Abstract Submitted
for the SHOCK19 Meeting of
The American Physical Society

High-pressure Pb and Pb-4wt%Sb strength measurements at the National Ignition Facility[1] ANDREW KRYGIER, PHILIP POWELL, JIM MCNANEY, CHANNING HUNTINGTON, SHON PRISBREY, BRUCE REMINGTON, ROB RUDD, DAMIAN SWIFT, CHRIS WEHRENBERG, TOM ARSENLIS, HYE-SOOK PARK, Lawrence Livermore National Laboratory, PETER GRAHAM, ED GUMBRELL, MATT HILL, ANDREW COMLEY, STEVE ROTHMAN, Atomic Weapons Establishment — We study the high-pressure plastic flow behavior of Pb and Pb-4wt%Sb samples dynamically compressed to ˜400 GPa peak pressure using the National Ignition Facility lasers. These are the highest-pressure strength experiments ever reported. Our samples have pre-formed sinusoidal ripples that seed the Rayleigh-Taylor (RT) instability and the resulting ripple growth during ramp loading is sensitive to strength. We find that the measured ripple growth factors agree well with hydrodynamic simulations using the Improved Steinberg-Guinan model for high-pressure body-centered-cubic phase of Pb. The inferred peak flow stress for the phase transformed and pressured hardened Pb is ˜4 GPa, which is ˜250 times larger than its ambient strength. In contrast to antimonial lead at ambient conditions, we find that alloying has no measurable effect on the strength under high strain-rate dynamic compression. This suggests that alloy-hardening effects are dwarfed by strain-hardening under these conditions.

[1]This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

Andrew Krygier
Lawrence Livermore Natl Lab

Date submitted: 02 Mar 2019 Electronic form version 1.4