

## Enhanced Ethylene Selectivity Toward Hydrodechlorination of 1,2-Dichloroethane over Ag-Pd Bimetallic Catalysts

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### Extended Abstract

Recently, catalytic hydrodechlorination (HDC) of chlorinated volatile organic compounds (CVOCs) receives increasing attention because it is an environmentally friendly technique to convert CVOCs air pollutants into useful chemicals, olefins [1]. Then, improving the olefins selectivity of the catalysts for HDC of CVOCs has attracted considerable attention. We have studied the Pd-Ag bimetallic catalysts toward HDC of 1,2-dichloroethane to ethylene reaction.

We used surface reduction method to prepare Pd-Ag/Al<sub>2</sub>O<sub>3</sub> catalyst, and evaluated their catalytic property toward HDC of 1,2-dichloroethane. As a result, Ag was deposited on the surface of Pd particles. With the increase of Ag content on the Pd surface led to the decrease of the amount of surface exposed Pd atoms. Thus, the Pd-Ag/Al<sub>2</sub>O<sub>3</sub> catalyst showed a higher ethylene selectivity (95%) than that prepared by conventional impregnated method (60%), shown in figure 1 [2].

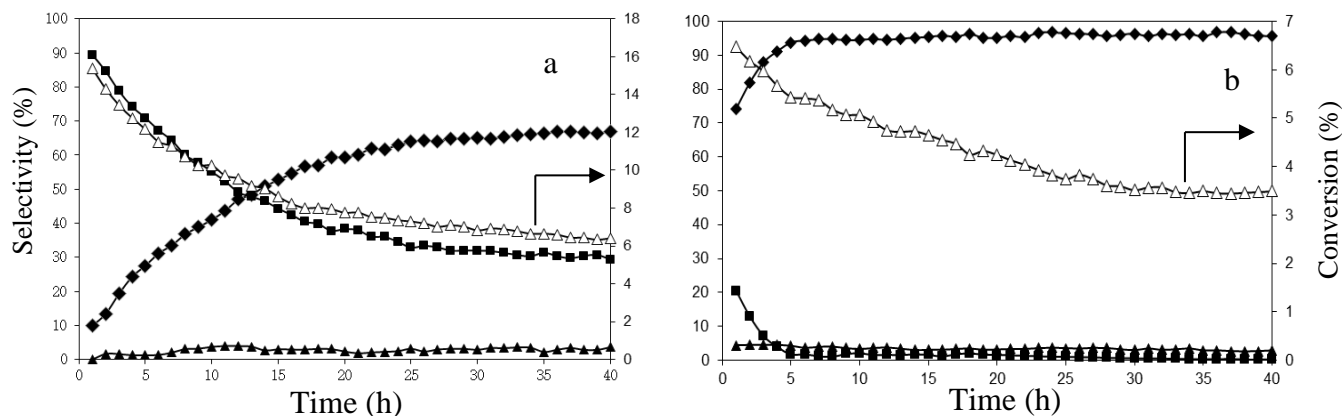


Fig. 1: The HDC of 1,2-dichloroethane over (a) im-Pd(0.97)-Ag(0.97)/Al<sub>2</sub>O<sub>3</sub> and (b) sr-Pd(0.94)-Ag(0.96)/Al<sub>2</sub>O<sub>3</sub> as a function of time on stream. (◆) Ethylene; (■) Ethane; (▲) Chloroethylene; (●) Chloroethane; and (Δ) Conversion.

Though the selectivity of ethylene was improved over the Pd-Ag/Al<sub>2</sub>O<sub>3</sub> prepared by surface reduction method, most of the Pd was not utilized. To overcome this disadvantage, we used co-impregnated method to prepare Pd-Ag/ZrO<sub>2</sub> catalyst with ultra low Pd loading. The results demonstrated that Ag(1.99)-Pd(0.099)/ZrO<sub>2</sub> showed a higher ethylene selectivity because isolated Pd atom was majority species at this Pd loading [3].

To enhance the utilization of Pd, very recently, we have prepared a series of Pd-Ag/Al<sub>2</sub>O<sub>3</sub> catalysts with galvanic replacement method. This method is a thermodynamic spontaneous redox process driven by the difference between the

standard electrode potentials of two metals, and extra reducing agents was unnecessary. The results indicated that the state of Pd was isolated sites, dimmer sites or clusters. When the replacement amount of Pd was below 0.13 wt.% , Pd existed as isolated sites on the Ag surface, which showed a high ethylene selectivity (95 %).

It can be found that Pd-Ag bimetallic catalyst showed a high ethylene selectivity toward HDC of 1,2-dichloroethane when Pd formed isolated atom, and the state of Pd could be adjusted by the catalyst preparation method.

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## References

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