Detecting Methods of Solid-Liquid and Solid-Solid Phase Transitions in Inorganic Compounds at High Temperatures and Pressures

by Shinroku SAITO, Yoshiharu OZAKI, Shinobu YAMAOKA, Osamu FUKUNAGA

The 4th Discussion on the Basic Science of Ceramics
at Nagoya in 1966

Abstract

Many investigations about solid-liquid and solid-solid phase transitions have been done under high pressures and high temperatures, and still it is important. The discovery of new phases under high pressures and temperatures about silicate minerals, seems to have been worked out. However, there still remains a lot of questions on the stable regions. The data of the P-T diagram about solid-liquid and solid-solid phase transitions under atomospheric pressure are poor. In our laboratory we are collecting data of solid-solid and solid-liquid phase transitions using a quenching method, a differential thermal analisis (DTA) method and variations of the electrical resistance, etc. Especially in present paper dynamic methods (the DTA, the electrical resistance measurement) are shown and some results obtained by using these methods are discussed.

1. Apparatus

Pressures were generated by a piston-cylinder apparatus. After a sample was set in a high pressure cylinder vertically supported by two separate 150-ton rams, it was pressed by a 600-ton rams. The apparatus was calibrated by Bi(1)-Bi(2) 25.4 kb, Bi(2)-Bi(3) 27.0 kb, and Tl(2)-Tl(3) 36.7 kb.

2. Experimental Procedure

(a) Electrical resistance measurement: The principle of this method is an abrupt change of electrical resistance after solid-solid phase transitions. A sample assembly is shown in Fig. 1. In this method a thermal electrical motive force is generated by a temperature difference between the sample ends.

(b) DTA method: The DTA method was developed for the investigation of the melting curves of the pure metals at high temperatures and pressures by Kennedy, Newton, and Jayaraman. The DTA method is