

Synthesis and structural examinations on LTA-type zeolite

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Zeolites were just curiosity for a long time, but nowadays the usage of their name is increasing and zeolites become very important materials in environmental issues and industry. For what thanks this approach changes? As usual, the main progress in the knowledge on zeolites was the successful structure determination.

Zeolites have a complex aluminosilicate frameworks structures. These frameworks are opened with large channels and interconnected cages. We can use zeolites in gas and petroleum industry, water softening, sewage treatment, agriculture, paper production, radioactive waste treatment as well as construction materials too. The structural channels and voids are occupied loosely bound cations and water molecules that we can remove and replace without disrupting the tetrahedral framework. This means that a zeolite structure is among the best candidates to perform cation exchange, adsorption molecular sieving (passing a gas or liquid through a zeolite), dehydration and rehydration processes, in addition it can be resistant to high energy radiation, too (Tschernich, 1992).

The present work focuses on preparation and structure determination of sodalite-related zeolites using X-ray and electron diffraction techniques. I synthesized LTA-type zeolite crystals from metakaolinite starting material with alkaline (NaOH) method. Then I replaced Na^+ with Cs^+ , and measured the resulted structural changes, using X-ray powder diffraction.

The LTA crystals revealed cube and sphere shapes under scanning electron microscope (Fig. 1.).

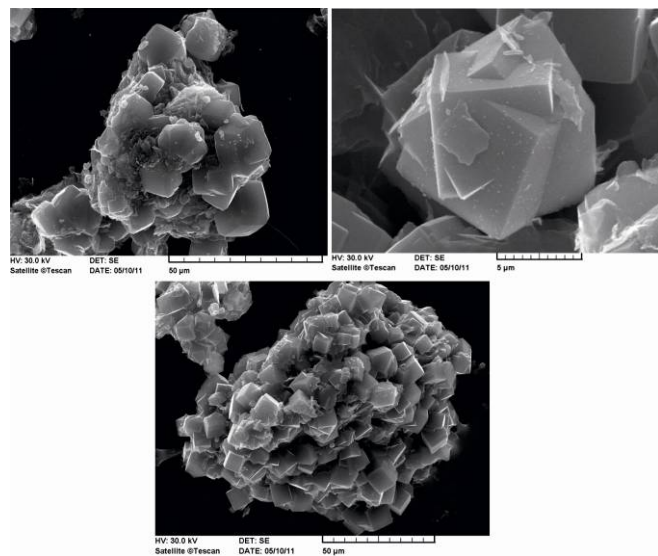


Fig. 1.: It was treated for 24 h with 3 mol NaOH. LTA-s hexahedron and rhombohedron, these have 8 to 11 μm edge length. We observed spheres with 1 μm size.

X-ray powder diffraction measurements on Na-LTA, acid treated LTA and Cs-LTA were performed. The hkl and intensity data sets were the inputs of structure determination using the SIR (Semi Invariant Reconstruction) and SHELX program packages. Due to overlapping reflections, some sample resulted in high R factor values. However, the resulted LTA-type framework proved to be evident (Fig. 2.).

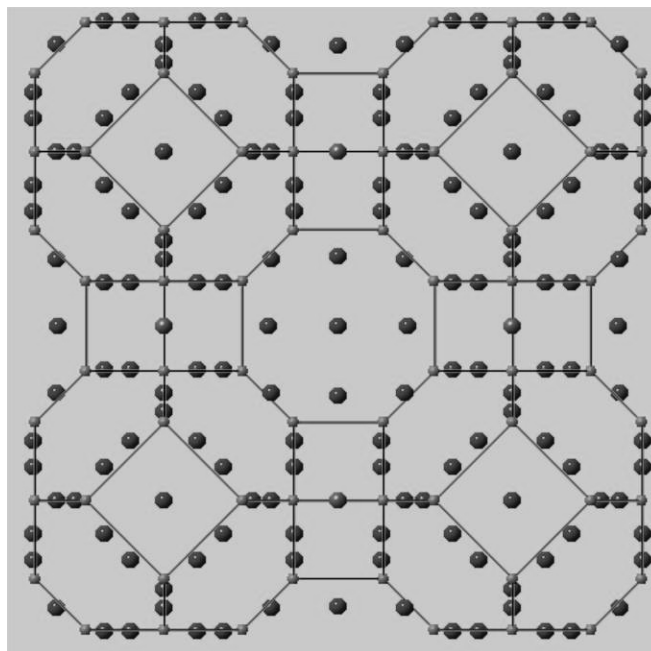


Fig. 2.: Na-LTA zeolite structure determined by SIR

Tschernich, R. W. (1992): Zeolite of the world. Geoscience Press Inc. USA