STUDIES OF DYNAMIC ISENTROPIC COMPRESSION OF MATERIALS USING A SMALL-CLASS DISC EXPLOSIVE MAGNETIC GENERATOR

E. V. Shapovalov, V. K. Baranov, A. M. Buyko, S. F. Garanin, A. M. Glybin, A. G. Golubinskiy, P. N. Guskov, A. A. Zimenkov, A. V. Ivanovskiy, D. A. Irinichev, V. A. Karepov, K. N. Klimushkin, V. B. Kudelkin, S. D. Kuznetsov, V. I. Mamyshev, S. M. Polyushko, Z. S. Tsibikov

FSUE «RFNC – VNIIEF», Sarov, Russia

Experiments [1] at Z-machine (USA) to investigate dynamic isentropic compression of materials are discussed. It is shown that from the pressure of ~10 Mbar realized on the investigated sample the diagnosable velocity of the inner surface of the liner is sensitive to pressure up to ~4 Mbar. This pressure and limits the investigated range of material compression.

The results of the first experiments with a small-class disk explosive magnetic generator (DEMG) are presented [2]. A unique multichannel fiber-optic velocimeter based on 0.125 mm diameter gradan collimators, manufactured by RFNC – VNIIEF, was developed for these experiments. It allows recording the velocity of the inner surface of a converging cylindrical liner down to a radius of 0.25 mm through six channels in one, two planes.

In experiments with a two-layer Al-Cu liner with a radius of the inner surface of the studied copper of 7.65 mm, it is shown that the recovery of the compression curve with a percentage error in pressure is possible at micron precision of the liner system fabrication. The compression curve was obtained at pressures ~0.7 Mbar.

It is shown that the capabilities of small-class DEMGs allow to recover the compression curve of copper up to 3.5 Mbar at dynamic compression of a double-layer liner with an internal radius of ~2.4 mm. The results of the experiment on isentropic compression of such a liner by a small-class DEMG current are presented.

References

1. **Lemke, R. W.** Probing off-Hugoniot states in Ta, Cu, and Al to 1000 GPa compression with magnetically driven liner implosions [Text] / R. W. Lemke, D. H. Dolan, D. G. Dalton, et al. // Journal of Applied Physics. – 2016. – Vol. 119. – P. 015904.

2. **Duday, P. V.** Disc Explosive Magnetic Generators of a New Generation [Text] : reports of the Russian Academy of Sciences. Physics. Technical Sciences / P. V. Duday, A. A. Zimenkov, A. V. Ivanovskiy et al. – 2021. – Vol. 498. – P. 7–10.