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LETTER

The elastic properties of diopside, $CaMgSi_2O_6$

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ABSTRACT

The 13 single-crystal elastic moduli of two samples of diopsidic pyroxenes close to the ideal composition ($CaMgSi_2O_6$) from different locations have been measured at ambient pressure and room temperature by Brillouin spectroscopy. We obtain (in GPa, $\pm 1\sigma$ uncertainty): C_{11} = 229.0(4), C_{22} = 179.0(4), C_{33} = 242.5(4), C_{44} = 78.9(3), C_{55} = 68.1(2), C_{66} = 78.2(3), C_{12} = 78.0(7), C_{13} = 69.8(6), C_{23} = 58.0(7), C_{15} = 9.9(3), C_{25} = 6.1(5), C_{35} = 40.9(3), C_{46} = 6.6(2), and C_{11} = 226.1(9), C_{22} = 179.5(8), C_{33} = 239.2(9), C_{44} = 78.1(6), C_{55} = 69.2(4), C_{66} = 76.4(8), C_{12} = 77.4(10), C_{13} = 70.2(13), C_{23} = 56.7(16), C_{15} = 9.9(7), C_{25} = 5.9(12), C_{35} = 41.0(7), C_{46} = 6.8(4) for the two diopside samples. There are no major differences in the elastic tensor of the nearly pure diopside composition compared with the second sample containing slightly higher Al and Fe contents. Polycrystalline averaging of the C_{ij} for the aggregate bulk and shear moduli yield K_s = 114.6(7) GPa, G = 72.7(4) GPa and K_s = 113.7(8) GPa, G = 72.2(5) GPa for the two diopside samples. The shear moduli reported here are 8% larger than those determined from previous measurements on a similar natural sample. We confirm the existence of systematic correlations between the composition of the M2 site and most of the C_{ij} values. No unusual compositional dependence of C_{ij} values or the shear modulus near end-member diopside composition is observed.

Keywords: Brillouin spectroscopy, clinopyroxene, diopside, elastic properties, single crystal