

Ag cluster as an effective catalyst for selective NO_x reduction and green chemical reactions

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Ag/Al₂O₃ shows very high catalytic performance on the H₂-assisted selective catalytic reduction of NO by hydrocarbons (H₂-HC-SCR), which is one of the promising technologies for removal of NO in diesel engine exhausts. A mechanistic study using in-situ UV-Vis, EXAFS, in-situ FT/IR, and DFT clarified that the higher rate of NO reduction by HC-SCR is accompanied by the formation of Ag cluster, which promotes (1) formation of Ag-hydride, (2) activation of O₂ by Ag-hydride to form H₂O₂-like species, (3) hydrocarbon partial oxidation by the H₂O₂-like species to form oxygenated hydrocarbons, then (4) reduction of surface NO_x (nitrates) species by oxygenated hydrocarbons. Knowing the essential role of Ag cluster on HC-SCR, it was found that Ag/Al₂O₃ can be applied to oxidant-free dehydrogenation of alcohols. We also developed other reactions using Ag cluster, i.e., direct C-C crosscoupling of alcohols, direct amide synthesis from alcohols and amines, N-benzylolation of anilines with alcohols, and selective hydrogenation of nitroaromatics.