

REGULATION OF POROUS STRUCTURE OF AMORPHOUS PHOSPHATES UNDER HYDROTHERMAL, MICROWAVE AND MECHANOCHEMICAL TREATMENTS

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Amorphous zirconium and titanium phosphates belong to the most studied and requested ion exchangers, acid catalysts, supports, i.e. are versatile materials. Development of methods for regulating parameters of their porous structure is very important field of researches. It is known that the phosphates synthesized via traditional techniques often possess low porosity with a predominance of micropores (which is especially characteristic for the zirconium phosphate). The possibilities of varying the parameters of porous structure through xerogels treatment are limited even when hydrothermal treatment (HTT) is used. Therefore, wet coagels of zirconium and titanium phosphates prepared by the way of precipitation were subjected to modification using different techniques. Thus, mechanochemical (MChT) and microwave (MWT) treatments were first applied for phosphates. Xerogels were modified in the same conditions for comparison.

It was found that samples of composition $Zr(HPO_4)_2$ possessing total pore volume $V_{\Sigma}=1.2-1.3 \text{ cm}^3/\text{g}$ and specific surface area $S=124-184 \text{ m}^2/\text{g}$ were produced via HTT of coagel of 88% moisture at 300-400°C, while its MWT at 230-270°C leads to creation of porosity equal 1.25-1.65 cm^3/g and $S>300 \text{ m}^2/\text{g}$. It should be noted that similar samples synthesized previously had pore volume no more than 0.8 cm^3/g and their specific surface area was less than 100 m^2/g . It is also important that all indicated specimens do not contain micropores and are either mesoporous (prepared via modification of xerogel) or meso-macroporous (after treatment of coagel). In the second case, resulted xerogels have mesopores size of 15-20 nm. Values of S and V_{Σ} drastically reduce (to 50-60 m^2/g and 0.08-0.10 cm^3/g , respectively) when MChT of xerogel is realized, whereas analogous treatment of wet coagel results in formation of mesoporous samples combining higher specific surface area (405-430 m^2/g) and sufficiently large pore volume (0.4-0.5 cm^3/g) and pore size (6-8.5 nm). The same results were obtained for the sample of composition $ZrO(H_2PO_4)_2$.

Titanium phosphate $Ti(HPO_4)_2$ was also prepared by HTT, MChT and MWT as series of samples with S and V_{Σ} equal to 200 m^2/g and 1.6 cm^3/g , respectively.

Thus, the approaches used in this work, allow to significantly extend the limits of regulation of porous structure parameters for zirconium and titanium phosphates. Particularly, synthesized samples possess either uniform mesoporous or meso-macroporous structure for which diffusion inhibition during their application in liquid- and gaseous adsorption and catalytic processes is absent. Besides, indicated phosphates can be prepared in form of granules or powders.