Phase relation in pyrolite under lower mantle conditions and its implications for dynamincs of mantle plume

Norimasa Nishiyama[1], Takehiko Yagi[2]

[1] ISSP, Univ of Tokyo, [2] Inst. Solid State Phys, Univ. Tokyo

Phase relation in pyrolite at temperatures up to 2200 K was investigated by quench experiments using KAWAI-type apparatus whose second stage anvils are made of tungsten carbide and sintered diamond. We were able to obtain reliable chemical composition data of constituent minerals such as Fe and Al-bearing Mg-perovskite, magnesiowüstite, garnet and Ca-perovskite. An excellent positive correlation between Al and total Fe was found suggesting that Fe and Al enter the Mg-perovskite by coupled substitution to Mg and Si. We calculated chemical composition of Mg-perovskite when total cation number was fixed to 2. Calculated number of oxygens were smaller than 3 by about 0.015 suggesting the existence of considerable amount of oxygen vacancies in Fe and Al-bearing Mg-perovskite. Mineral proportions of constituent minerals in pyrolite were calculated based on the chemical composition data. Proportion of garnet increased with increasing temperature at 24 GPa. There was no temperature effect for the mineral proportions of pyrolite at 30 GPa. The mineral proportion change at the most upper part of the lower mantle might have considerable effect on the density of mantle plume.