# COMPOSITION AND STRUCTURE OF IMPACT GLASSES

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Impact glasses are formed as a result of short-term influence of ultrahigh temperatures and pressure at impact of a meteorite. Extreme conditions of formation of glasses cause singularity of their chemical composition, anomality of a structural position of the basic and impure elements, appearance of rare mineral phases. For studying the structure and properties of the given glasses we carry out the complex investigation including of X-ray diffraction, X-ray microprobe analyses, gas chromatography, Mössbauer and infra-red spectroscopy. Objects of studying are impact glasses from Zhamanshin crater and Popigai impact structure, and also Muong Nong-type tektites from Vietnam.

The investigated glasses of Popigai impact structure are combined by thin alternation of two differences. Glasses of I type pure transparent in sections. They are pale greenish yellow with a parameter of refraction ≈ 1.537. The glasses of II type brown crystallized in semi-transparent units, which represent a close interlacing needle and table-shaped microlites. Thickness of microlites is 1-2 microns and length is till 20-30 a micron.

The glasses of Zhamanshin crater represent the quenched portions impact melt, combined by alternation of several differences. In sections following types of glasses are distinguished: type I – pure transparent pale yellow glass; type II - pure transparent glass with microspotty light brown painting; type III - semi-transparent glass which has brown color in transmitted light and blue is in reflected light; type IV – pure transparent glass with microspotty dark brown painting; type V - pure transparent glass with homogeneous light brown painting. The distribution of described glasses in volume of samples is very non-uniform.

The Vietnam tektites represent the quenched glass. Two samples are homogeneous, pale yellow color. They contain individual spherical bubbles. Two other samples have the expressed finely banded constitution and consist of alternation of light and dark bands.

The chemical compositions of glasses of Popigai impact structure are rather close among themselves. The chemical compositions of the investigated samples of Zhamanshin crater have the following features: 5 samples have banded texture, which formed by alternation of chemically close differences I and II. In other samples the banded texture is due to alternation of glasses, which were differed on composition and attributed to petrographic types III, IV and V. The Vietname tektites as well as Popigai are composed by two types of glasses and are practically similar on composition.

X-ray investigation of samples has been shown, that all samples have amorphous structure. Crystalline phases are not detected in two samples. In all other samples traces of quartz and feldspar are observed. Some samples contain pyroxene, cristobalite and traces of magnetite. It is possible that cristobalite and magnetite are products of glasses crystallization. These are traces of rutile in two samples of Zhamanshin crater. The Vietnam tektites are extremely fresh and perfect amorphous.

The contents of water in glasses have been determined by gas chromatographic analysis. In glasses from Popigai impact structure significant amounts of water are found. Non-crystallized glasses type I are essentially poorer water, than crystallized glass type II. In the last the contents of water reaches 2.25 wt. %. This result is in good agreement with obtained data for others of impact melt rocks of Popigai astrobleme [1; 2]. In glasses of the Zhamanshin crater the contents of water very low (0.001-0.059 wt. %) and distribution of water very non-uniform. However, correlation with petrographic types of glasses is not found. Thus, the role of water in formation of banded texture of the investigated samples is excluded. The contents of water in investigated Vietnamese tektites very low (0.0008-0.016 wt. %). Muong Nong-type tektites show similarity with finely banded glasses of the Zhamanshin crater on low contents of water.

The IR-spectra investigated tektites have three major absorption bands: the high-frequency region above 1000 $cm^{-1}$ contains a strong, broad asymmetric band with a maximum near 1100 $cm^{-1}$; peak is centred at 800 $cm^{-1}$; and strong band appears in the low-frequency region at 470 $cm^{-1}$. The band at 1100 $cm^{-1}$ is assigned to Si–O–Si stretching vibrations associated with tetrahedral $SiO_4$ groups. The band in region 400-

500 $cm^{-1}$ is assigned to bending mode Si–O–Si(Al) [3; 4]. The band with maximum at 800 $cm^{-1}$ is connected to vibrations of $AlO_4$ tetrahedra. In some samples bands in region 580-640 $cm^{-1}$ are observed. These bands are connected with vibration of $AlO_5$ and $AlO_6$ groups [5]. Also, in some samples is a shoulder in region 900-1000 $cm^{-1}$ which is due to stretching vibrations non-bridging bonds $Si–O^-$.

In investigated tektites and impactites ferric iron is in tetrahedral positions. Contents $Fe^{3+}$ in samples is 2-7 % from the common content of iron in glasses. Low value $Fe^{3+}/Fe^{2+}$ is reliable established feature of tektites [6]. Three other doublets are assigned to cations $Fe^{2+}$, occupying three various octahedral positions. The quadrupole doublet with the greatest values of isomer shift and quadrupole splitting is attributed to cations $Fe^{2+}$ in less distorten octahedron [7; 8]. The positions $Fe^{2+}$ with the isomer shifts, which have one lower values are related to more distorted octahedral positions. The large variety of structurally nonequivalent positions of $Fe^{2+}$ indicates a high degree unregulated of oxygen environment iron. Such unregulated is due to formation of tektites and impactites as a result of fast quenching from high temperatures.

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