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Transient x-ray diffraction with simultaneous imaging under high strain-rate loading DUAN FAN, SHENG-NIAN LUO, The Peac Institute of Multiscale Sciences, THE PEAC INSTITUTE OF MULTISCALE SCIENCES TEAM — Real time, in situ, multiframe, diffraction, and imaging measurements on bulk samples under high and ultrahigh strain-rate loading are highly desirable for micro- and mesoscale sciences. We present an experimental demonstration of multiframe transient x-ray diffraction (TXD) along with simultaneous imaging under high strain-rate loading at the Advanced Photon Source beamline 32ID. The feasibility study utilizes high strain-rate Hopkinson bar loading on a Mg alloy. The exposure time in TXD is 2–3 μs, and the frame interval is 26.7–62.5 μs. Various dynamic deformation mechanisms are revealed by TXD, including lattice expansion or compression, crystal plasticity, grain or lattice rotation, and likely grain refinement, as well as considerable anisotropy in deformation. Dynamic strain fields are mapped via x-ray digital image correlation, and are consistent with the diffraction measurements and loading histories.

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