STUDING OF THE TEKTITES AND IMPACTITES USING X-RAY ABSORPTION SPECTROSCOPY.

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Introduction: Tektites and impactites are the products of hypervelocity impacts of extraterrestrial bodies onto the Earth's surface. The study of silicate glasses and melts is widely distributed [1-3]. However, the complex studies of the element and phase distribution are quite rare. The X-ray absorption spectroscopy was applied for analyzing the Fe oxidation state and coordination numbers of tektites even less often [4-6]. The variation of the metal oxidation state in tektites depends on their origin (interplanetary region of formation) and formation temperature. However to the best authors knowledge there is no systematic investigations of Fe role in tektites and impactites covering all the variety of these rocks. The goal of this study is to determine iron oxidation states and Fe coordination numbers for a wide series of tektites and impactites for establishment of the formation parameters.

We consider a wide set of 12 samples covering the genetic series of tektites and impactites, specifically aerodynamic shaped tektites (high-speed ejects from impact craters), Muong-Nong tektites (irregular glass bodies that are apparently lower-temperature), silica-rich and silica-poor zhamanshinites (impactites from the Zhamanshin crater), irgizites (drops of melt from the Zhamanshin crater).

Methods: The Fe *K*-edge X-ray absorption spectra (XANES, EXAFS) in transmission mode (Si111 monochromator) were obtained for the 12 samples of tektites and four reference samples at the source of synchrotron radiation of NRC "Kurchatov Institute" (Moscow, Russia). The measurements were carried out in the transmission mode for pellets which were previously compressed with the addition of boron nitride.

Results: The pre-edge region of the spectra was analyzed to estimate the charge state and coordination number of iron for 12 tektites by the method described in [7,8]. Additionally, the Fe oxidation state was estimated by the energy position of the absorption edge of XANES spectra (so-called chemical shift). For such analysis we compare the positions of the absorption edge of the Fe K-XANES spectra of tektites and impactites with references.

Two aerodynamic shaped tektites, two Muong-Nong tektites, one Moldavite, one silica-rich Zhamanshinite and one silica-poor Zhamanshinite are six coordinated, slightly distorted octahedral with the Fe oxidation state 2+. Two Irgizites and one silica-rich Zhamanshinite have slightly higher Fe oxidation state 2.2+ with an admixture of five coordinated iron. The average Fe coordination numbers of these three samples are 5.5. Two silica-poor Zhamanshinites are six coordinated with the oxidation states 2.6+ and 2.7+.

In average, the Fe oxidation state in the aerodynamic shaped tektites, Muong-Nong tektites and Moldavite are approximately the same (+2 with error ±0.1). The Fe oxidation state in the Irgizite impact glasses is slightly higher (2.2), while the one in the samples of silica-rich Zhamanshinite is 2-2.35. The highest value of the Fe oxidation state was found in the silica-poor Zhamanshinite (2.7). Analysis of the Fe *K*-EXAFS spectra is in process to estimate the coordination numbers and interatomic distances around Fe atoms in the tektites and impactites. Accordingly, we observed a tendency of increase of the Fe oxidation state in the raw: the aerodynamic shaped tektites, Muong-Nong, Moldavite, Irgizite and Zhamanshinite.

Conclusions: The estimated Fe oxidation state grows in a number of samples from the lowest value for the aerodynamic shaped tektites, Muong-Nong tektites, Moldavite and Irgizite to the highest value for the silica-poor Zhamanshinite. The coordination numbers of the most part of the samples are 6 with the exception of two Irgizites and one silica-rich Zhamanshinite with the average Fe coordination numbers 5.5.

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