

Organization of porous structure of phosphate-modified silicate materials

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Abstract

Phosphate-containing silicate materials prepared from TEOS using sol-gel method were investigated at the variation of the amount of phosphate modifier. These materials were characterized for chemical composition, textural and structural properties by FTIR-spectroscopy, PEM and N₂ adsorption. It was shown that the materials possess monomodal pore size distribution of 5 to 20 nm for the samples dried at 100 °C and 40 to 60 nm for the specimens calcined at 600 °C. The mean pore size and surface area depend on the amount of phosphoric acid varying from 5 to 50 % mas. in terms of P₂O₅. Before the stage of high temperature treatment phosphoric acid, introduced into the structure of the materials as a modifying agent, was uniformly distributed inside a porous space of the material and was not chemically bonded with silicate. After high temperature treatment up to 600 °C both chemical interaction of silicate with phosphate, forming the silicate-phosphate structures, and redistribution of free modifier from the bulk of granules to its surface took place. The polyphosphate layer is formed on the material surface closing the internal porous space. However, in this case a part of the phosphate modifier remains chemically unbound to SiO₂ structure.