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Magnetic field effects on ultrafast lattice compression dynamics of Si(111) crystal when excited by linearly-polarized femtosecond laser pulses KOJI HATANAKA, HIDEHO ODAKA, KIMITOSHI ONO, HIROSHI FUKUMURA, Tohoku University — Time-resolved X-ray diffraction measurements of Si (111) single crystal are performed when excited by linearly-polarized femtosecond laser pulses (780 nm, 260 fs, negatively-chirped, 1 kHz) under a magnetic field (0.47 T). Laser fluence on the sample surface is 40 mJ/cm^2, which is enough lower than the ablation threshold at 200 mJ/cm^2. Probing X-ray pulses of iron characteristic X-ray lines at 0.193604 and 0.193998 nm are generated by focusing femtosecond laser pulses onto audio-cassette tapes in air. Linearly-polarized femtosecond laser pulse irradiation onto Si(111) crystal surface induces transient lattice compression in the picosecond time range, which is confirmed by transient angle shift of X-ray diffraction to higher angles. Little difference of compression dynamics is observed when the laser polarization is changed from p to s-pol. without a magnetic field. On the other hand, under a magnetic field, the lattice compression dynamics changes when the laser is p-polarized which is vertical to the magnetic field vector. These results may be assigned to photo-carrier formation and energy-band distortion.

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