The 379th Geodynamics Seminar

Melting temperatures of MgO up to 35 GPa measured in a CO_2 laser-heated diamond anvil cell

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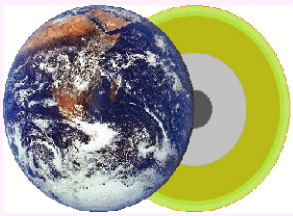

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Abstract

Determination of melting behavior of MgO-FeO-SiO_2 system is important to understand the chemical differentiation and the origin of seismic-wave attenuation. The Clapeyron slope of the melting curve of MgO was experimentally determined to be ~30 K/GPa at zero pressure, which is, however, several times lower than those estimated by some theoretical calculations. To address the large controversy on the MgO melting curve, further experimental study is needed.

The experimental attempt to directly measure the melting behavior of MgO has been made so far only by Zerr and Boehler (1994) using a laser-heated diamond anvil cell because of the difficulties in establishing melting criteria at high pressure. In their study, the melting was determined only from the abrupt temperature increase, which is assumed to be caused by the change in optical absorption efficiency through the melting. In this study, we performed a series of melting experiments on MgO at high pressure by using a CO_2 laser-heated diamond anvil cell, and determined the melting curve on the basis of both discontinuous changes in the heating efficiency and textural characteristics observed in the recovered samples.

A temperature plateau in the relation between the laser power and the sample temperature was reproducibly observed between ambient pressure and 35 GPa. The plateau's temperature at ambient pressure is in good agreement with the melting temperature of MgO. Both FE-SEM and TEM observations from the recovered sample showed a fiber-like texture in the hot spot, which is attributed to rapid grain growth through the solidification. Taking into account these facts, I attributed those plateaus to signals of the MgO melting. The melting temperatures carefully determined in our experiments are in good agreement with those of Zerr and Boehler (1994), implying that the melting curve of MgO intersects with that of $MgSiO_3$ perovskite at ~50 GPa.

詳細は当センターホームページ： http://www.ehime-u.ac.jp/~grc/をご覧ください
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