Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SIT004-16 Room:105 Time:May 25 17:30-18:00

Density profile of pyrolitic lower mantle

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Density profile of pyrolite at lower mantle high-pressure (P) and -temperature (T) conditions was investigated by using laser-heated diamond-anvil cell up to 117 GPa and 2800 K. The density was determined from chemical composition and unit-cell volume of each constituent mineral ($MgSiO_3$-rich perovskite, ferropericlase and $CaSiO_3$-rich perovskite). The chemical compositions of coexisting phases were analyzed by transmission electron microscope, and their volumes were obtained by in-situ X-ray diffraction measurements. To avoid extensive chemical segregation during laser-heating, sample was coated by gold that worked as a laser absorber (Sinmyo and Hirose 2010 PEPI). Results of chemical analyses show that Mg-Fe (total Fe) partitioning coefficient between $MgSiO_3$-rich perovskite and ferropericlase [$K* = (Fe*/Mg)_{Pv}/(Fe*/Mg)_{Fp}$] is about 0.6, slightly higher than the value previously reported in the pyrolitic bulk composition (Murakami et al. 2005). The lower $K*$ value in the previous study may be attributed to the chemical heterogeneity in the sample induced by strong temperature gradient during laser heating. The calculated density profile of pyrolite is indeed in good agreement with the PREM model within experimental errors, in contrast with the mismatch reported by the previous study (Ricolleau et al. 2009). Our results support the lower mantle has pyrolitic bulk composition, and thus it is not necessary to suppose the chemically stratification in the lower mantle.