

Supplementary Information for:

Controllable Synthesis of Novel Hierarchical V₂O₅/TiO₂ Nanofibers

with Improved Acetone Oxidation Performance

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Fig S1. Conversion of acetone as a function of reaction temperature. Reaction conditions: 300 ml/min feed flow, 500 ppm acetone, 5% O₂, N₂ balance, 50 mg catalyst, corresponding to a GHSV of 360,000 ml/(g·h).

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To further demonstrate the superiority of this special hierarchical nanofibrous morphology, we synthesized and tested another V_2O_5/TiO_2 nanoparticles prepared by impregnation method. Firstly, 5.6436 g ammonium metavanadate and 12.1606 g oxalic acid dehydrate were dissolved in 40 ml deionized water. The solution turned into mazarine after 3 h of magnetic stirring. Afterwards, 4 ml obtained solution was transferred into a 100 ml beaker with 4 g P25 (a kind of TiO_2 powders which is widely used in laboratory, denoted as TiO_2 -NPs) in it. After continuous stirring for 15 min, the mushy mixture was dried in oven at 110 °C overnight. Then the as-obtained sample was calcinated at 500 °C for 3h. Thereby, the V_2O_5/TiO_2 nanoparticles were fabricated, which was denoted as V_5Ti -NPs. The mass percentage of V_2O_5 in V_5Ti -NPs was controlled at 5 wt. %, which is the same with V_5Ti nanofibers (denoted as V_5Ti -NFs), since V_5Ti -NFs displayed the highest catalytic activity among the V_xTi nanofibers.

The catalytic activities of the obtained V_5Ti -NPs and TiO_2 -NPs for the total oxidation of acetone under the conditions of acetone/oxygen molar ratio = 1/100 and GHSV = 360,000 mL/(g·h) were measured at temperatures ranging from 200 °C to 400 °C. The results were illustrated in Fig. S1. In the whole temperature range, V_5Ti -NFs displayed a better acetone oxidation performance than V_5Ti -NPs. Moreover, T_{50} and T_{90} of V_5Ti -NFs are both reduced by about 15 °C compared with V_5Ti -NPs. In brief, the special hierarchical nanofibrous morphology could promote the mass transfer of reactants and products, which is confirmed by the better oxidation performance of hierarchical V_5Ti -NFs than that of V_5Ti -NPs prepared by impregnation method.

Additionally, we have also compared the catalytic performances of pure TiO_2 nanofibers (denoted as TiO_2 -NFs) with pure TiO_2 nanoparticles (P25, denoted as TiO_2 -NPs). The results were illustrated in Fig. S1. In the whole temperature range, pure TiO_2 -NFs displayed a higher activity than pure TiO_2 -NPs. Thereby, the superiority of this special hierarchical nanofibrous morphology was further proven by comparison of pure TiO_2 samples.

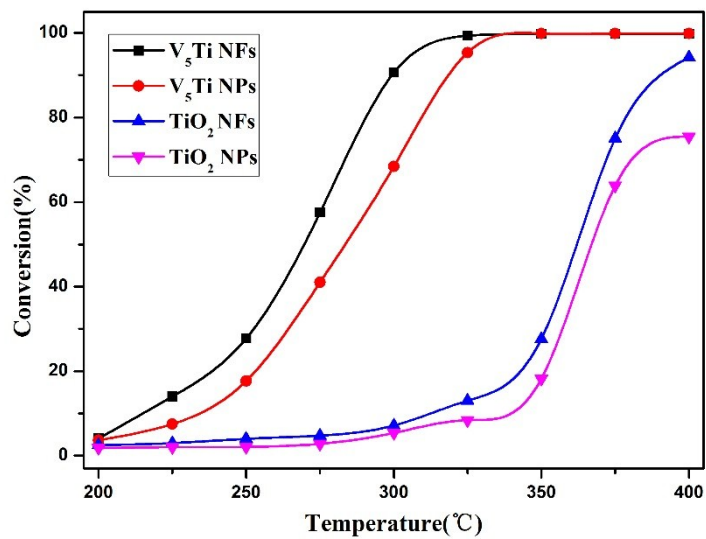


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