Abstract Submitted
for the SHOCK05 Meeting of
The American Physical Society

High-pressure phase synthesis of iron using femtosecond laser-driven shock wave TOMOKAZU SANO, AKIO HIROSE, KOJIRO KOBAYASHI, Osaka University, OSAMI SAKATA, Japan Synchrotron Radiation Research Institute / SPring-8, YASUAKI OKANO, KATSUYA OGURI, HIDETOSHI NAKANO, NTT Basic Research Laboratories — The quenching of the high-pressure phase of iron, which has not been observed under a conventional shock compression, was attained using a femtosecond laser. The lower pressure and temperature alpha-iron (bcc) transforms at higher temperatures to the gamma-iron (fcc) and at higher pressures to the epsilon- iron (hcp). Crystalline structures in a recovered iron sample after the femtosecond laser (800 nm, 120 fs, 10^{13} - 10^{16} W/cm^2) irradiation were determined using the electron backscatter diffraction pattern, the electron diffraction, and the synchrotron X-ray diffraction methods. These results show the existence of the hcp structure and a small amount of the fcc structure in the recovered iron. The quenched hcp structure is found to be the high-pressure epsilon phase as a result of the temperature calculations during the shock-loading and shock-release process. The femtosecond laser driven shock wave may have the potential to quench high-pressure phases of other materials. [Ref. T. Sano et al., Appl. Phys. Lett. 83, 3498 (2003).]

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Date submitted: 04 Apr 2005 Electronic form version 1.4