

Elasticity of six polycrystalline silicate garnets at pressure up to 3.0 GPa

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ABSTRACT

The elasticities of six polycrystalline silicate garnets (almandine, grossular, pyrope, uvarovite, andradite, and $\text{Prp}_{25}\text{Alm}_{56}\text{Spe}_{19}$) have been experimentally studied at pressures up to 3.0 GPa using a phase comparison method with an ultrasonic interferometer in a liquid cell piston-cylinder apparatus. Complete elasticity data sets (P- and S-wave velocities, bulk moduli K_s , shear moduli G , and their first pressure derivatives K'_s and G') have been obtained for all six garnets, and are used together with an up-to-date compilation of garnet elasticity data to examine composition-elasticity systematics of garnets. Our results suggest that pyralspite and ugrandite have different relationships between bulk sound velocity (V_ϕ) and mean atomic weight (\bar{M}_0), between Poisson's ratio (σ) and density (ρ), and between G/K_s and K_s/ρ ratios. A large error may occur when the systematics are applied across different garnet groups.