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Electron-Hole Dynamics during the Formation of Warm Dense Copper[1] BYOUNG ICK CHO, Gwangju Institute of Science and Technology — The recent advent of the XFEL allowed us to follow ultrafast electron dynamics in the WDM. We used femtosecond pulses from the PAL-XFEL to measure the ultrafast changes in the X-ray absorption of Cu nanofoil excited by intense laser pulses. Upon exposure to laser irradiation, significant portions of 3d electrons are excited, and the strongly perturbed copper evolves into warm dense matter with temperatures of a few eV. We present the results of measurements of the X-ray absorption spectra below the copper L3 edge with 100 fs resolutions. The data visualize the creation and annihilation of holes in the highly excited 3d band. Comparison of the experiment with the predicted absorption based on the two-temperature-model enabled the initial nonequilibrium durations to be determined at a stage at which the TTM is non-applicable. This investigation allows us to quantify the lifetimes and the decay speed of d holes in warm dense copper. It raises an issue of the fast thermalization concept and the widely used two-temperature model to describe the nascent stage of intensively photoinduced material responses.

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