Single crystal elastic properties of hemimorphite

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Hemimorphite (Zn₄Si₂O₇(OH)₂•H₂O) as hydrous mineral contains two different types of bonded hydrogen: molecular water and hydroxyl. The elastic properties of hemimorphite have been investigated by Brillouin spectroscopy at ambient condition. Nine independent single-crystal elastic moduli (C_ij) of hemimorphite have been obtained. The root mean square (RMS) error for best-fit model of the C_ij tensor is 32.4 m/s. The Voigt-Reuss-Hill averaged aggregate isotropic elastic moduli are K_s(VRH)= 73.9±2.7GPa and \( \mu(VRH) = 26.52±0.10GPa \), for the adiabatic bulk modulus and shear modulus, respectively. The average P velocity is 5.601km/s, and for S velocity is 2.760km/s. Hemimorphite has distinctive acoustic properties for: (i) strong anisotropy, especially for Vs (46.924%); (ii) a high Vp to Vs ratio (Vp/Vs=2.02). The maximum Vp/Vs is in the (010) plane, which contains both varieties of “water”; (iii) and a large Poisson’s ratio (\( \sigma = 0.345 \)).