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Ultrafast coherent acoustic and optical phonon dynamics of amorphous $\text{Ge}_2\text{Sb}_2\text{Te}_5$ thin films MIN JU SHIN, DONG HAK KIM, DAEYOUNG LIM, Kyung Hee University — The coherent acoustic and optical phonon dynamics of $\text{Ge}_2\text{Sb}_2\text{Te}_5$ (GST) thin films are investigated by pump-probe spectroscopy. The transient reflectivity changes with oscillation period on the order of sub-picosecond and tens of picoseconds were observed. The longer oscillation with oscillation period and dephasing time on a time-scale of tens of picoseconds hasn't been reported previously and can be consistently explained by coherent acoustic phonon generation in the form of a strain pulse propagating into substrate. The shorter period oscillations correspond to coherent optical phonon A_1 mode by displacive excitation of coherent phonon mechanism. Its temperature dependent frequency shift was due to a three-phonon anharmonic decay, while its dephasing was dominated by temperature independent phonon-defect scattering. Laser fluence-dependent coherent optical phonon A_1 mode softening and a dephasing rate increase were observed and attributed to the high density electrons and accompanying lattice distortion as well as to the lattice heating.

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