RAMAN SPECTRA OF TITANOSILICATE MELTS

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Titanium is a minor element in most rock-forming silicate melts. Nevertheless, this element is petrologically significant (MYSEN et al., 1980). Titanium is in six-fold coordination by oxygen in the majority of natural silicates, and titanium can replace silicon in four-fold coordination in alkaline minerals. A structural feature of titanosilicate glasses is that titanium can be both in six-fold coordination, and in four-fold coordination. Structure of melts of systems: $33\%Na_2O{\cdot}67\%SiO_2$-x%$TiO_2$, $40\%Na_2O{\cdot}60\%SiO_2$-x%$TiO_2$, $50\%Na_2O{\cdot}50\%SiO_2$-x%$TiO_2$ (x=1, 5, 10, 20 %) have been investigated by Raman high-temperature spectroscopy. The pulse laser was used for excitation of spectra and a synchronized system of account of photons was used for the registration. It is necessary to discriminate a thermal background from the heating furnace and melt.

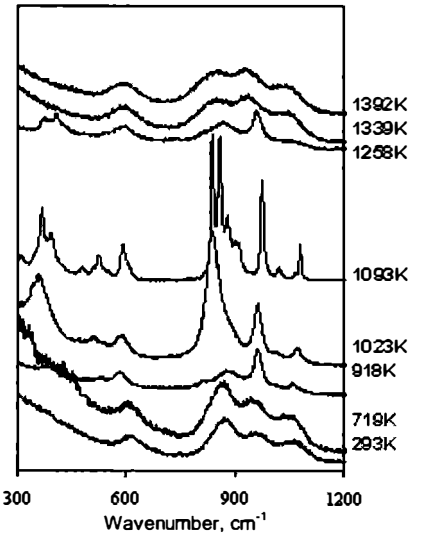

Fig. 1. Raman spectra of the compound with $50\%Na_2O$-$45\%SiO_2$-$5\%TiO_2$ at different temperatures

As an example, Raman spectra of the compound with $50\%Na_2O$-$45\%SiO_2$-$5\%TiO_2$ are shown in Fig. 1 at temperatures of 293-1389 K. Bands in the range of 1050-1075 cm^{-1}, 940-970 cm^{-1}, 860-880 cm^{-1} and 570-625 cm^{-1} are observed in the spectra of titanosilicate glasses and melts. Bands at 1050-1075 cm^{-1} and 940-970 cm^{-1} are attributed to the highly localized symmetric Si-nonbridging O stretching vibrations of Q^3 and Q^2 species, respectively (MYSEN & NEUVILLE, 1995). The low frequency bands are associated with stretching vibrations of Si-O-Si linkages. The band at 860-880 cm^{-1} is assigned to vibrations of TiO_4 units (FURUKAWA & WHITE, 1979). Raman spectra of crystalline phases which are formed at heat treatment of glasses at temperatures of 800-1000 K were obtained too. Systematics of the band behavior in Raman spectra depending on composition (SiO_2 and TiO_2 content) and temperature are established.

References

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