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Ballistic properties of debris produced by laser shock-induced micro-spallation of tin samples DIDIER LOISON, THIBAUT DE RESSEGUIER, ANDRE DRAGON, Institut P' - CNRS UPR 3346 - ISAE-ENSMA, DPMM TEAM — Dynamic fragmentation in the liquid state after melting under shock compression or upon release leads to the ejection of a cloud of droplets. This phenomenon, called micro-spallation, remains essentially unexplored in most metals. We present laser shock experiments performed on tin, to pressures ranging from about 60 to 220 GPa. Experimental diagnostics include skew Photonic Doppler Velocimetry (PDV) measurements of the droplets velocities, transverse observations of the expanding cloud of droplets, and soft recovery of ejecta within a low density gel. Optical microscopy of the gel reveals the presence of droplets which confirm shock-induced melting prior to fragmentation. To quantify size distribution of the debris, 3D X-ray micro-tomography has been performed at the ESRF synchrotron facility in France (similar to US Advanced Photon Source), where sub-micrometer resolution could be achieved. In this paper, the resulting velocity and size distributions are presented and compared with theoretical predictions based on a one-dimensional description accounting for laser shock loading, wave propagation, phase transformations, and fragmentation. Discrepancies between measured and calculated distributions are discussed. Finally, combining size and velocity data provides estimates of the ballistic properties of debris and their kinetic energy, which are key issues for anticipating the damage produced by their impacts on nearby equipments.

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