BTX sorption by surfactant-modified synthetic zeolite

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Zeolites are group of aluminosilicate minerals that are distinguishable by their high porosity, high cation exchange capacity and regular cage-like structure. They possess a negative charge that is an effect of heterovalent substitutions of Si^{4+} by Al^{3+} in the thetraedra which are the primary building units of the mineral's framework. Synthetic zeolite was created from fly ash after coal combustion in hydrothermal conditions. Modification of zeolite was conducted with the use of one of the quaternary ammonium salts: hexadecyltrimethylammoniumbromide(HDTMA-Br). Suspension of synthetic zeolite was mixed with HDTMA solution in high temperature for 24 hours. Surfactant was adsorbed onto a synthetic zeolite in amounts of 1.0 and 2.0 of the external cation exchange capacity (ECEC) in quantities of 24.4 and 48.8 mmol per 100 g of zeolite respectively. Third sample that was used was pure zeolite.

The purpose of this research was to evaluate the difference in sorption of BTX (benzene, toluene, xylenes) on the unmodified zeolite and organo-zeolite modified by HDTMA.

Modification in amount of 2.0 ECEC shows higher sorption of BTX then organo-zeolie 1.0 ECEC. Further still, was the unmodified zeolite. This is caused due to high affinity of apolar BTX to the hydrophobic zone of HDTMA chains. The range of BTX concentrations used in this study was limited by their solubility in water.

Additional objective was to investigate whether FTIR could be used in qualitative and quantitative determination of BTX adsorbed by the zeolite. Our study has provided information on presence of particular spectra that correspond to certain organic compound.

We gratefully acknowledge the support of NCBiR having provided grant PBS1/A2/7/2012.

Three-dimensional distribution of anatectic melt inclusions in garnets by X-ray micro-tomography

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X-ray micro-tomography (μCT) has been applied to investigate the three-dimensional distribution of primary melt inclusions in garnets from El Hoyazo (Neogene Volcanic Province, Spain). Modeling the distribution density allows a better understanding of the growth and trapping history of peritectic minerals and coexisting fluids and melts during the partial melting of the crust. Glassy inclusions are trapped in nearly all mineral phases in metapelitic enclaves found within El Hoyazo dacites and they have been extensively analyzed. To better investigate their three-dimensional distribution and to understand the relationship between them, other mineral inclusions and the host phase, two garnets have been imaged through μCT. One of the two was then cut to expose a nearly-equatorial plane to SEM analyses. A preliminary classification based on different absorption coefficients was applied to different inclusions in the tomographic images and then verified by SEM chemical maps. We measured the volume and position with respect to garnet barycenter of glassy melt inclusions and of single-phase inclusions such as monazite, zircon and apatite for a comparison. The modeling reveal a clear peak of melt inclusions density at 1/3 radius distance from the garnet center, while mineral phases are more randomly distributed. Moreover, the type and the size of the inclusions are statistically related to their spatial distribution. There is no evidence of a sharp boundary between inclusion-rich cores and inclusion-free rims. This together with the chemical profile of the garnet composition strongly suggests that the garnet grew in one single event in the presence of anatectic melt. After the maximum, the linear decrease in the density of melt inclusions could indicate trapping at a constantly slowing growth rate of the host mineral or a constant decreasing melt supply. The first hypothesis is less convincing, since mineral inclusions are still trapped after the decrease of melt inclusions, and even seem to increase in density.

DOI:10.1180/minmag.2013.077.5.20