

Thermodynamic distribution of Mg^{2+} and Fe^{2+} between olivine and melt in the MgO–FeO–SiO₂ system

A. A. Ariskin¹, A. V. Shildt²

¹V. I. Vernadsky Institute of Geochemistry and Analytical Chemistry RAS, Moscow

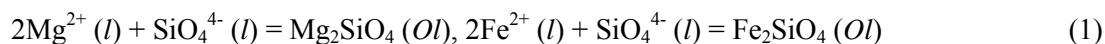
²M. V. Lomonosov Moscow State University, Department of Geology, Moscow

ariskin@rambler.ru

Key words: geothermometer olivine-melt, structure of silicate melts, dissociation degree

Citation: Ariskin, A. A., A. V. Shildt (2011), Thermodynamic distribution of Mg^{2+} and Fe^{2+} between olivine and melt in the MgO–FeO–SiO₂ system, *Vestn. Otd. nauk Zemle*, 3, NZ6007, doi:10.2205/2011NZ000137.

We proposed a new thermodynamic model describing olivine-melt equilibrium in simple silicate systems as a function of the structural state of the silicate liquid. This model is based on molecular mass calculations allowing one to estimate concentration of free oxygen ion O^{2-} and proportions of Si-species (SiO_4^{4-} , $Si_2O_7^{6-}$, and so on) in the melt, as well as thermochemical calculations for mineral-forming reactions controlling crystallization of Ol end-components:



Application of this model to 38 olivine-melt equilibrium compositions in the MgO–FeO–SiO₂ system resulted in systematic differences between observed and modeled $K_D^{Fe-Mg}(Ol-l)$ values, calculated as $(FeO/MgO)_{Ol}/(FeO/MgO)_l$. These differences have been interpreted as indication at incomplete dissociation of FeO in the silicate melts. Using results of the structural-thermochemical calculations mentioned above, the degree of dissociation $\alpha_{Me} = n_{Me^{2+}}/n_{MeO}$ [Korzhinsky, 1959] has been parameterized as a function of silica content (degree of polymerization) in the melt. This allowed us to develop a more accurate Ol-melt equilibrium model describing the observed $K_D^{Fe-Mg}(Ol-l)$ values in a wide range of ~0.1-0.4.

References

Korzhinsky, D.S. (1959). *Dokl Akad. Sci. USSR*, v.128, No 2, pp.383-386 (in Russian)