

INFRARED AND MÖSSBAUER SPECTROSCOPY OF NATURAL GLASSES

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Natural glasses have been investigated by methods of IR- and Mössbauer spectroscopy. The ^{57}Fe Mössbauer spectra were obtained at room temperature using spectrometer MC-2201. The spectra of the studied glasses represent an asymmetrical doublet, the high-velocity peak is slightly wider and less intense in comparison with low-speed peak. The mathematical simulation of spectra was done by the program UNIVEM. At modeling of spectra the equaling of half-widths and intensities of low- and high-velocity lines of each doublet was supposed.

It is shown, that ferrous iron dominates in modern basalt glasses. The Fe^{2+} ions occupy octahedral positions in glasses, which are characterized by a different degree of distortion of the polyhedron. The Fe^{3+} ions also occupy octahedral positions. The redox ratio of iron in basalts from the East-Pacific Rise is slightly higher than the redox ratio of iron in oceanic basalts from the Mid-Atlantic Ridge. The redox ratio of iron in basalts from the Bouvet triple junction varies from 10 to 28 %. The redox ratio of Fe ions in ancient glasses considerably exceeds that of Fe ions in modern basalt glasses. It is related with secondary changes due to postmagmatic hydration.

In investigated tektites and impact glasses ferric iron is in tetrahedral positions. Its content amounts to 2-7 % of the total content of iron in glasses. The Fe^{2+} ions are in octahedral coordination and occupy structurally nonequivalent positions. This is related to the formation of tektites and impacts as a result of fast cooling from high temperatures.

The IR-spectra of investigated tektites and basalt glasses show 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} ; a peak is centred at 800 cm^{-1} and a strong band appears in the low-frequency region at 470 cm^{-1} . The band at 1100 cm^{-1} is assigned to Si-O stretching vibrations associated with tetrahedral SiO_4 groups. The band in the region $400\text{-}500\text{ cm}^{-1}$ is assigned to the bending mode Si-O-Si(Al) (TAYLOR, 1990; POE et al., 1992). The band with maximum at 800 cm^{-1} is connected to vibrations of AlO_4 tetrahedra. In some samples bands in the region $580\text{-}640\text{ cm}^{-1}$ are observed. These bands are related to vibrations of AlO_5 and AlO_6 groups (McMILLAN et al., 1992). In some samples also a shoulder is present in the $900\text{-}1000\text{ cm}^{-1}$ region which is due to stretching vibrations of non-bridging Si-O bonds.

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References

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