American Mineralogist, Volume 99, pages 2374–2377, 2014

A new interpretation of decomposition products of serpentine under shock compression

Youjun Zhang[1], Toshimori Sekine[1,*] and Hongliang He[2]

[1]Department of Earth and Planetary Systems Science, Hiroshima University, Kagamiyama 1-3-1, Higashi-Hiroshima 739-8526, Japan
[2]National Key Laboratory of Shock Wave and Detonation Physics, Institute of Fluid Physics, China Academy of Engineering Physics, P.O. Box 919-111, Mianyang 621900, China

Abstract

Dense hydrous magnesium silicates (DHMSs) may play an important role in water transport during planetary accretion and as water reservoirs in the Earth's deep mantle. We show that the dynamic decomposition products of antigorite, $Mg_3Si_2O_5(OH)_4$, can be interpreted as containing the newly discovered, dense hydrous silicate, phase H ($MgSiO_4H_2$). The Hugoniot for phase H was calculated based on the Hugoniots for its constituent oxides and equation of state data derived from first-principles calculations. The measured antigorite Hugoniot, previously suggested to decompose into high-pressure phases without generating fluid H_2O, was compared with those derived from calculations involving phase H. Sound velocity data were also compared to confirm that the dynamic breakdown product of antigorite at pressures above ~40 GPa is most likely phase H plus MgO without formation of fluid H_2O.

Keywords: Dense hydrous magnesium silicates, phase H, high pressure, Hugoniot, decomposition, serpentine