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Femtosecond laser-driven shock synthesis of high-pressure phases of silicon MASASHI TSUJINO, TOMOKAZU SANO, AKIO HIROSE, Division of Materials and Manufacturing Science, Osaka University, NORIMASA OZAKI, RYOSUKE KODAMA, Division of Electrical, Electronic and Information Engineering, Osaka University, OSAMI SAKATA, Japan Synchrotron Radiation Research Institute / SPring-8, MASAYUKI OKOSHI, NARUMI INOUE, Department of Electrical and Electronic Engineering, National Defense Academy of Japan — High-pressure phases of silicon: SiII, SiXI, and SiV phases, which have never remained after pressure release with conventional compression methods, are synthesized using the femtosecond laser-driven shock wave. A femtosecond laser pulse is focused and irradiated on the single crystal silicon surface in air at the room temperature. We analyze the crystalline structures of the silicon with x-ray diffraction methods using synchrotron x-ray of SPring-8. Grazing incidence x-ray diffraction measurements show the evidence that SiII, SiXI, and SiV phases exist in the atmospheric pressure. Transmission x-ray diffraction measurements using micro x-ray for the cross section of the laser irradiated spot suggested the existence of SiVIII phase and that the particle size of the phase is around 180 nm. Many defects are observed and it is suggested that large residual stress is loaded to SiI: diamond structure with transmission electron microscopy.

Masashi Tsujino
Division of Materials and Manufacturing Science, Osaka University

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