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Bounds on the Rate Dependent Plastic Flow of Tantalum up to 75 GPa[1] BRYAN REED, REED PATTERSON, MUKUL KUMAR, Lawrence Livermore National Laboratory — We report improvements in a general thermodynamics-based velocimetry analysis method designed to extract strength and plastic-flow information from shock and ramp compression experiments. The method allows extraction of thermodynamic histories, including deviatoric stress and plastic strain, including nonsteady rate-dependent features. The improved method includes free-surface corrections for pullback waves, reduced noise sensitivity, and application to pressures of 75 GPa and higher. Specifically, we show results for shock waves in tantalum, including bounds on the plastic flow behavior at strain rates exceeding 1e7/s.The deviatoric stress appears to be almost entirely dependent on strain rate, with very little pressure dependence.The deviatoric stress in the post-shock plateau state appears to be very small at higher pressures, calling into question the value of considering strength as a steady- state pressure-dependent quantity.

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