NATURAL ZEOLITE - KLINOPTILOLITE IDENTIFICATION

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The natural zeolite is investigated in the work. The roentgenographic analysis of polycrystalline powder has been carried out. The comparison of obtained results, chemical analysis results and scientific publication data allow us to relate the investigated zeolite to klinoptilolite type.

Introduction.

Nowadays the physical processes in one-dimensional objects: nano-tubes and nano-pores are intensively investigated. The special interest is connected with obtaining [1] of property investigations [2] and practical use [3] of carbonic nano-tubes (CNT). The nano-porous materials are also not without the attention so they have the series of unique properties. The works on obtaining [4-6], investigation of optical [7,8] and electrical [9] properties of porous silicon have been carried out.

In porous dielectrics the self-sustaining electron emission (SE) [10] intensified by the field which is used in electron-optical transformers of IR-images [11-13]. The porous emission is also observed on metal surface [14-15]. The molecular system state in pores of solid matrix presents the essential interest from both fundamental science and practices point of view [16-17].

The zeolites are the classic representatives of nano-porous materials. The zeolite value is caused by the scroll alumosilicate carcass forming the system of pores and cavities the dimension of input window of which is enough big one that the molecules and ions of many organic and inorganic compounds can penetrate in them. The zeolite carcasses are like to bee's cells and formed by chains of silicon and aluminum anionites. The carcass has the negative charge because of its structure and this charge is compensated by water molecules and cations of alkali and alkali-earth metals weakly connected with it. The zeolite pores have the right forms. Connecting between each other through "windows" they form the perforated channel chain. That's why the zeolites can be considered as the object on which besides well-known phenomena (adsorption, ion-exchange phenomena), investigate the electron porous emission, electron multiplication and gas discharge in pores, dielectric and electric properties at pore saturation by different gases and liquids. In Azerbaijan 14 varieties of mineral zeolite family which are mainly connected with Azerbaijan magmatic associations.

In present work the roentgenographic analysis of natural zeolite on results of which the zeolite-klinoptilolite type has been defined, has been carried out.

Experiment

We have the monoblock of natural zeloite (fig.1) from which cut out the plastic samples for physical experiment. The fine-crystalline powder (fig.2) obtained at this operation is the investigation object of the present work.

The roentgenographic investigation is carried out on diffractometer ДРОН-2,0 in which $Cu_{k\alpha}$ -radiation with λ=1.54Å is used. The high measurement accuracy of peak heights i.e. reflection intensity of rotation angle of 20^{th}counter is the important advantage of diffractometer use at single crystal investigation.

Fig.1. Natural zeolite mineral.

Fig.2. Zeolite powder

Results and discussion.

The big number of peaks of different intensities with big spread in interplanar spacing values d: from 1.541A up to 10.281A is observed on diffractogram (fig.3). From diffractogram analysis it is seen that maximum intensity, i.e. the main peak corresponds to interplanar spacing d_1=3,352 A and d_2=4,25 A, d_3=1,82 A which are the evidence of silicon dioxide SiO_2-α quartz presence in the given sample. The following values of interplanar spacings d_4=3,97 A, d_5=2,58 A, d_6=2,13A, d_7=1,63A are belong to aluminum oxide Al_2O_3. Later, the interplanar spacings d_8=3,53A and d_9=2,49A are related to potassium iodine and interplanar spacing values d_{10}=2,39A, d_{11}=2,76A, d=1,69A evidence about presence of calcium oxide in the given sample. The values of interplanar spacings and intensities are given in the table 1.

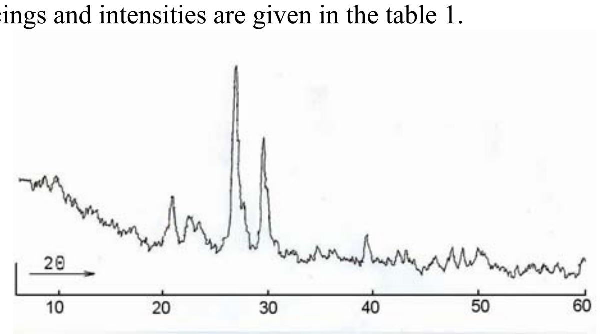

Fig.3. Zeolite diffractogram powder

Table 1

$d(A^0)$	I	$d(A^0)$	I	$d(A^0)$	I	$d(A^0)$	I
3.35	100	3.97	22	3.53	10	2.39	30
4.25	35	2.58	10	2.49	20	2.76	20
1.82	25	2.13	10	-		1.69	10
-	-	1.63	10	-		-	-
SiO_2		Al_2O_3		KJ		CaO	

Note that our sample chemical composition independently on our investigation has been verified with the help of spectral analysis. The percentage of all ingredients including in compound composition is defined. As a result it take place: SiO_2- 67.84%, KJ-11,64%, Al_2O_3-11,36%, K_2O-2,01%, CaO-2,29%, Na_2O-1,25%

Fe_2O_3-1,19%,P_2O_5-0,11%, MgO-0,49%, TiO_2-0,08%, MnO-0,078%, SO_3-0,030%. As it is seen the results obtained by roentgenographic method coincide with these data excluding the fact that the content of any component that is less than 2% in the sample is diffractometrically registered. The diffractometric method gives the possibility only to establish the relation of investigated sample to definite narrow class of compounds.

From data comparison of diffractometric and chemical analysis with scientific literature information on alumosilicate-zeolite structure [18] one can conclude that natural zeolite investigated by us is related to zeolites of klinoptilolite type. This zeolite type has the wide spread in Azerbaijan.

The klinoptilolite has the following characteristics: monoclinic syngony, symmetry space group C2/m; elementary cell parameters: a=1,761nm b=1,780 nm, c=0,741 nm, β=115,2^0. The alumosilicateoxide carcass and nano-channels in crystals of klinoptilolite is presented on fig.4 [19].

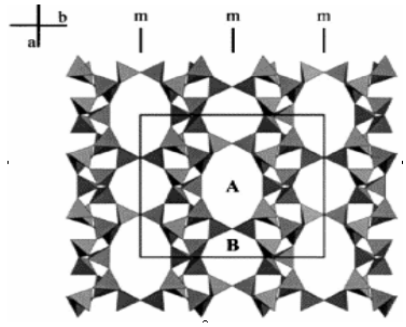

Fig. 4. The alumosilicateoxide carcass and nano-channels in K type crystals (klinoptilolite)

The tetrahedrons are the alternating groupings AlO_4 and SiO_4. Channel A has the section 0,6x0,4nm; channel B has the section 0,4x0,4nm. In natural conditions the channels can be filled by water, ammonia (in small quantities) and exchangeable Na^+, K^+, NH_4^+, Ca^{2+} and other ions. The symmetry and perfect cleavage planes are designated by m symbol.

Conclusion

The natural metal from Azerbaijan exploitations has been investigated by roentgenographic method. The comparison with chemical analysis results and scientific literature data allows us to relate this mineral to zeolite-klinoptilolite type. The volume samples cut out from monoblock of natural mineral or suppressed from poly-crystalline powder can serves as objects for observation of physical phenomena in nano-pores of this mineral.

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NATURAL ZEOLITE - KLINOPTILOLITE IDENTIFICATION

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TƏBİİ SEOLİT-KLİNOPTİLOLOITİN İDENTİFİKASİYASI

Azərbaycanın təbii minerallarından olan kimyəvi birləşmə rentgenoqrafik üsulla tədqiq edilmişdir.Kimyəvi analiz nəticəsində və ədəbiyyatda məlum olan birləşmələrin müqayisəsindən tədqiq etdiyimiz maddənin seolit-klinoptiloloit sinfinə aid etməyə imkan verir.

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ИДЕНТИФИКАЦИЯ ПРИРОДНОГО ЦЕОЛИТА-КЛИНОПТИЛОЛИТА

В работе исследуется природный цеолит. Проведен рентгенографический анализ поликристаллического порошка. Сравнение полученных результатов, результатов химического анализа и литературных данных позволяет отнести исследуемый цеолит к типу клиноптилолита.

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