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Synthesis of efficient VPO catalyst for selective oxidation n-butane to MA product: Mechanism of crystal transformation

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Abstract

Serial VPO catalysts with different crystal structures were prepared by adjusting ratios of air and N2 in calcination process. The results showed that, as the air and N2 ratios were lower than 1:1, the ordered VOHPO4*0.5H2O phase was mainly formed in precursors during calcination process. However, as the ratio of air and N2 reached 3:1, the amorphous VOPO4 phases would be formed over the surface of precursor during calcination process, which would prevent the formation of ordered V5+ species over the surface of VPO catalyst after activation. The evaluation results of n-butane oxidation showed that, as the ratio of air and N2 was 1:3, the corresponding VPO-1A catalyst presented the highest conversion of n-butane and yield of MA product (57.6 m% at 412 °C). Finally, a kinetic and thermodynamic model was established and calculated to investigate the characteristics of n-butane oxidation reactions for various VPO catalysts.

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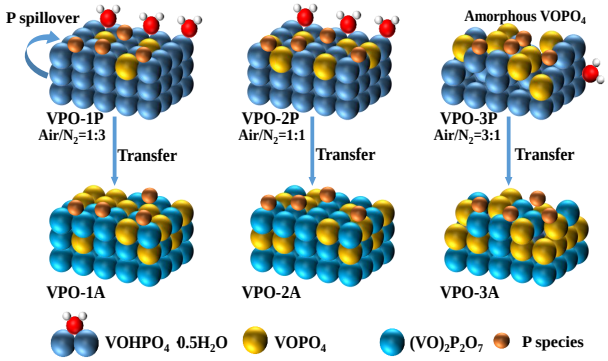
Graphic Abstract



Principle of crystal transformation from different VPO precursors to catalysts.