

Article ID: 1003-7837(2005)02,03-0349-01

Conductivity of ion-replaced forms of clinoptilolite

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Though recently researchers are paying great attention to the physics of zeolites, the theory of these minerals conductivity is practically undeveloped. That is why the paper is aimed at studying the influence of the exchange cation on the clinoptilolite conductivity. The clinoptilolite is a widely spread natural zeolite, having industrial value.

In this connection samples were received on the basis of monofractions of this mineral processed by 1 M chlorides solutions of alkaline metals (Lithium, Sodium and Potassium) in static conditions at room temperature. All samples were investigated with the following methods: infrared-spectroscopy, nuclear adsorption, X-ray diffractometry, differential thermal and thermal gravimetric analyses. The experiments were made on the dehydrated samples, pressed by the method of dry pressing, their hydration degree was less than 1%–1.5% of their weight in the temperature interval 300–700 K.

The continuous conductivity increase is established with the temperature growth. The energies of the activation process, calculated from the an inclination dependencies $\ln\sigma = f(1/T)$, change in the limits: at low temperatures 0.1–0.4 eV, at high temperatures 1.6–1.9 eV. It points to two conductivity mechanisms: (1) at low temperatures the contribution to the general conductivity is made with the protons and ions H_3O^+ , which can insignificant due to a low degree of the sample hydration; (2) at high temperatures the contribution is made with the exchange cations.

It is established, that the concentration of charge carriers in the researched samples is $10^{15} - 10^{18} m^{-3}$, and their mobility is $10^{-6} - 10^{-7} m^2/V \cdot c$, depending on the prevailing cation type. The change of the activation energy, the concentration and mobility in its increase occurs from Lithium forms of the clinoptilolite to Potassium ones.

The research is supported with the grant of the Russian Academy of Science Far-Eastern division.