

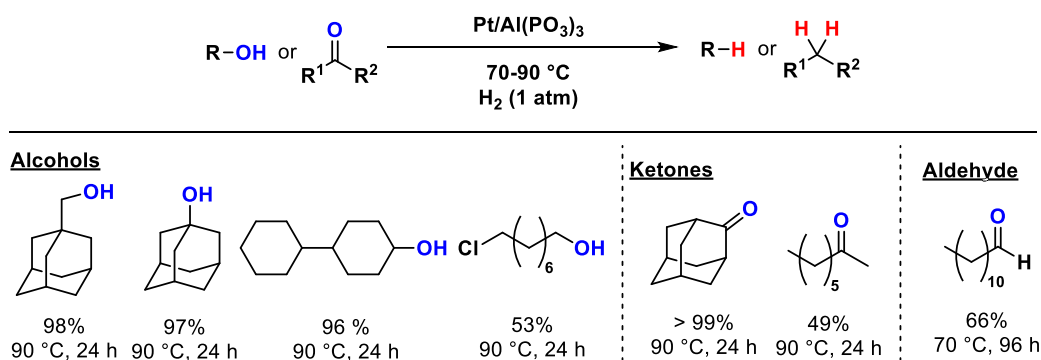
Hydrogenolysis of alcohols and carbonyl compounds to alkanes by Pt/Al(PO₃)₃ catalyst

(¹The University of Tokyo) ○Kento Oshida,¹ Xionjie Jin,¹ Kyoko Nozaki¹

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Deoxygenation of alcohols and carbonyl compounds have been widely used in fine chemical synthesis and biomass conversion. Hydrogenolysis using molecular hydrogen as hydride source has the highest atomic efficiency among the deoxygenation reactions and is ideal because it produces only water as a byproduct. Various catalytic systems^{1,2)} have been reported so far, but they either require harsh reaction conditions (>150 °C or high-pressure conditions) or have limited substrate scope.

In this study, we developed the hydrogenolysis of alcohols and carbonyl compounds to alkanes by metal–support cooperative catalysis of Pt nanoparticles supported on aluminum metaphosphate (Pt/Al(PO₃)₃). Pt/Al(PO₃)₃ was applicable to all primary, secondary, and tertiary alcohols under relatively low temperature (<90 °C) and ambient pressure of hydrogen gas. The corresponding alkanes were obtained in high yields from various alcohols and aliphatic carbonyl compounds, including primary alcohols without hydrogen at the β-position, polycyclic alcohols with a hydroxy group at the bridgehead position and halogen-substituted alcohols. Hydrogenolysis of alcohols did not proceed by using Pt/γ-Al₂O₃ as the catalyst, suggesting metaphosphate anion in Al(PO₃)₃ contributed to the high efficiency. For the hydrogenolysis of aliphatic primary and secondary alcohols, it is suggested that the reaction likely proceeds through S_N2 mechanism with the accumulation of positive charge on the transition state for C–O bond activation. As for tertiary alcohols, the hydrogenolysis likely proceeds through the dehydration-hydrogenation pathway or S_N1 like mechanism.



1) T. Schwob, P. Kunas, N. de Jonge, C. Papp, H. P. Steinrück, R. Kempe, *Sci. Adv.* **2019**, 5, No. eaav3680. 2) N. Antil, A. Kumar, N. Akhtar, R. Mewar, W. Begum, K. Manna, *Inorg. Chem.* **2021**, 60, 9029-9039.