

Dynamic Compression at Pohang X-ray Free Electron Laser Facility (PAL-XFEL)

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We have successfully commissioned dynamic compression studies at the Pohang X-ray Free Electron Laser facility (PAL-XFEL) in Korea by utilizing instrumentations at FXS (Femtosecond X-ray Scattering) –XSS (X-ray Scattering and Spectroscopy) beamline. As the first experiment, a polycrystalline iron foil has been illuminated by an 800 nm wavelength uncompressed optical laser with ~6 mJ in 150 ps pulse length, focused onto a 100 mm FWHM spot. The shock-compressed sample has then been probed by ca. 50 fs quasi-monochromatic (bandwidth 0.4%) X-ray pulse at an energy of ~10 keV with 10^{11} photons per pulse, focused to ca. 30 mm diameter using a CRL optics. The sample is positioned normal to the X-ray pulse at a distance of ca. 12 cm from a Rayonix mx225 detector in a way to cover 2 θ angles up to ca. 65 degrees. Single-shot diffraction measurements were performed with ca. 100 ps. increment up to one nanosecond. We demonstrate that PAL-XFEL can provide a unique opportunity in probing ultrafast lattice dynamics with sufficient spatial and temporal resolution in intermediate pressure regime.

Keywords: dynamic compression, laser shock, iron, X-ray free electron laser