Establishing equation of state of MgO and MgSiO3 perovskite based on simultaneous measurements of acoustic velocity and density.

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Single crystal MgO and powder MgO specimens are enclosed in an aluminum capsule which was embedded in an octahedral pressure medium (Fig.1). Ultrasonic velocity of MgO was measured for the single crystal MgO (1.5 x 1.0 x1.0 mm), and Xray density for powder specimen. Both data will be combined in order to yield an equation of state of MgO, or an absolute pressure scale based on MgO.

We found that Spring8 experimental hall is of relatively high noise. In order to overcome the noise problem, following countermeasures were made;

(1) While signal observed on the channel 1, an alternative trigger pulse was put on channel 2 in order to get stable triggering.
(2) Utilize averaging function of the digital oscilloscope. We can get nearly noiseless profile by 64-256 times averaging.
(3) Eight of anvils were electrically connected in order to serve as a shield box.
(4) Use high quality coaxial cable, such as 5D2V, as short as possible.

Using the cell assembly, we observed up to the pressure of 5.6 GPa at 700 ton both by Au and MgO pressure scale. The ultrasonic signal was successfully observed, although the quality was not satisfactory. An example of ultrasonic signal is shown in Fig.2. Due to the low quality of the signal, the toraveltime may have uncertainty of one period of the carrier wave, or 20 nsec.

The present experiments at Spring 8 confirmed the potential capability of the simultaneous ultrasonic and x-ray density measurement.

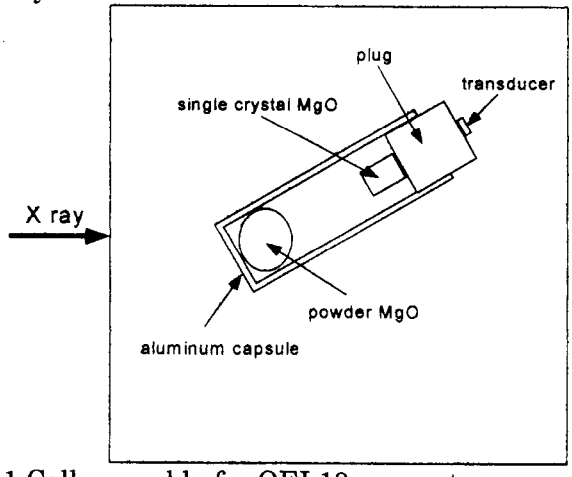

Fig.1 Cell assembly for OEL18mm system.

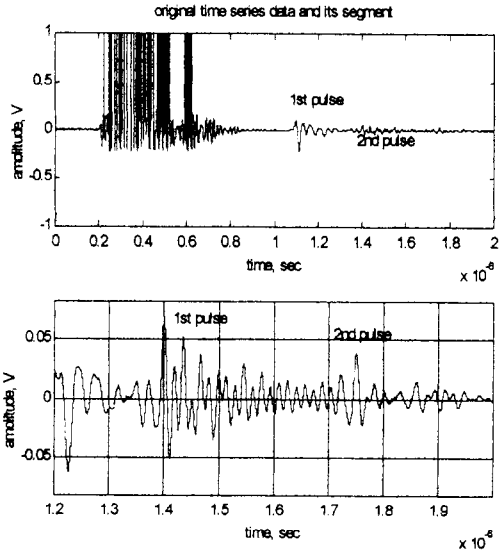

Fig.2 Ultrasonic signal at 1.25 GPa (100t).