American Mineralogist, Volume 93, pages 1678–1681, 2008

Letter

Iron partitioning between perovskite and post-perovskite: A transmission electron microscope study

Kei Hirose,[1,*] Naoto Takafuji,[1] Kiyoshi Fujino,[2] Sean R. Shieh,[3] and Thomas S. Duffy[4]

[1]Department of Earth and Planetary Sciences, Tokyo Institute of Technology, Meguro, Tokyo 152-8551, Japan
[2]Division of Earth and Planetary Sciences, Hokkaido University, Sapporo, Hokkaido 060-0810, Japan
[3]Department of Earth Sciences, University of Western Ontario, London, Ontario N6A 5B7, Canada
[4]Department of Geosciences, Princeton University, Princeton, New Jersey 08544, U.S.A.

Abstract

The effect of iron on the post-perovskite phase transition has been controversial. We have performed direct chemical analyses of co-existing perovskite and post-perovskite that were synthesized from an $(Mg_{0.91}Fe_{0.09})SiO_3$ bulk composition using a laser-heated diamond anvil cell at pressures above 100 GPa and temperatures of 1700–1800 K. Analysis on quenched samples was carried out using the transmission electron microscope (TEM). The results demonstrate that crystalline perovskite grains are enriched in iron compared to adjacent amorphous parts presumably converted from post-perovskite. This indicates that ferrous iron stabilizes perovskite to higher pressures. The ferrous and ferric irons are likely to have competing effects on the post-perovskite phase transition, and therefore the effect of iron may be controlled by aluminum.

Keywords: Perovskite, post-perovskite, iron partitioning, phase transition, D″ layer