

## Elastic wave velocities of Al-bearing stishovite at high P and T

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Like continental crust, mid-oceanic ridge basalts and sediments are enriched in Silicon. It has been suggested that subduction processes provide a way of enriching the mantle with silica. Above 10 GPa, SiO<sub>2</sub> transforms to stishovite with a tetragonal rutile structure (space group P4<sub>2</sub>/mnm), which is believed to be a major mineral of mid-oceanic ridge basalts subducted to the mantle transition zone [1]. Previous studies have shown that stishovite has a relatively high-density compared to other constituent minerals of subducted slabs, and could generate chemical and density heterogeneities in the deep mantle. For this reason, numerous studies reported the physical properties of pure stishovite (see [2], and references therein). However, in the subduction context, stishovite can contain up to 2.5 wt% Al<sub>2</sub>O<sub>3</sub> in dry systems [3] and up to 9 wt% Al<sub>2</sub>O<sub>3</sub> in hydrous systems [4]. Therefore stishovite is proposed to be an important carrier of Al and H<sub>2</sub>O into the transition zone and lower mantle. The incorporation of even small amounts of Al and its possible coupling with oxygen vacancies can influence the stability, density and compressibility of SiO<sub>2</sub> [5-7].

The pressure and temperature dependences of the elastic properties of stishovite + 1 to 6 wt% Al<sub>2</sub>O<sub>3</sub> were examined *in situ* up to 24 GPa and 1700 K by using a Kawai-type multi-anvil press apparatus coupled with synchrotron X-ray diffraction and ultrasonic interferometry. The collection of P-V-T-V<sub>P</sub>-V<sub>S</sub> data simultaneously provided a strong constraint on the pressure, temperature and Al-content dependences of velocities and elastic properties of Al-stishovite. Generally, we found that sound velocities of P- and S-waves are substantially slower for SiO<sub>2</sub> + only 1 wt% Al<sub>2</sub>O<sub>3</sub>. Thermoelastic data are extrapolated to higher P, T and Al-content and used to directly estimate density and velocity profiles for various composition and temperature profiles. Our results are discussed in regards with the structure and composition of slabs subducted to the depths of the mantle transition zone and lower mantle.

### References:

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