

EFFECTS OF CHEMICAL AND THERMAL TREATMENT OF FINE DISPERSED GEORGIAN HEULANDITE-CLINOPTILOLITE

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ABSTRACT

The article considers the processes leading to a change in the structure and properties as a result of calcination followed by acid treatment of heulandite-containing tuff from the Georgian Dzegvi-Tedzami deposit. The samples obtained by heat-acid treatment were studied by the X-ray energy dispersion spectra and diffraction patterns, as well as by adsorption of water and benzene methods. It was found that pre-heat treatment reduces weight loss and the degree of dealumination during subsequent acid treatment, and also affects the decationization process: with increasing preheating temperature, the participation of sodium ions in the process slows down, while the participation of potassium ions increases, the overall degree of decationization decreases, and after annealing at 800 °C, compensating cations do not wash out. The crystalline structure of heulandite is preserved after heating to 400-450 °C and subsequent acid treatment, which is confirmed by the preservation of the peak positions in the X-ray diffraction patterns; the change in peak intensity depends on the acid concentration and is associated with changes in the content and distribution of cations. After heating to 500 °C and higher temperatures, the acid-treated samples transform into an amorphous state with crystalline inclusions of chabazite, α -quartz and albite feldspar. The adsorption of water, reflecting the volume of micropores and all pores, as well as the adsorption of benzene, reflecting the hydrophobicity of the surface, decrease with increasing calcination temperature; subsequent acid treatment is of little significance.

Keywords: heulandite, chabazite, dealumination, decationization, dehydration, amorphization

INTRODUCTION

Natural and synthetic zeolites are widely used due to the unique set of molecular-sieve, sorption, ion-exchange and catalytic properties, determined by the structure of these hydrated aluminosilicates $M_x[Al_xSi_yO_{2(x+y)}]mH_2O$. The zeolite framework is built from alternating SiO_4 and AlO_4^- tetrahedrons forming cages and channels with “entrance windows” with a diameter of 0.5 – 1.2 nm, making up the microporous structure of the zeolite [1]. Unlike synthetic zeolites [2], natural zeolites have an irregular system of