

High-pressure synchrotron X-ray diffraction study of spessartine and uvarovite: A comparison between different equation of state models

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ABSTRACT

The lattice parameters of natural spessartine and uvarovite garnets were measured as a function of pressure up to 25 and 35 GPa, respectively, by synchrotron radiation powder diffraction. The bulk modulus and its first and second derivatives were determined by fitting three equation of state (EoS) models to the pressure-volume data: the Birch-Murnaghan EoS, the Vinet EoS, and the Poirier-Tarantola logarithmic EoS. The third-order Birch-Murnaghan EoS, assuming V_0 at its experimental value, yields $K_0 = 171$ (1) GPa and $K_0' = 5.4$ (2) with $V_0 = 1573 \text{ \AA}^3$ for spessartine, and $K_0 = 160$ (1) GPa and $K_0' = 5.8$ (1) with $V_0 = 1697.5 \text{ \AA}^3$ for uvarovite. The results obtained by the EoS models are consistent with each other within the experimental uncertainties. A comparison is made with earlier results from the literature.