STREAMS OF JETS UNDER IMPACT ACTION ON PLATES OF STRUCTURAL MATERIALS FORMING A STEPPED JOINT

V. P. Khalemenchuk[1], K. A. Ten[1], E. R. Pruuel[1], A. O. Kashkarov[1], A. M. Asylkaev[1, 5], A. S. Tumanik[1, 5], I. A. Rubtsov[1, 2], L. I. Shechtman[3], A. A. Glushak[3], B. P. Tolochko[4]

[1]Lavrentyev Institute of Hydrodynamics of SB RAS, Novosibirsk, Russia

[2]Center for Collective Use "Siberian Ring Photon Source", Koltsovo, Russia

[3]Budkera Institute of Nuclear Physics SB RAS, Novosibirsk, Russia

[4]Institute of Solid-State Chemistry and Mechanochemistry SB RAS, Novosibirsk, Russia

[5]Novosibirsk State University, Novosibirsk, Russia

When a strong shock wave (SW) with an intensity of ~40 GPa is applied to the joints of metal structures, jets (streams) of microparticles are ejected from them [1–2]. The formation of streams is associated with the development of micro-perturbations (instabilities) on the free surface (FS) of the substance. The development of the process of instability growth on the FS of the metal and, accordingly, the characteristics of the jet streams depend on the loading conditions, the phase state of the material, the surface roughness, etc.

In the work [1] the flows of microparticles from a "straight" joint of metal disks were investigated. The registration of the X-ray shadow was carried out along the movement of the jet. This setup allowed us to establish the fact of the presence of a jet and measure the speed of the jet for different materials. This work is a continuation of this topic. A more complex joint shape (fig. 1) (of the "step" type) is investigated and a lateral scheme of recording the X-ray shadow is used. This registration scheme allows us to determine the shape of the jet and its mass characteristics. In addition, it was possible to determine the flow of particles from the opposite side (lower) of the disk surface.

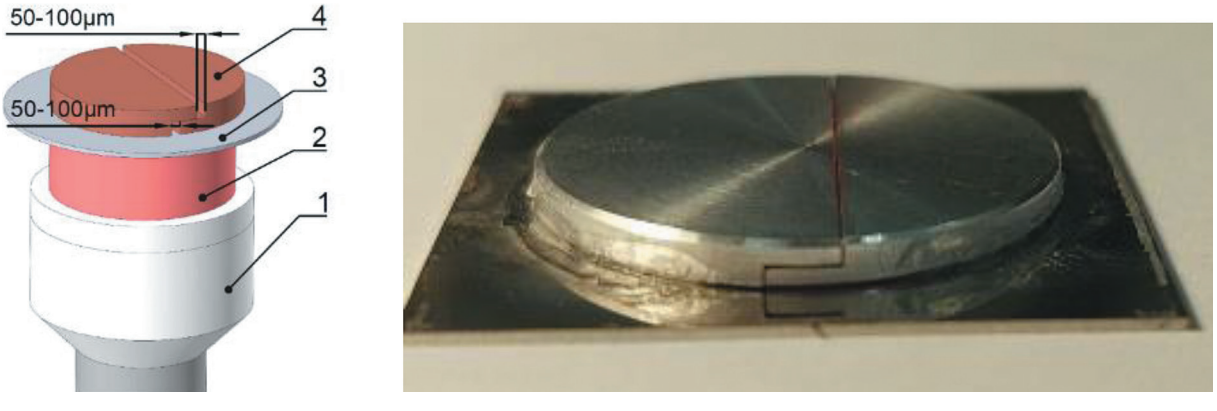

Fig. 1. Diagram of the structural joint under study.

1 – Plane shock wave generator; *2* – HE charge; *3* – cut off; *4* – disk with a structural "step" joint

The study of particle emission was carried out at the Submicrosecond Diagnostics station of the VEPP-3 accelerator complex of the INP SB RAS using the method of pulsed radiography with synchrotron radiation with an energy of 2 GeV and a pulse duration of 1 ns. The registration of the X-ray shadow was carried out by a single-coordinate DIMEX detector recording 100 frames with a time interval between frames of 124 ns [3].

X-ray experiments were conducted to measure the mass distribution of micro-jets formed from structural joints of the "step" type of plates made of M1 copper, D16T aluminum alloy (fig. 2) and O1 grade tin under shock wave loading.

The jets are recorded from the upper and lower surfaces of the disks. The dynamics of the flows of both jets are obtained. The accuracy of measuring the linear density distribution is 1 mg/cm^2.

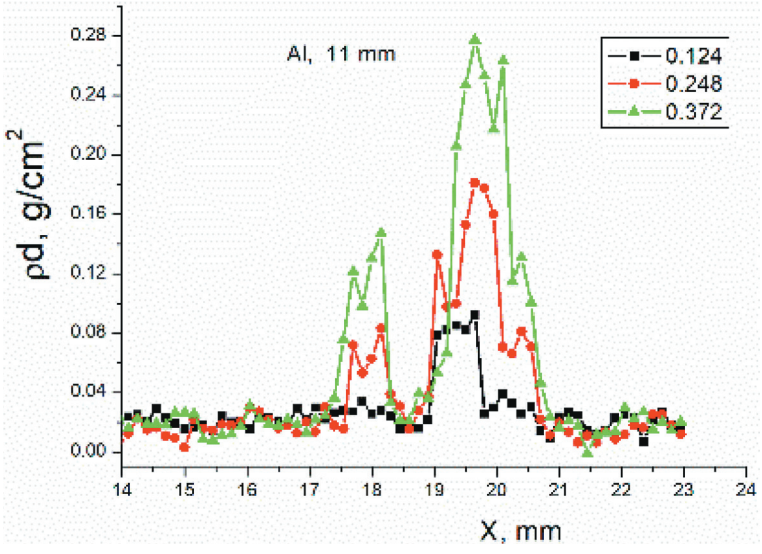

Fig. 2. Dynamics of the linear density of two jets from the "step" joint for aluminum plates. The left jet comes from the lower plate. The time between frames is 124 ns

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