Elastic Property of Portlandite $Ca(OH)_2$ at High Temperature Conditions

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Introduction

It is very important in the earth science to understand H_2O behavior under mantle condition. Portlandite is one of the hydrous minerals that might occur in the Earth's mantle. Under high pressure conditions, Fukui et al. (2000)[1] reported that it does not dehydrate but melts congruently using differential thermal analysis (DTA) and the slope of the dehydration curve is getting more negative as pressure increases. To understand the behavior of portlandite under high pressure conditions, we investigate the elastic property under high temperature conditions.

Experimental Method

MAX80 system installed at AR-NE5C with sintered diamond anvils of 6 mm edge length was used. Mixture of Sample and NaCl powders were inserted in a 9 mm cube pressure medium made of boron epoxy resin. Graphite disks were used as furnace. Silica glass tube was used as a container in order to avoid the effect of water from epoxy resin. The temperatures of the sample space were acquired using chromel-alumel thermocouples. X-ray data were collected by an energy dispersive method using a pure germanium SSD.

Results and Discussions

We obtained clear diffraction patterns. A typical one is shown in Fig. 1. The unit cell volume were calculated with six diffraction lines from 001 100 101 102 110 and 111 planes. Bulk modulus and its pressure derivative at ambient temperature are consistent with previous reports [2][3].

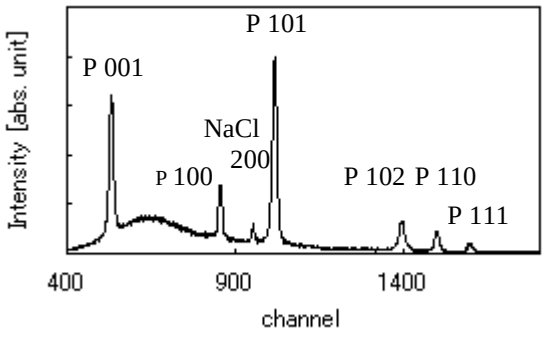

Figure 1. Diffraction pattern of sample at ambient condition. A halo was from SiO_2 glass sample camber.

The volumes are plotted in P-T-V space and it is shown in Fig. 2. The volume change of portlandite is systematic and there are no indications that melting temperature decreases as pressure increases. The cause of gradual melting temperature decreasing may be elastic property of the liquid phase of portlandite.

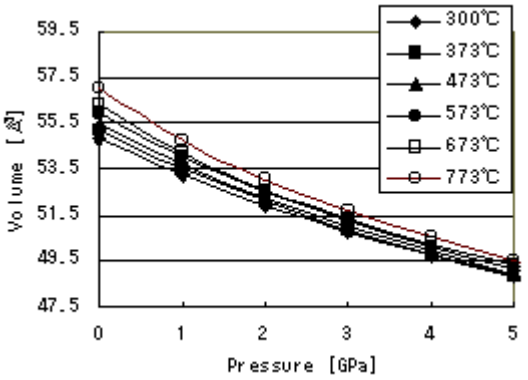

Figure 2. Compression curves of $Ca(OH)_2$ portlandite at various temperatures.

References

[1] Fukui et al., Phys. Chem. Minerals, 27, 367-370 (2000)

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