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In-situ areal density measurement of the fragmentation of laser shock-melted metal using x-ray backlighting DONGBING LIU, JINMING CHENG, LIN ZHANG, YINGHUA LI, QINGGUO YANG, BOZHONG TAN, YAN YE, QIXIAN PENG, Institute of Fluid Physics, China Academy of Engineering Physics — The fragmentation of shock-melted material is an issue of great interest for both basic and applied science, and is suitable for experimental investigation by the laser-driven shock-loading technology. Here, we developed an in-situ laser-driven x-ray backlighting technique to image the fragmentation behavior of laser shock-melted aluminum and tin at the SG II and SG II upgrading high energy laser facility in China. To optimize spatial resolution, pinhole backlighting target and microwire backlighting target were utilized, respectively. The shape, size and internal details of dynamic fragment were obviously observed from the high-quality and high-resolution images which were compared with simultaneous laser ultrahigh speed shadowgraphs. In order to derive the areal density of the fragment accurately, a step wedge with certain thickness was mounted in the plane of the physical target. In addition, we proposed a light field calibration method based on neural network and Gaussian fitting algorithm to minimize the influence of x-ray field nonuniformity on density inversion. Finally, the areal density images of fragment under the different shock loading situations were obtained.

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