Molten-salt derived titanium dioxide supported ultralow loading platinum catalysts with high catalytic performance for the removal of acetone

Sha Li, Zhiwei Wang, Yuxi Liu, Hongxing Dai, Jiguang Deng*

Key Laboratory of Beijing on Regional Air Pollution Control, Beijing Key Laboratory for Green Catalysis and Separation, College of Environmental and Energy Engineering, Beijing University of Technology, Beijing, 100124, China

*Corresponding author: jgdeng@bjut.edu.cn

As we know, volatile organic compounds (VOC) caused harmful effect on atmospheric environment and human health. More and more attention had been paid to control the emission of VOC. Among the various technologies, catalytic combustion is believed to be one of the efficient pathways for the removal of VOC. The key issue of such a method is the development of high performance catalysts. Although transition metal oxide supported noble metal catalysts have been widely used for the catalytic oxidation of VOC, there are several places, e.g. to reduce the amount of noble metals, to enhance the carbon dioxide-, water-, and sulfur dioxide-resistance of catalysts, worthy to be improved. Previously, we developed a novel strategy, an in-situ molten salt method, for the preparation of Mn_2O_3 supported ultralow loading (single-atom) Ag catalysts, and found they exhibited high activity for toluene removal. However, the stability of the supported Ag catalyst was very poor, because it is difficult to convert O_2 molecules into reactive lattice oxygen species over the active sites of the Ag-Mn_2O_3 interface, and the surface reactive lattice oxygen species could not be fully recovered. Compared with Ag, Pt possessed stronger ability for the adsorption and activation of the reactants. Furthermore, TiO_2 might possess better stability than Mn_2O_3. As a further study, we fabricated the TiO_2 supported ultralow loading (0.05 wt%) Pt catalysts via the in-situ molten salt method, and evaluated their catalytic performance for the removal of acetone (the major pollutants emitted from the pharmaceutical industries). Under the reaction conditions of acetone concentration = 1000 ppm, acetone/oxygen molar ratio = 1/400, and space velocity = 40000 mL/(g h), the present supported Pt catalyst exhibited high active for acetone complete oxidation. Within 40-h on-stream reaction time at 270 ^{o}C, acetone conversion over the 0.05 wt% Pt/TiO_2 catalyst did not exhibit much difference. In other words, the 0.05 wt% Pt/TiO_2 catalyst showed very good catalytic stability. We further found that the addition of CeO_2, V_2O_5, and WO_3 into 0.05 wt% Pt/TiO_2 could enhance their carbon dioxide-, water-, and sulfur dioxide-resistance. Thus, the present

ultralow loading Pt catalyst is an alternative for commercial noble metal catalysts for the removal of VOCs.

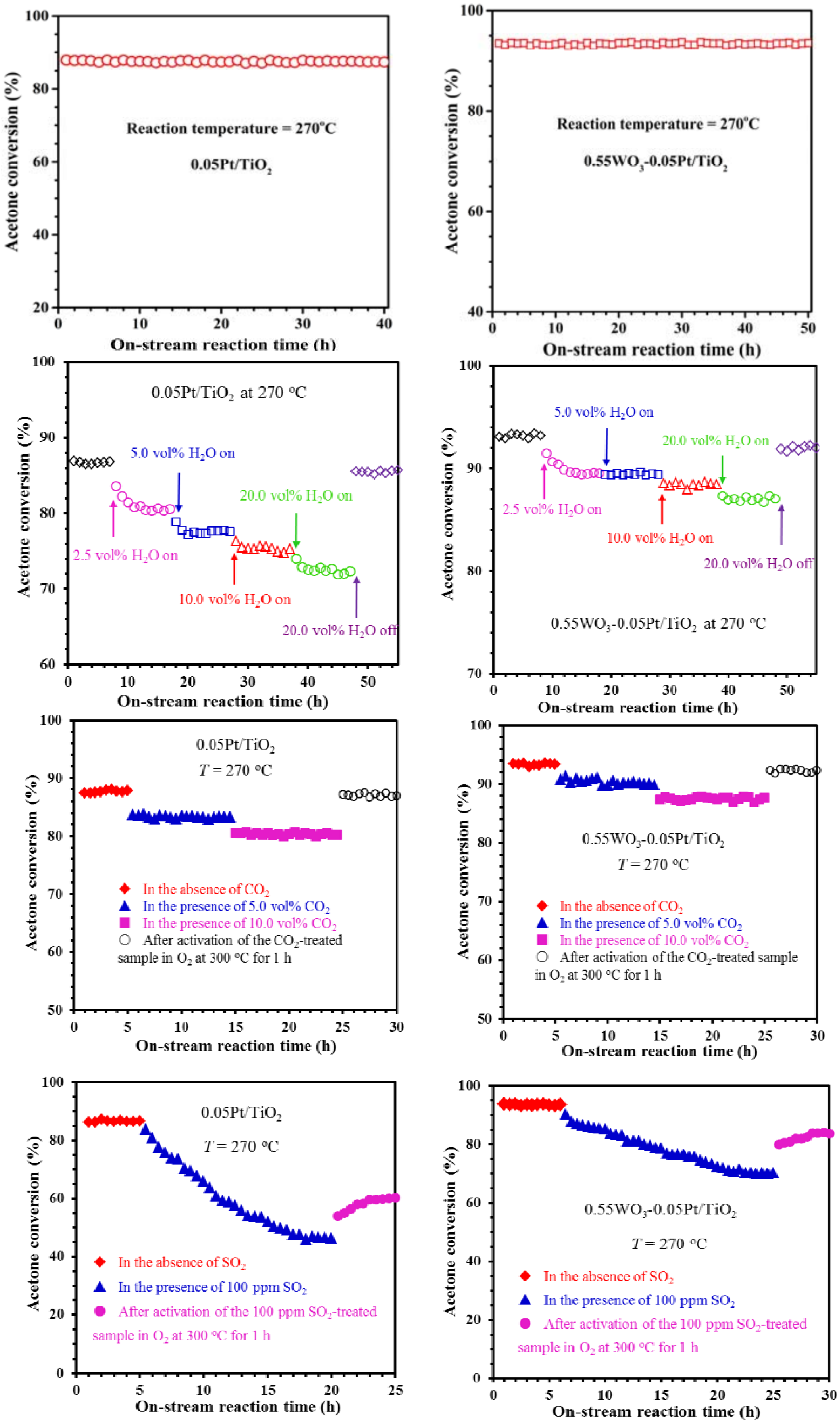

Figure 1. Catalytic performance of the 0.05 wt% Pt/TiO_2-based catalysts for acetone removal

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