Abstract Submitted
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Shockless magnetic acceleration of Al flyer plates to ultra-high velocity using multi-megabar drive pressures[1] R.W. LEMKE, M.D. KNUDSON, D.E. BLISS, J-P. DAVIS, H.C. HARJES, S.A. SLUTZ, Sandia National Laboratories — The intense magnetic field generated in the 20 MA Z-machine is used to accelerate metallic flyer plates to high velocity for the purpose of generating strong shocks in equation of state experiments. We present results pertaining to experiments in which a 0.085 cm thick Al flyer plate is magnetically accelerated across a vacuum gap into a quartz target. Peak magnetic drive pressures up to 4.9 Mbar were produced, which yielded a record 34 km/s flyer velocity without destroying it by shock formation or Joule heating. Two-dimensional MHD simulation was used to optimize the magnetic drive pressure on the flyer surface, shape the current pulse to accelerate the flyer without shock formation (i.e., quasi-isentropically), and predict the flyer velocity. Shock pressures up to 11.5 Mbar were produced in quartz. Accurate measurements of the shock velocity indicate that a fraction of the flyer is at solid density when it arrives at the target. Comparison of measurements and simulation results yields a consistent picture of the flyer state at impact with the quartz target.

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