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Transient Lattice Deformation in Laser-Irradiated Semiconductor Studied by Picosecond Time-Resolved X-ray Diffraction KAZUTAKA NAKAMURA, HIROAKI KISHIMURA, YOICHIRO HIRONAKA, KEN-ICHI KONDO, Tokyo Institute of Technolgy, TOSHIYUKI ATOH, Tohoku University — The transient lattice behavior of Si(111) single crystal under 300-ps laser irradiation has been studied by using picosecond time-resolved X-ray diffraction. When the laser is irradiated, the rocking curves of the laser-irradiated Si(111) have a higher-angle-shifted component due to lattice compression by laser ablation. The maximum lattice strain is estimated at 5.6 %, which is larger than the Hugoniot elastic limit for Si (111). After 1000 ps, a broadening of the main peak is observed. In addition, the rocking curve of the recovered sample is clearly broader than that of a pristine sample. Reciprocal space mapping for the recovered sample shows that the lattice spacing of the recovered sample does not change from that of the pristine sample, whereas lattice planes are misoriented. The results of the time-resolved measurement and the assessment of the recovered sample indicate that mosaic blocks with inclined orientations are induced by laer-driven elastic compression and the subsequent pressure release within 1000 ps, rather than plastic deformation.

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