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Study of Materials at High Negative Pressures Using Picosecond Laser Pulses I.K. KRASYUK, S.A. ABROSIMOV, A.P. BAZHULIN, P.P. PASHININ, A. YU. SEMENOV, I.A. STUCHEBRYUKHOV, V.V. VORONOV, GPI RAS, Moscow, Russia, K.V. KHISHCHENKO, JIHT RAS, Moscow, Russia — In the present work, the dynamic strength of Al, Pb, Cu, and Ta was studied by the method of generation of shock waves under the action of laser pulses of 70 ps duration. The use of such short pulse make it possible to realize in the experiments strain rates exceeding 10^7 s^{-1}. We have used an approach that is based on both the measurement of the spallation depth after the laser-pulse action on the target and the subsequent numerical simulation of the shock-wave process in the matter under study. The obtained data show that, at moderate amplitudes of shock loading, spall strength values are in a good agreement with the known functional dependencies of the strength upon the rate of deformation. With greater loading pressure, a sharp growth of spall strength, that indicates the strengthening of the material as a result of loading, takes place. The registered growth of spall strength of the metals is connected with the fact that, in the experiments, the increase of the rate of deformation was achieved not only by shortening of the pulse duration, but also by the increase of the amplitude of loading. The latter increase leads to hardening of the material under study. In this case, defects, which cause the premature spallation of the material, may be disappeared.

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