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New accurate elastic parameters for the forsterite-fayalite solid solution

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Abstract

Three natural olivines with $Fo_{80}Fa_{20}$, $Fo_{71}Fa_{29}$, and $Fo_{62}Fa_{38}$ compositions were investigated in situ at high pressure by single-crystal X-ray diffraction using a diamond-anvil cell up to ~8 GPa at room temperature. The bulk modulus, K_{T0}, and its first pressure derivative, K', do not show any significant variation among the compositions investigated and, using the data on a further sample with $Fo_{92}Fa_{8}$ composition recently investigated in the same laboratory and using the same experimental technique, we obtain, for the first time, a single equation of state for the entire $Fo_{92}Fa_{8}$-$Fo_{62}Fa_{38}$ compositional range. The equation has the following coefficients: K_{T0} = 124.7(9) GPa and K' = 5.3(3) and can be used for thermodynamic calculations involving the most common mantle olivine compositions.

Keywords: Olivine, diffraction, pressure, elasticity