Catalytic Oxidation of Volatile Organic Compounds over Ceria-zirconia Supported Noble Metal Catalysts

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Abstract
Catalytic oxidation is a green and efficient way to handle man-made emissions of volatile organic compounds (VOC), which represent serious environmental issue. Despite high purchasing costs, supported noble metal catalysts are favored over metal oxides due to their high activity and selectivity, excellent stability and superior resistance against poisoning. In the present work, ceria-zirconia mixed oxide was employed as a support for gold and platinum catalysts that were characterized and tested in the gas-phase oxidation of model VOCs to investigate the influence of noble metal loading and type on the catalytic performance and selectivity of the catalysts. In the oxidation of dichloromethane, the noble metal catalysts showed lower catalytic performance than the parent $Ce_{0.5}Zr_{0.5}O_2$ due to lower amount of acid sites that act as chemisorption sites for chlorinated compounds. However, platinum catalysts exhibited significantly enhanced selectivity to CO_2. In contrast, the catalytic performance in chlorobenzene oxidation was increasing with increasing noble metal content. The positive effect of noble metal addition was ascribed to the oxidation of chlorine species, which block the active sites, by noble metals. In ethanol oxidation, the catalytic performance increased linearly with increasing Pt content and the influence of Pt loading on the mechanism of ethanol oxidation was revealed, while the introduction of gold had only a minor effect. Finally in toluene oxidation, only platinum catalysts with 0.35 wt. % and higher loading exhibited better catalytic performance than the pure support.

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