Chemical and mechanical activation of VPO catalysts

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Vanadium phosphorus oxides (VPO) can be chemically or mechanically activated to produce catalyst for selective oxidation reactions. Chemical activation is usually followed by heating precursors in butane/air or N_2 at high temperature for several days. Mechanical treatment of VPO catalyst causes a substantial increase of both catalytic activity in *n*-butane oxidation and the selectivity to maleic anhydride [1]. In addition, this kind of treatment is technically simple and environmentally friendly. Changes in specific surface area and anisotropic deformation take place. Mechanochemical treatment of the initial reagent impairs such properties that they remarkably influence the catalytic properties of the final catalyst.

$VOHPO_4 \cdot 0.5H_2O$ (VHP) was mechanotreated in ethanol and air for a duration of time and the morphology studied under scanning and transmission electron microscopes (SEM, TEM) and by x-ray powder diffraction (XRD). This was compared with the morphology of the initial reagent and sample thermally treated in a vacuum. Also the product $(VO)_2P_2O_7$ (VPP), which was obtained from $VOHPO_4 \cdot 0.5H_2O$ in reactor under butane/air gas mixture, was compared. SEM shows that the initial sample mainly of flat smooth needle like particles, which are held together like a blossom morphology. Under mechanochemical treatment the blossom morphology is lost and layer formation forms, with more circular particles. XRD shows that milling in ethanol for 5 minutes broadened the peaks, indicating smaller particle size but did not change the phase. Milling in air for 28 minutes gave an amorphous phase also supported by the electron diffraction pattern which shows a diffused ring pattern. Milling for longer converted VHP to VPP. The thermally activated sample shows a phase change to $(VO)_2P_2O_7$ but minor phase of the initial material is still present.

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Reference

[1] V.A. Zazhigalov, J. Haber, J. Stoch, A.I. Kharlamov, L.V. Bogutskaya, I.V. Bacherikova, and A. Kowal, *Solid State Ionics*, **101-103** (1997), 1257.