SPECIFIC FEATURES OF RICHTMYER-MESHKOV INSTABILITY GROWTH WITH 2D AND 3D INITIAL PERTURBATION GEOMETRY

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According to classical concepts of Richtmyer-Meshkov instability growth mechanism [1, 2], 3D initial perturbations in material without strength should always grow faster than 2D perturbations, if their initial amplitudes and wavelengths are identical. In order to test this statement for condensed materials, a series of experiments with essentially different intensities of shock waves produced in samples was conducted. Perturbation growth was studied on shock arrival at a free surface of a condensed material with deterministic 2D and 3D initial perturbations of different profiles. In one of the experimental approaches, the shock in the sample was produced by a charge of condensed HE, the amplitude of pressure at the shock front in the sample of interest (lead) was ~400 kbar, which caused melting of metal sample. The resulting perturbations were recorded using pulsed radiography. In the second experiment, the shock was produced in a sample of water solution of gelatin or wet clay using a specially developed two-piston shock tube. Shock intensity in this case was ~0.5kbar; perturbations were recorded using a streak camera.

It was proven experimentally that in the hydrodynamic approximation (experiments with leak) the growth rate of 2D and 3D perturbations are the same. In case of rather weak shock waves, it was found that growth rate of 3D initial perturbations depends on their concrete profile and it is possible that perturbation of some profiles will not grow at all. We suppose that this can be attributed to stabilizing effects of dissipative properties of material samples.

Numerical simulations of experiments were performed using LEGAK code [3]. It was demonstrated that the experimental data can be reproduced if for the experiments with weak shock waves the liquid is assumed incompressible (speed of sound $c_0 \to \infty$). The results are analyzed theoretically. It is shown that perturbation growth in the case of interest resembles the process of shaped charge jet formation [4].

The work has been funded in part by RFFI (Project 08-01-00807)