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The effect of microstructure on Rayleigh-Taylor instability growth in solids

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The effect that grain size and material processing have on high-strain rate deformation of copper and tantalum has been assessed through measurements of unstable Rayleigh-Taylor (RT) perturbation growth. The dynamic loading conditions and initial sinusoidal perturbations imposed on the samples are kept constant while the microstructure of the sample material is varied. Different polycrystalline grain-sizes, single-crystal orientations, and strain-hardened samples have all been dynamically tested. The RT perturbation growth is measured by acquiring a time-sequence of radiographs using the Los Alamos National Laboratory Proton Radiography (pRad) Facility. Single-crystal orientation and stain hardening due to material processing are both observed to affect the perturbation growth. However, polycrystalline grain size variations in both tantalum and copper samples do not influence the growth rate under the loading conditions investigated.

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