American Mineralogist, Volume 92, pages 570–576, 2007

Single-crystal elasticity of zoisite $Ca_2Al_3Si_3O_{12}(OH)$ by Brillouin scattering

Zhu Mao,* Fuming Jiang, and Thomas S. Duffy

Department of Geosciences, Princeton University, Princeton, New Jersey 08544, U.S.A

Abstract

The single-crystal elastic constants of zoisite $Ca_2Al_3Si_3O_{12}(OH)$ were determined by Brillouin scattering at ambient conditions. The elastic tensor was obtained by an inversion of acoustic velocity data for three different crystal planes. The aggregate bulk modulus, shear modulus, and Poisson's ratio are K_{S0} = 125.3(4) GPa, G_0 = 72.9(2) GPa, and σ_0 = 0.26(1) for the VRH (Voigt-Reuss-Hill) average, respectively. The maximum azimuthal anisotropy of zoisite is 22% for compressional velocity and 33% for shear velocity. The maximum shear splitting is 21% along the [001] direction. Our results resolve the discrepancies in bulk modulus and axial compressibilities reported from static compression studies, and provide the first experimental constraints on the shear modulus. Trends in the elastic moduli of minerals in the CaO-Al_2O_3-SiO_2-H_2O (CASH) system are evaluated.

Keywords: Zoisite, single crystal, elasticity, Brillouin scattering