

Compressional behavior of the O-H bond in chrysotile: A Raman high-pressure study

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A change in the linear pressure behavior of the chrysotile Raman O-H band is revealed by an in-situ high-pressure Raman study using a diamond anvil cell at 0.1-0.4 GPa pressure intervals. The peak of 3701 cm^{-1} can be accurately determined in the pressure range of 0.2-4.5 GPa. The pressure-wavenumber relationship for the peak is closely approximated by two linear functions with the slopes of $4.3\text{ cm}^{-1}/\text{GPa}$ and $1.7\text{ cm}^{-1}/\text{GPa}$ at pressures above and below 1.7 GPa, respectively. The spectral resolution given by a peak fitting method (0.5 cm^{-1}) implies that these functions for changes in the positions of the 3701 cm^{-1} peak provide pressure estimates with resolutions of 0.1-0.2 GPa. The pressure shift characterized by the change in slope and the associated decrease of the peak width can be explained by a model where the change in compressibility of the tetrahedral layer affects the interaction between the inner O-H and Si atoms forming a six-membered ring. The higher pressure dependence at pressures lower than 1.7 GPa may be a contribution of a dominant layer-parallel compression that compensates a distortion in the tetrahedral layer of chrysotile. Our result indicates that chrysotile changes its compressibility at around 1.7 GPa.