

Structure and Equation of State Study of Mantle Minerals Through in situ X-ray Observation

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An equation of state study of CaSiO_3 perovskite was performed up to about 20 GPa and 1400 K. Experiments were performed at BL04B1 using SPEED1500 high pressure apparatus.

CaSiO_3 perovskite is regarded to be one of the important constituent of the Earth's lower mantle. Since it is unquenchable to ambient condition, only very limited studies have been made on its equation of state. In the present experiment, crystalline CaSiO_3 with sudo-wolastonite structure was compressed to about

20 GPa using double stage high pressure apparatus. Sample assembly used for the present experiment is shown in Fig. 1. The truncation length of the second stage anvil was 2mm. The sample was then heated to about 1400 K and transformed into perovskite structure. After it was completely converted into perovskite structure, its unit cell volume was measured precisely using powdered x-ray diffraction technique by changing both temperature and pressure. An example of the diffraction profile obtained by these measurements are shown in Fig. 2. More than 50 measurements under different pressure and temperature conditions were made for both perovskite sample and pressure marker. Detailed analysis is in progress and these data will be useful to construct reliable equation of state, which will play important role for the discussion of the Earth's lower mantle.

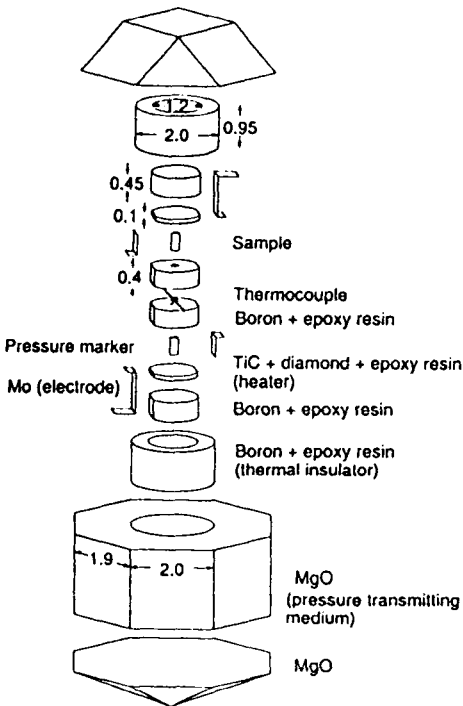


Fig. 1. Sample assembly for high pressure and temperature experiment.

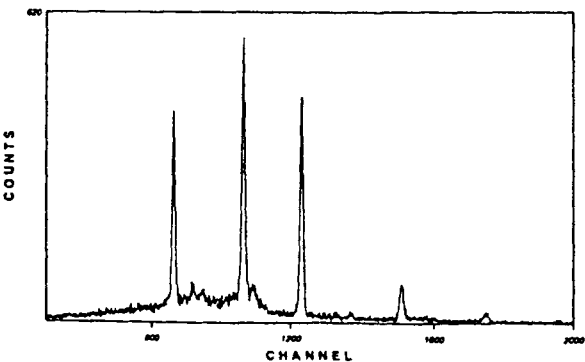


Fig. 2. An example of the diffraction pattern of CaSiO_3 perovskite obtained at about 23 GPa and 1300 K.