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On the residual yield stress of shocked metals DAVID CHAPMAN, DANIEL EAKINS, Institute of Shock Physics, Imperial College London, London, SW7 2AZ, United Kingdom, ANDREY SAVINYKH, GENNADY GARKUSHIN, Institute of Problems of Chemical Physics of Russian Academy of Sciences, Chernogolovka, 142432 Russia, GENNADY KANEL, Joint Institute for High Temperatures of Russian Academy of Sciences, Izhorskaya 13, Moscow, 125412 Russia, SERGEY RAZORENOV, Institute of Problems of Chemical Physics of Russian Academy of Sciences, Chernogolovka, 142432 Russia — The measurement of the free-surface velocity is commonly employed in planar shock-compression experiments. It is known that the peak free-surface velocity of a shocked elastic-plastic material should be slightly less than twice the particle velocity behind shock front; this difference being proportional to the yield stress. Precise measurement of the free-surface velocity can be a rich source of information on the effects of time and strain on material hardening or softening. With this objective, we performed comparative measurements of the free-surface velocity of shock loaded aluminium AD1 and magnesium alloy Ma2 samples of various thicknesses in the range 0.2mm to 5mm. We observed the expected hysteresis in the elastic-plastic compression-unloading cycle for both AD1 and Ma2; where qualitatively the peak free-surface velocity increased with increasing specimen thickness. However, the relative change in magnitude of hysteresis as function of specimen thickness observed for the Ma2 alloy was smaller than expected given the large observed change in precursor magnitude. We propose that softening due to multiplication of dislocations is relatively large in Ma2 and results in a smaller hysteresis in the elastic-plastic cycle.

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