MEASUREMENTS OF OXYGEN INTRINSIC FUGACITY AND WATER CONTENT IN TEKTITIC GLASSES: THE PROBLEM OF OXYGEN AND HYDROGEN REGIME DURING OF TEKTITE FORMATION

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The measurements of oxygen intrinsic fugacity (fO_2) within temperature range of 800-1150 °C using solid elerctrochemical cells and water content using FTIR-spectroscopy were conducted for 5 samples of tektitic glasses (moldavites, indishinites and irgizite). fO_2 values for moldavites and indoshinite (Vietnam) at temperature > 900°C are between that of oxygen buffers wustite-magnetite (WM) and iron-wustite (IW). fO_2 values of these samples at temperature < 900°C is lower than fO_2(IW). Irgizite and indochinite (Indochine) have higher fO_2 values. Irgizite has the most high fO_2 values, that at temperatures > 850 °C are higher than fO_2(MW) and are approach to fO_2(FMQ) with temperature increasing. The slope of linear dependence logfO_2-1/T K for all studied tektites except irgizite is approximately the same as that for WM (fig. 1).

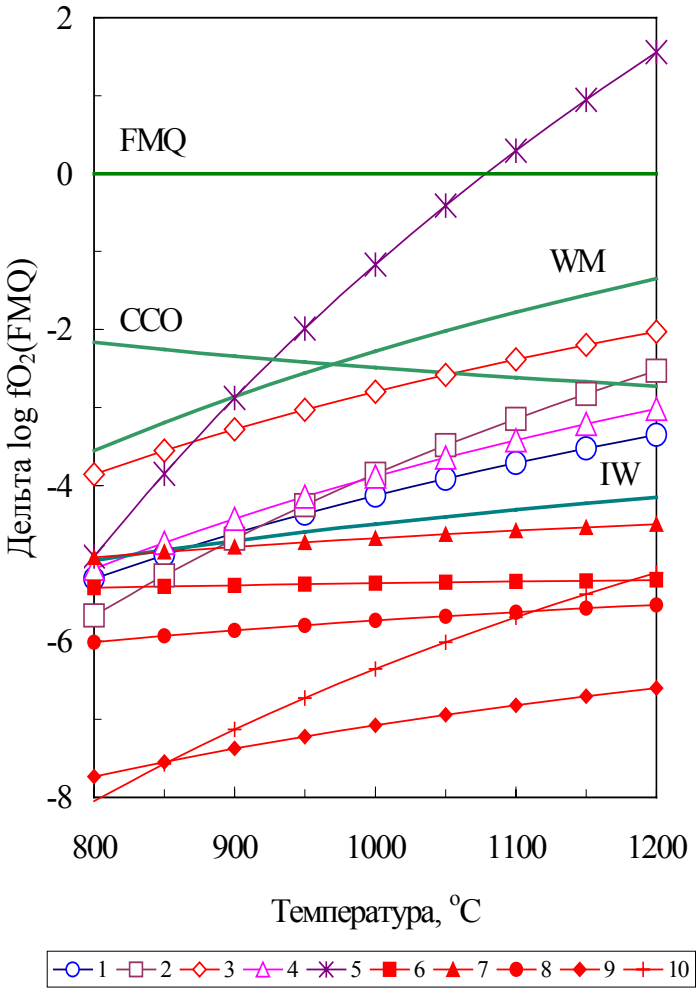

Fig.1. The comparison of measured tektite glasses fO_2 values with fO_2 of several meteorites (Brett and Sato, 1984) [1]. It is shown value of logfO_2 relative to the logfO2(FMQ): $\Delta\log fO_2$ = logfO_2(sample) – logfO_2(FMQ).
Accepted signs for tektite glasses: 1- moldavite (Luchenice), 2 – moldavite (Koroseki), indochinite (Indochinite, N 2684), 4- irgizite (Zhamanshine, Kazakhstan).
Accepted signs for meteorites: 6 and 8 - ordinary chondrite LL3 and L3, 8 – H6 (Guarena), 9 – enstatite chondrite E6, 10 – pallasite (Salta).
CCO – buffer graphite-CO-CO_2.

Table. Water content in studied samples of tektites.

Samples	Thickeness of glass plates, μm	Absorbance of 3600 sm^{-1} band	Concentration water as OH-group, wt.%
Moldavite, Koroseki (a)	0.0270	0.0300	0.0095 (7)
Moldavite, Koroseki (b)	0.0270	0.0350	0.0111 (7)
Indichinite, Vietnam	0.0410	0.0180	0.0038 (5)
Irgizite, Zhamanshine	0.0296	0.1200	0.0348 (11)

Note.
Errors of measurements are shown in brackets (last significant numbers).

Water concentration in moldavites and indochinites glasses is 0.004 - 0.011 wt.%, and is significantly higher - 0.035 wt.% (see table) - in irgizite glass. fO_2 electrochemical determinations of moldavites and indochinites indicate that these tektites are more reduced in comparison with crust and mantle magmatic melts. At the same time their fO_2 is significantly higher than characteristic fO_2 values for carbonaceous, ordinary and enstatitic chondrites. Irgizites have the highest degree of iron oxidation in comparison with moldavites and indochinites, and also the highest water concentrations. These data are consistent with general trend showing impact glasses are more oxydized and hydrous than tektites. The reduced character of tektite glasses and their very low water concentrations are supposed to be connected with the peculiarities of chemical and dynamical processes during melt and vapor phases formation after impact events The processes of evaporation and condensation of silicate liquids from high-temperature vapor are obvious to have the greatest influence upon redox state of iron, water behavior and other components during tektite formation.

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References

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