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Laser shock tube. Research & development.

Ivan Lebo[1,2] & Vladimir Zvorykin[2]

1. Department of Cybernetics,
Technical University-MIREA, Moscow, Russia
lebo@mirea.ru

2. Lebedev Physical Institute of RAS,
Moscow, Russia
zvorykin@sci.lebedev.ru

Abstract.

A concept of laser-driven shock tube (LDST) is developed. (Zvorykin (2000)). Research & Development of LDST, selection of necessary sizes and materials has been performed, different diagnostic methods are developed and tested.

The experimental and numerical investigations (using 2D "ATLANT_C-code (Iskakov (]) of shock wave propagation in air (the initial pressure being within 0.1-2 bar) were made using KrF-laser GARPUN (Zvorykin (1999)) for the irradiation of targets made of different materials (Al, polyethylene, iron etc.). Good agreement between the calculated and experimental data was reached. It was shown that the shock wave velocity is defined mainly by the laser intensity and initial pressure of the surrounding atmosphere, and weakly depends on the target material.

The experimental study and numerical modelling of thin polymer film acceleration were made. The maximum velocities about 4 km/s were reached. The good agreement of the calculated and experimental data was obtained.

The development of hydrodynamic instabilities at the contact boundary "film-erosion plasma" and "film rear side-compressed air" were experimentally studied. The initial perturbations were given with the help of a metal grid placed between the laser and the film. We obtained dynamic characteristics of broadening of a matter cluster formed after passing of a SW through the film and the development of jets. It should be noted that at later time moments the jets came in front of enveloping SW.

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References

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