

LETTER

Cation distribution in MgFe₂O₄ vs. pressure and temperature: Experiments in a “piston-cylinder” apparatus

ALEXANDER I. TURKIN¹ AND VALERI A. DREBUSHCHAK^{1,2,*}

¹Institute of Mineralogy and Petrography SB RAS, Prospect Ac. Koptuyuga 3, Novosibirsk 630090, Russia

²Molecular Design and Ecologically Safe Technologies, REC-008, Novosibirsk State University, Ul. Pirogova 2, Novosibirsk 630090, Russia

ABSTRACT

The cation distribution in magnesioferrite MgFe₂O₄ was investigated using a “piston-cylinder” apparatus at three pressures (ambient, 1, and 2 GPa) over a temperature range of 600 to 1200 °C. Quenched samples of magnesioferrite were investigated by X-ray powder diffraction. The inversion parameter was derived from the unit-cell parameter at ambient temperature.

The inversion parameter increases with pressure, being a smooth function of *P-T* conditions. The changes in the cation distribution in magnesioferrite caused by the changes in *P-T* conditions produce the contributions to the bulk modulus (<0.01%) and thermal expansion coefficient (12–60%). On average, the pressure increment of 0.01 GPa is compensated for by 1 °C heating.

The effect of pressure on the cation ordering obeys the fundamental relationship $(dV/dx)_{T,P}(dx/dP)_T < 0$. The terms are $(dV/dx) < 0$ and $(dx/dP) > 0$ for MgFe₂O₄ and MgAl₂O₄.