Abstract:

Stishovite, a high pressure polymorph of quartz (SiO₂), is a prototype of high pressure phases accommodating Si atoms in the six-fold coordination. It is considered to exist in subducting slabs. The single crystal elastic constants of Stishovite were investigated by means of high frequency resonant ultrasound spectroscopy (HF-RUS).

A large single crystal of stishovite was synthesized in the Kawai type high pressure apparatus at around 12 GPa through slow cooling method. The characterization was conducted by polarized microscope, x-ray diffraction, and FTIR spectroscopy. The single crystal grain was formed to a rectangle specimen (229x288x502 μm) by manual polishing after determining crystallographic orientation.

Through sensitive HF-RUS measurements, 15 resonant peaks were identified between 6-20 MHz. From the inversion analysis on these peaks, 6 independent elastic constants of stishovite are determined as C₁₁=468 GPa, C₃₃=752 GPa, C₁₂=211 GPa, C₁₃=193 GPa, C₄₄=250 GPa, and C₆₆=326 GPa, respectively. The Voigt-Ruess-Hill averages of bulk modulus and rigidity are a few percent higher than those of previous Brillouin studies.

In this presentation, the background of RUS and the development of HF-RUS are briefly mentioned as well.