

The effect of silica on ferric/ferrous ratio in silicate melts: An experimental study using Mössbauer spectroscopy

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ABSTRACT

We conducted a Mössbauer study of synthetic glasses with anorthite-diopside eutectic composition modified with either 5 or 1 wt% Fe₂O₃ and variable amounts of silica. Glasses were synthesized in air in the temperature range 1400–1570 °C. Room-temperature Mössbauer spectra showed the presence of magnetically ordered Fe³⁺, for which a systematic fitting procedure was developed to correctly estimate Fe³⁺/Fe²⁺. At constant T - f_{O_2} we observed a minimum in the variation of Fe³⁺/Fe²⁺ ratio with silica that varied from 56 to 63 wt% SiO₂, depending on temperature. It was also demonstrated that the temperature dependence of the ferric/ferrous ratio [$\log(\text{Fe}^{3+}/\text{Fe}^{2+})$ vs. $1/T$] is essentially similar for basic and silicic melts.

Keywords: Mössbauer spectroscopy, ferric/ferrous ratio, silicate melts, experiments