

BL04B1 : In situ observation of high pressure phase change of simple material

<Pressure induced phase transition of graphite>

Introduction

The BL04B1 beamline is designed particularly for conducting researches on the precise in situ X-ray measurements of the crystal structures and physical properties under high pressure and high temperature conditions. Graphite is one of the well-known simple materials (C) and has a hexagonal structure at ambient condition. However, graphite changes the structure from hexagonal to cubic system

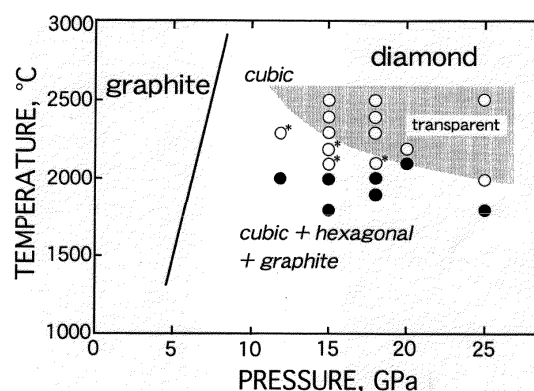


Fig. 1 Phase diagram of the graphite

(diamond) with increasing pressures and temperatures. In the practice, we observe the pressure induced phase transition of graphite by the X-ray diffraction technique.

Experimental method

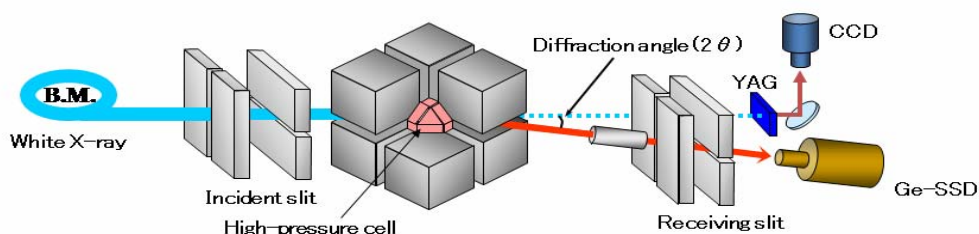


Fig. 2 Schematic illustration of the experimental set-up

High pressure and high temperature experiments are performed combining a large-volume multi-anvil device (SPEED-1500) and an energy-dispersive X-ray diffraction. Incident white X-ray from bending magnet is introduced via the slits and then passes the sample container through the anvil gap, (Fig. 2,) and the diffracted X-ray from the sample is detected by Ge-SSD.

Practice

1. Put a sample piece (graphite disk) into the high pressure cell like fig. 3.

2. Set the high pressure cell on the cavity of eight tungsten carbide cubes surrounded by the glass epoxy disks.

3. Set the packed high pressure cell assemblage on the first stage anvils of large-volume multi-anvil press (SPEED-1500) .

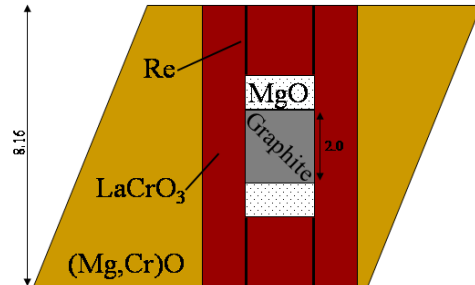


Fig.3 Cross section of the cell assembly

4. Collect the diffraction patterns of the sample at ambient condition.

5. Increase pressures to 16GPa, and then heat the sample to about 2000°C (estimated by power supply). The phase transition will be started at 1200°C.

6. Observe the phase transition from graphite to diamond by X-ray diffraction pattern (Fig. 4), and then decrease temperatures and pressures.

7. Take the sample from the high pressure cell after releasing pressures, and observe the recovered sample by optical microscope.

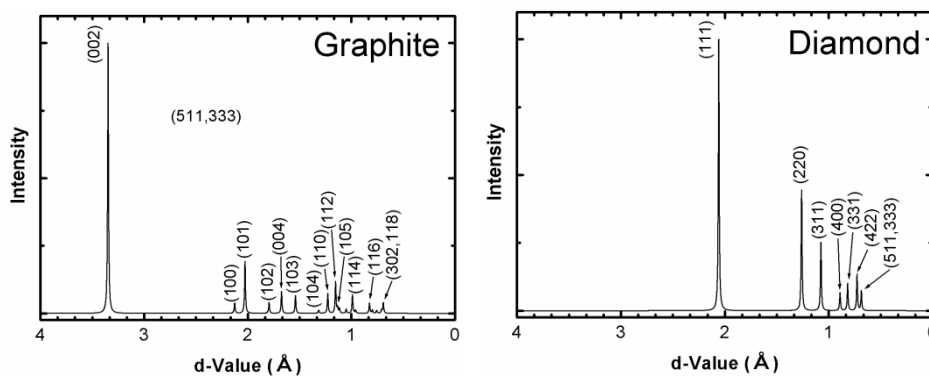


Fig. 4 X-ray diffraction pattern of graphite and diamond