

# Selective Hydrogenolysis of Tetrahydrofurfuryl alcohol over Supported Pt Catalysts

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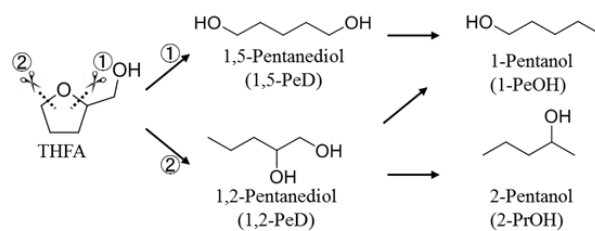
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Tetrahydrofurfuryl alcohol (THFA) is one of the furfural derivatives, which has been produced through multistep reaction process (hydrolysis-dehydration-hydrogenation) in the conversion of hemicellulose in non-edible biomass. Among various processes for converting THFA to value-added chemicals, the selective C-O hydrogenolysis over heterogeneous catalysts provide a significant route to the production of 1,2-, and 1,5-pentanediol (PeD) (Scheme 1). In this study, we investigated the relationship between catalytic performances of Pt/WO<sub>3</sub>/ZrO<sub>2</sub> catalysts with various loading amount of WO<sub>3</sub> in the THFA hydrogenolysis and local structures around tungsten species.

Figure. 1 shows the results of THFA hydrogenolysis over supported WO<sub>3</sub>, Nb<sub>2</sub>O<sub>5</sub>, and V<sub>2</sub>O<sub>5</sub> catalysts. 1,5-PeD was mainly produced together with 1-pentanol (1-PeOH). The activity of supported WO<sub>3</sub> catalysts was higher than those of supported Nb<sub>2</sub>O<sub>5</sub> and V<sub>2</sub>O<sub>5</sub> catalysts. Among the supported WO<sub>3</sub> catalysts, Pt/WO<sub>3</sub>/ZrO<sub>2</sub> gave the highest yield of 1,5-PeD.

The loading amount of WO<sub>3</sub> significantly affected the products distribution in hydrogenolysis of THFA (Fig. 2). The yield of 1,5-PeD was increased with increase of WO<sub>3</sub> loading, and reached the highest at 5 wt% loading (with 36.4% yield accounting for 64.8% selectivity). According to WO<sub>6</sub> unit size (0.22 nm<sup>2</sup>) [1] and structural characterization, in the case of 5 wt% WO<sub>3</sub> loading, the surface coverage of ZrO<sub>2</sub> with WO<sub>3</sub> was ca. 50 %. When WO<sub>3</sub> loading was further increased over 10 wt%, inert WO<sub>3</sub> crystals as well as a decrease of Brønsted acidity would occur and subsequently resulted in reduction of catalytic

activity. This result suggests that hydroxyl groups located at the boundary between WO<sub>3</sub> species domain and ZrO<sub>2</sub> (W-(OH))-Zr, work as active sites for the selective hydrogenolysis of THFA to 1,5-PeD.



Scheme.1 Reaction pathway of THFA hydrogenolysis.

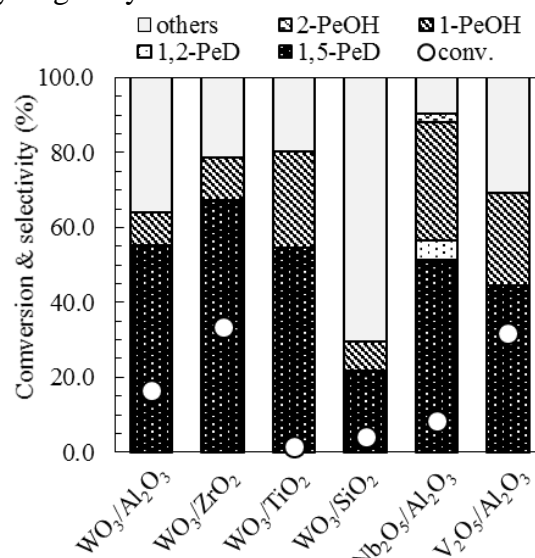


Fig. 1 Effect of support on THFA hydrogenolysis over Pt catalysts. Conditions: 2-PrOH 5 mL, 423K, H<sub>2</sub> 5MPa, 5h for WO<sub>3</sub>/Al<sub>2</sub>O<sub>3</sub> and WO<sub>3</sub>/ZrO<sub>2</sub>, 15h for others.

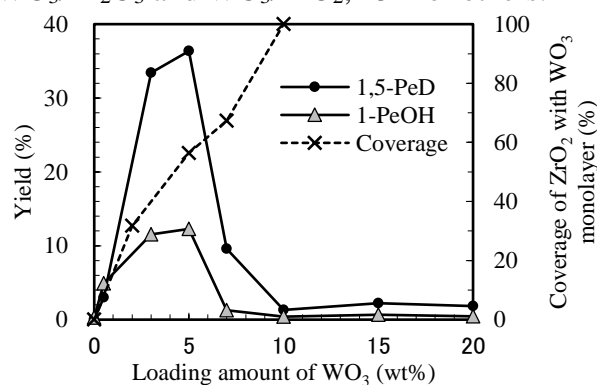


Fig. 2 Yield of 1,5-PeD over Pt/WO<sub>3</sub>/ZrO<sub>2</sub> and surface coverage of ZrO<sub>2</sub> with WO<sub>3</sub>. Conditions: 423 K, H<sub>2</sub> 5MPa, 5 h

## REFERENCES

- [1] C. Pfaff, M. J. PérezZurita, C. Scott, P. Patiño, M. R. Goldwasser, J. Goldwasser, F. M. Mulcahy, M.Houalla, D. M. Hercules, Catal. Lett., 49 (1997) 13.