

Ultrafast measurement of non-equilibrium d-band electron dynamics in warm dense copper using an XFEL

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We present an ultrafast x-ray absorption spectroscopy measurement of warm dense copper plasma (WDCu) using PAL-XFEL in Korea. The non-equilibrium WDCu was created by isochorically heating free-standing copper foil (70 nm thick) with frequency doubled Ti:sapphire laser pulse. The WDCu was probed by time-resolved x-ray absorption spectroscopy technique with 100 fs temporal resolution. The unoccupied density of state at the upper edge and deeper part of Cu d-band (1 to 4 eV below the Fermi energy) were probed with 1 eV bandwidth XFEL pulse. The evolution of x-ray absorption demonstrates non-equilibrium behavior which is different from the two-temperature model (TTM). In particular < 1 ps, the strong deviation from TTM illustrates an interesting thermalization process of hot electrons in a non-equilibrium system.

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