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Shifts in thermal expansivity with Fe content for solid solutions of $MgSiO_3$-$FeSiO_3$ with the perovskite structure

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Abstract

This study presents evidence that for a solid solution of $Mg_xFe_{x-1}SiO_3$ perovskite, the shift in volume thermal expansivity, α, is small as the index x is changed. According to data obtained theoretically by Hama and Suito (1998), α decreases by 0.3–0.4% as x changes from 1 to 0.9 in a temperature range of 1900 K. Furthermore, the relative shift in α for Fe substitution is -0.4% under lower mantle conditions. Hama and Suito used the Vinet equation of state to calculate thermoelastic properties. Using a thermodynamic approach applied to the properties of a Debye solid, the data show that the relative shift in α is less than the relative change in specific volume, and, as x changes from 1 to 0.9, V increases by 0.6% and α decreases by 0.4%.