Geodynamics Seminar

第312回ジオダイナミクスセミナー

P-V-T equation of state of Ca-perovskite up to 60 GPa and 1900 K Elastic wave velocities of stishovite at high pressure and high temperature

Fulong Wang
(Ph.D. Student, GRC)

主催：愛媛大学地球深部ダイナミクス研究センター
日時：12/16（金）午後 4時30分～
場所：総合研究棟 4F 会議室

EHIME UNIVERSITY
GRC
GEODYNAMICS RESEARCH CENTER

Abstract
Mineral physics constraints on the composition of the Earth's lower mantle rely on knowledge of thermal equations of state of candidate minerals. Until recently, pressure-volume-temperature data have been obtained for (Mg,Fe)SiO_3 perovskite and mangesiowustite up to lower mantle conditions by using multianvil apparatus. But phases containing other major elements such as Ca have not been well studied. According to current estimates of the composition of the Earth, and MgO-FeO-SiO_2 system would account for about 90 % of the mantle volume, whereas including CaO and Al_2O_3 components may improve the coverage to 99 %. On the other hand, a number of experimental studies indicate that the most likely calcium-bearing phase is $CaSiO_3$ perovskite. But equations of state measurements of CaSiO3 perovskite are complicated by the instability of this material. Thus it is not possible to synthesize the sample in one experiment and conduct high pressure, high temperature measurements in another. *Wang et al*. [1996] have reported the thermoelastic properties of Ca-perovskite by using synchrotron X-ray diffraction with a cubic-anvil. However, the pressure conditions up to only 13 GPa, the limitied pressure range did not allow a complete determination of the thermal equation of state. In this study, a comprehensive P-V-T EOS of CaSiO3 has been obtained up to 60 GPa and 1900 K, using synchrotron X-ray diffraction by a multianvil apparatus, known as SPEED.MK-II with sintered diamond cube as second stage anvils. Analyses using MGD model yielded consistent results with Wang et al.[1996] for V0 = 45.579 (58), KT0 = 229(3) GPa, K′T0 = 4.8*, γ0 = 1.845(97), q = 2.15(47) and Θ0 = 637(227) K. These results are used to predict the bulk modulus and density of CaSiO3 perovskite under lower mantle conditions. along the geotherm, the density of the Ca-Pv agrees with that of the PREM within 1% through the lower mantle. The bulk modulus shows smaller pressure dependence along the adiabat; it matches that of PREM at the top of the lower mantle but is aobut 10 %.

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
問い合わせ先：桑山 靖弘（TEL:089-927-8408,e-mail:kuwayama@sci.ehime-u.ac.jp）