The mechanochemistry use for the vanadium-containing nanocatalysts preparation

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In this communication the results obtained at mechanochemical treatment and synthesis of oxide catalysts on the base of vanadium (V_2O_5, VPO, VMoO, VTiO) are presented. The properties of the prepared solids were studied by means of XRD, SEM, HREM, AFM, XPS and XANES methods.

It was established that mechanochemical treatment of V_2O_5 in air leads to chaotic destruction of the oxide crystals with essential increase of specific surface area and dimension of the particles size up to 10-20 nm. Treatment in ethanol allows to an anisotropic deformation of the crystals and reduction of vanadium ions. The flat particles with thickness near 15 nm and length up to 60-100 nm formed. Treatment in water accompanies by decomposition of the water with hydrogen production, and vanadium peroxocomplexes formation. It was shown that the use of the samples treated in ethanol permits to realize the catalytic reaction of direct benzene oxidation by molecular oxygen to phenol.

The mechanochemical treatment of VPO precursor leads to formation of nanodimensions crystalline regions (10-20 nm) of $(VO)_2P_2O_7$ in amorphous environment. This sample demonstrates high selectivity to maleic anhydride in n-butane oxidation. It was shown that mechanochemical introduction of lanthanum ions in VPO precursor permits to obtain the dispersed distribution of this element on surface. As results prepared catalyst realizes new direction of n-butane oxidation to tetrahydrofuran.

Treatment of V_2O_5 and MoO_3 mixture allows to preparation of nanoparticles of V_2MoO_8 phase, which demonstrates high selectivity in propane oxidation to acrolein.

At the treatment of V_2O_5 and TiO_2 mixture the effect of the supporting of the one oxide on surface second compound was observed. The supporting order and the size of formed particles determine by the nature of medium treatment. It was shown that the catalysts prepared by this method have higher activity than industrial catalyst of o-xylene oxidation to phthalic anhydride.