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Material ejection from surface defects in laser shock-loaded metallic foils.

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Ejecta production upon the breakout of a shock wave at a rough surface has been the subject of extensive research work for about six decades. For a few years, we have investigated how laser-driven shocks could provide original, complementary data on this issue, over specific ranges of high loading pressures, very short pulse durations (ns-order), small dimensions (tens of micrometers) and extremely high strain rates. Selected results will be shown in various metals (Cu, Sn, Al, Au), with either single triangular grooves of controlled depths and sharp angles or periodic, quasi-sinusoidal perturbations of different amplitudes and wavelengths. Experimental data will include (i) measurements of jet velocities using both optical shadowgraphy and Photonic Doppler Velocimetry, (ii) post-recovery evidence of the jetting process, (iii) attempts to evaluate ejecta size distributions using fast shadowgraphy or fragment recovery, and (iv) ultra-fast laser based x-ray radiography to estimate mass ejection. Results will be compared with the predictions of analytical models, numerical simulations, and data obtained by other teams from explosive-based experiments, over much larger temporal and spatial scales. Thus, both interest and limitations of laser shocks for this particular field of shock physics will be illustrated and discussed.

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