

Synthesis of SnPt Bimetallic Nanoparticle Catalysts for Chemoselective Hydrogenation of Unsaturated Aldehyde

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In the supported bimetallic catalysts, the secondary metal usually interacts with not only the main metal component, but also the support, bringing about the formation of various species (mono metal and bimetal species) over the surface of catalysts. Particle size effect is also complicated. These make it difficult to elucidate the actual active sites. In this study, in order to discard the effect of support-metal interaction, the unsupported SnPt bimetallic nanoparticle catalysts for selective hydrogenation for crotonaldehyde were prepared by the polyol method [1]. The effective SnPt bimetallic structure and composition for crotonaldehyde hydrogenation were also discussed.

Figure 1 shows the XRD patterns of SnPt bimetallic nanoparticle (SnPt NPs) catalysts with various Sn/Pt atomic ratios. The addition of small amount of Pt (Sn/Pt = 0.5) brought about the peak shift toward lower 2θ , suggesting the formation of Sn_1Pt_3 alloy. At the Sn/Pt ratio greater than 0.7, the peaks attributed to Sn_1Pt_1 alloy phase appeared and their intensities were increased with increasing the amount of added Sn. The Sn_1Pt_1 alloy phase was only observed on the SnPt NPs with Sn/Pt = 1.4 and 1.5. Further addition of Sn (Sn/Pt = 2.2) led to the formation of Sn_2Pt_1 alloy phase.

The effect of Sn/Pt atomic ratios of SnPt NPs for selective hydrogenation of crotonaldehyde is shown Fig. 2. The selectivity of butyraldehyde (SAL) decreased

with increasing the Sn/Pt ratio of up to 1.4, and increased at the Sn/Pt ratio greater than 1.5. The highest selectivity of crotyl alcohol (target molecular in this reaction, UOL) was observed over the SnPt NPs with 1.4 of Sn/Pt ratio. These results suggested that the Sn_1Pt_1 alloy phase was effective for chemoselective hydrogenation of crotonaldehyde. Notably, the formation of Sn_2Pt_1 alloy phase caused by the further addition of Sn to Sn_1Pt_1 alloy phase was found to decrease the selectivity of UOL.

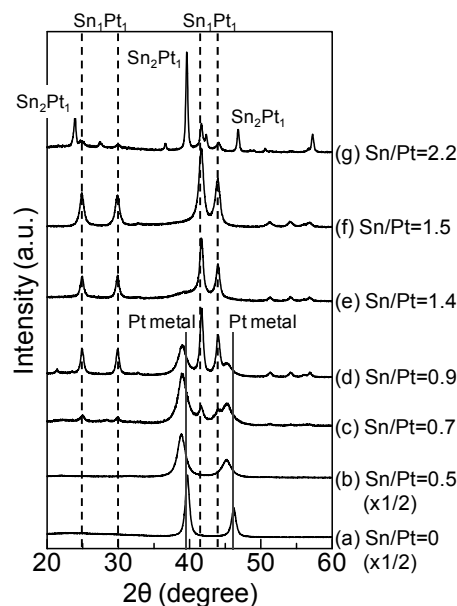


Fig. 1 XRD patterns of SnPt bimetallic nano particle catalysts

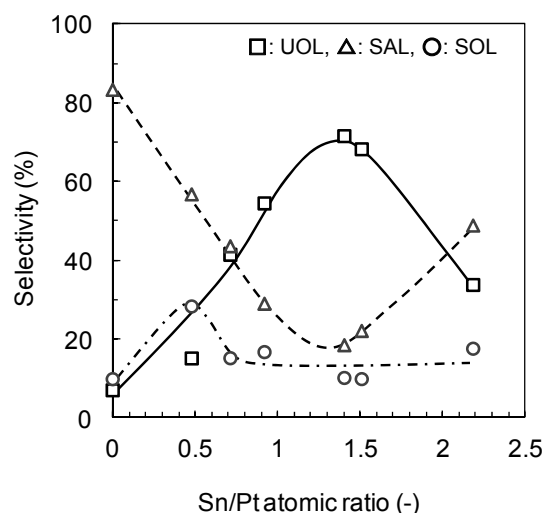


Fig. 2 Hydrogenation of crotonaldehyde over SnPt NPs catalysts

REFERENCES

[1] W. Oduro, N. Cailuo, K.M.K. Yu, H. Yang, S.C. Tsang, *Phys. Chem. Chem. Phys.*, **13** (2011) 2590.