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Application of 6-6 type multi-anvil system for MAX-80 and MAX-III

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Introduction

Recently 6-6 compression system was developed (Nishiyama et al., 2008; Kawazoe et al., 2010), and this system has a lot of advantages compared to the conventional single stage cubic anvil system. The advantages are as follows: 1) As for the first stage anvil alignment, it is considerably easy because we only have to align the anvil surface distance. 2) Because the size of the second stage anvil become smaller, it is easy to introduce various kinds of anvil materials comparatively at low price. 3) Even if the brow-out of the second stage anvil has occurred, it is easy to exchange the anvil. In general, the damage of the first stage anvil is few. This means that the second stage anvil can be used until the plastic strain limit in spite of the risk of the blow-out.

We have conducted in situ X-ray experiment using the 6-6 system to test the performance at NE5C (MAX-80) and NE7A(MAX-III) of PF-AR. Moreover, using this system, we had collected the data of 1) X-ray diffraction of anhydrous and hydrous silicate melt, 2) P-V-T of hydrous phases, and 3) the time resolved X-ray diffraction to determine the dehydration kinetics of hydrous phases, under high pressure and high temperature.

Experimental

We used Tr. 27 mm WC anvil for first stage anvil, and Tr. 4, 5, or 6 mm WC anvil for second stage anvil. The boron epoxy was used for pressure medium. The photographs of 6-6 system used in the present experiments are shown in Fig. 1.

Results and discussion

In the performance test, it was possible to compress up to 180 ton at Tr. 5mm system, and the generated pressure was 12.7 GPa in Au pressure scale [3] (Fig.2). After that, the blow-out was occurred. Moreover, the P-V-T experiments of serpentine were successful up to 8 GPa and temperature up to 773K at Tr. 5 mm system (Fig. 3). The upper bound of this temperature is not the limit of this system, but upper limit of the stability of serpentine. In addition, the data collections of the diffraction of anhydrous and hydrous albite melts were also successful. For example, the generated pressure at 80 ton in Tr. 4 mm was ~8 GPa under high temperature at which melt formed. Thus the 6-6 system can apply to the MAX-80 and MAX-III with no problem and great advantages.

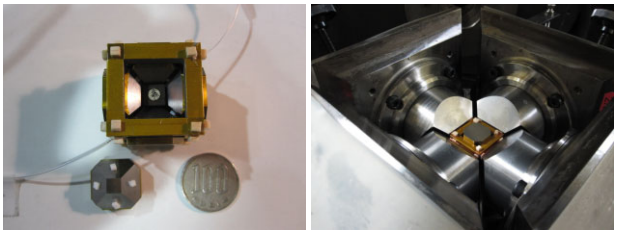

Fig.1 The photographs of 6-6 system.

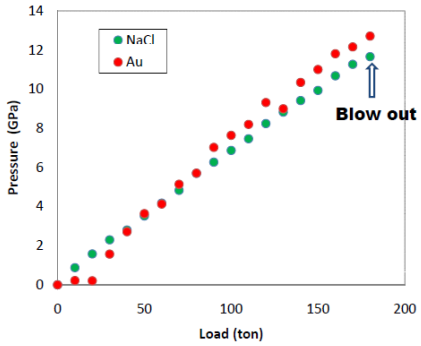

Fig.2 The pressure calibration at Tr. 5 mm system. The size of boron-epoxy pressure medium was 7 mm cube. The pressures were calculated by EoS of Anderson [3] for Au and Decker [4] for NaCl, respectively.

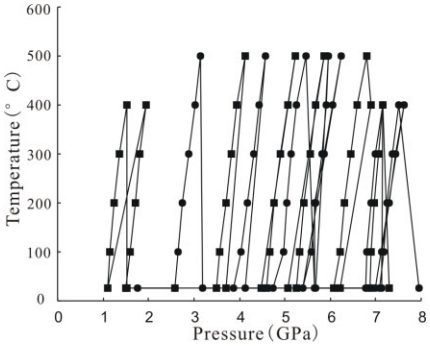

Fig.3 P-T path for P-V-T experiment of serpentine in Tr. 5 mm system.

References

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