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Thermal expansion of $MgSiO_3$ and $FeSiO_3$ ortho- and clinopyroxenes

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ABSTRACT

Unit-cell parameters of synthetic $(Mg,Fe)SiO_3$ ortho- and clinopyroxenes were determined at regular intervals in the temperature range 293–1094 K using powder X-ray diffraction techniques. Volume thermal expansion coefficients calculated from these data show that orthopyroxenes expand faster than clinopyroxenes (i.e., $\alpha_{opx} > \alpha_{cpx}$), irrespective of their composition along the $MgSiO_3$-$FeSiO_3$ join. For both ortho- and clinopyroxenes, α_{MgSiO_3} exceeds α_{FeSiO_3}. Axial thermal expansion coefficients calculated for each of the pyroxene phases studied here are a complex function of the changes in structure at high temperature. Thermodynamic calculations of the position of the phase boundary between $MgSiO_3$ ortho- and clinopyroxene show excellent agreement with the experimentally reversed boundary.