time, and then filtered and dried at 60 ^oC for overnight. The resulting hydrous zirconia was ion-exchanged in $NH_4{\cdot}NO_3$ solution to remove the residual Na^+ and K^+ ions. Finally, all samples were calcined at 700 ^oC for 6 h to obtain the crystalline ZrO_2. The samples denoted as P(x, y), where P, x, and y means the species of precipitant, aging time (h) and number of ion-exchange times, respectively.

The samples were characterized by X-ray diffraction (XRD), N_2-sorption analysis, scanning electron microscopy (SEM), *iso*-propanol-temperature programmed desorption (IPA-TPD), and Pyridine adsorbed infrared spectroscopy (Py-IR) to correlate with catalytic activity of the IPA dehydration.

Fig. 1 shows that pure tetragonal crystallites were formed from ZrO_2 catalysts aged for 24 h after calcination at 700 ^oC. From the N_2-soprtion analysis, a KOH(24, 0) catalyst has larger specific surface area than NaOH(24, 0), and NH_4OH(24, 0). In addition, specific surface area of the samples was increased with the increasing aging time.

IPA-TPD results in Fig. 2 revealed that the NH_4OH(24, 0) had the lowest desorption temperature amongst the samples without ion-exchange process. However, ZrO_2 catalysts used KOH and NaOH after ion-exchange showed lower desorption temperature than NH_4OH(24, 0) catalyst.

The best catalytic activity for the dehydration of IPA was shown over a NaOH(120, 1) catalyst, and this result was well correlated with high specific surface area, and acid functionalities.

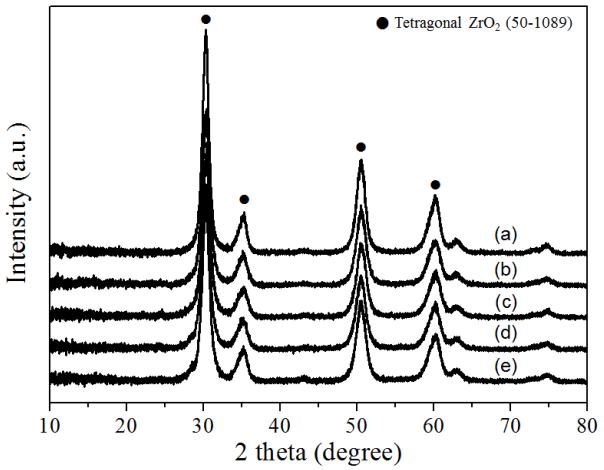

Fig. 1. XRD patterns of the calcined ZrO_2 catalysts aged for 24 h at 100 ^oC with different precipitants: (a) NH_4OH(24, 0), (b) NaOH(24, 0), (c) KOH(24, 0), (d) NaOH(24, 1), and (e) KOH(24, 1).

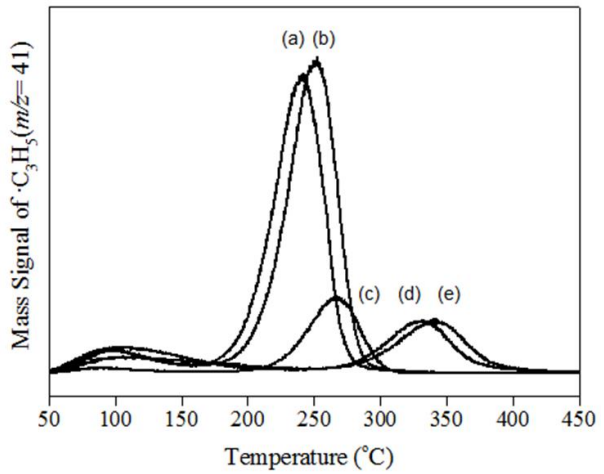

Fig. 2. IPA-TPD profiles of the calcined ZrO_2 catalysts. The mass signal of $\cdot C_3H_5$ (m/z = 41) was recorded by using QMS detector. Same notations in Fig. 1 were used.

REFERENCES

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