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Measurements of a Strength of Metals in a Picosecond Time Range SERGEY ASHITKOV, PAVEL KOMAROV, MIKHAIL AGRANAT, GENNADY KANEL, VLADIMIR FORTOV, Joint Institute for High Temperatures of Russian Academy of Sciences — We studied the shock-wave phenomena in metal films of a micron or submicron thickness irradiated by femtosecond laser pulses. The single-shot interferometer technique was used to record the time and spatial resolved displacements of both the frontal and rear surfaces of the films. The free surface displacement histories were converted into the free surface velocity histories using several various approaches. As a result, new data on the HEL and spall strength values have been obtained for aluminum, iron, nickel and other metals in strongly metastable states close to ultimate shear and tensile stresses. Comparison of measured parameters of elastic shock waves with the data of plate impact experiments at larger sample thicknesses demonstrate different regimes of the decay: whereas for pure fcc metals the decay may be described by one power function over 1 μm to 10 mm range of the distances, in the case of bcc iron main decay occurs obviously at the distance of order of 50 μm. The data are discussed from the view point of main mechanisms of high-rate deformation and fracture.

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