Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SIT41-09 Room:302 Time:May 20 11:15-11:30

Sound velocities of laser-shocked iron alloys under Earth's core condition

SAKAIYA, Tatsuhiro[1*], KONDO, Tadashi[1], SHIGEMORI, Keisuke[2], KADONO, Toshihiko[2], Youichirou Hironaka[2]

[1]Graduate School of Science, Osaka Univ., [2]ILE, Osaka Univ.

When we consider the structure of the Earth's interior, the sound velocity is one of the important physical properties of the interior materials because it can be directly compared with the seismological data which can yield the physical properties of the Earth's interior. Although it needs to measure the sound velocity of the interior material under high pressure and temperature, the sound velocity measurement of the materials on the condition over 200 GPa and 4000 K, such as the Earth's core condition, is technically difficult in static compression technique (e.g. diamond anvil cell: DAC) (1-4). Therefore, in such higher pressure and temperature, dynamic compression technique, such as gas gun, is used. Although some works about the sound velocity of pure iron have been done by gas gun (5-7), it is not enough to discuss about the Earth's core which consists of iron alloy. Although Badro et al. (8) and Fiquet et al. (9) measured compressional sound velocity for some iron alloys (FeO, FeSi, FeS, FeS2, and Fe3C) at room temperature by inelastic x-ray scattering (IXS) at the DAC, the sound velocity data of liquid iron alloy is very few (10, 11).

We performed laser-shock experiments of liquid iron alloys at HIPER system of GXII laser in Institute of Laser Engineering, Osaka University (ILE) (12). We measured the sound velocities of iron alloys (Fe-Si, Fe-Ni-Si) under the Earth's core condition. The sound velocities were measured by side-on radiography (7). We will report the results of the sound velocity measurement for the laser-shocked iron alloys.

Part of this work was performed under the Joint Research of Institute of Laser Engineering, Osaka University.

References

1. H. K. Mao et al., Nature 396, 741 (1998).
2. H. K. Mao et al., Science 292, 914 (2001).
3. G. Fiquet et al., Science 291, 468 (2001).
4. J. F. Lin et al., Science 308, 1892 (2005).
5. J. M. Brown, R. G, McQueen, J. Geophys. Res., 91, 7485 (1986).
6. J. H. Nguyen, N.C., Holmes, Nature 427, 339 (2004).
7. K. Shigemori et al., Eur. Phys. J. D 44, 301 (2007).
8. J. Badro et al., Earth Planet. Sci. Lett. 254, 233 (2007).
9. G. Fiquet et al., Phys. Eartth Planet. Inter. 172, 125 (2009).
10. H. Huang et al., J. Geophys. Res. 115, B05207 (2010).
11. H. Huang et al., Nature 479, 513 (2011).
12. C. Yamanaka et al., Nucl. Fusion 27, 19 (1987).

Keywords: Sound velocity, Laser, Shock wave, FeSi, Earth's core, Experiment