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Sound velocities of wadsleyite β-$(Mg_{0.88}Fe_{0.12})_2SiO_4$ to 10 GPa

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ABSTRACT

We measured the sound velocity of wadsleyite β-$(Mg_{0.88}Fe_{.0.12})_2SiO_4$ to 9.6 GPa at room temperature using ultrasonic techniques in a uniaxial split-cylinder apparatus using a polycrystalline specimen hot-pressed at 14 GPa and 1200 °C. Bench-top velocity measurements yielded V_P = 9.33(3) km/s and V_S = 5.43(2) km/s; the calculated bulk modulus (K) and shear modulus (G) are 172(2) GPa and 106(1) GPa, respectively. These K and G values are indistinguishable from those for single crystal and polycrystalline specimens of Mg_2SiO_4-wadsleyite. Pressure derivatives of the bulk and shear moduli have been obtained by fitting the current experimental data to 9.6 GPa using third-order, finite strains equations, yielding K'_{S0} = 4.6(1) and G'_0 = 1.5(1). From comparison with previous data for similar specimens and techniques, we observe no effect of iron content on the pressure derivatives of either the bulk or shear moduli, within the limited compositional range investigated.