

High-pressure infrared spectra of talc and lawsonite

HENRY P. SCOTT,^{1,*} ZHENXIAN LIU,² RUSSELL J. HEMLEY,² AND QUENTIN WILLIAMS³

¹Department of Physics and Astronomy, Indiana University South Bend, South Bend, Indiana 46634, U.S.A.

²Geophysical Laboratory, Carnegie Institution of Washington, 5251 Broad Branch Road NW, Washington, D.C. 20015, U.S.A.

³Department of Earth Sciences, University of California at Santa Cruz, Santa Cruz, California 95064, U.S.A.

ABSTRACT

We present high-pressure infrared spectra of two geologically important hydrous minerals: talc, $\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$, and lawsonite, $\text{CaAl}_2\text{Si}_2\text{O}_7(\text{OH})_2 \cdot \text{H}_2\text{O}$, at room temperature. For lawsonite, our data span the far infrared region from 150 to 550 cm^{-1} and extend to 25 GPa. We combine our new spectroscopic data with previously published high-pressure mid-infrared and Raman data to constrain the Grüneisen parameter and vibrational density of states under pressure. In the case of talc, we present high-pressure infrared data that span both the mid and far infrared from 150 to 3800 cm^{-1} , covering lattice, silicate, and hydroxyl stretching vibrations to a maximum pressure of 30 GPa. Both phases show remarkable metastability well beyond their nominal maximum thermodynamic stability at simultaneous high-pressure and high-temperature conditions.

Keywords: Lawsonite, talc, hydrous silicates, high pressure, infrared