High Frequency Resonant ultrasound spectroscopy for sub-millimeter specimens of high pressure phases

Akira Yoneda[1]; Shunsuke Sakai[2]

[1] ISEI, Okayama Univ.; [2] Dept. Earch Sci. Kumamoto Univ.

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Resonant ultrasound spectroscopy (RUS) is one of the typical techniques to measure elastic moduli of relatively small sample; it is based on natural vibration mode analysis on detected peaks in the frequency domain. However we have been unable to detect peaks of natural frequencies higher than 10MHz frequency by conventional RUS method. In other words the size of sample must be larger than 1 mm. Therefore it is significant for us to develop high frequency RUS up to 100 MHz for measurement for a few hundred microns sample.

We examined the performance of the high frequency RUS apparatus up to 50 MHz by using a ZrO3 sphere of 200 micrommeter diameters. We succeeded in detecting 8 resonance peaks between 15 MHz and 50MHz. We calculated the P wave and S wave velocities from those resonance frequencies; Vp=8470 m/s, and Vs=4839 m/s, respectively. The reference values supplied from the manufacturer (Tosoh, Japan) are Vp=8858 m/s and Vs=4870 m/s, respectively. Both the velocities are consistent within 5 %. The difference of these velocities may be cause by inhomogeneity of sample and imperfection of sphere shape.