The sound velocity in expanded liquid lead

Kondratyev A M[@] and Rakhel A D

Joint Institute for High Temperatures of the Russian Academy of Sciences, Izhorskaya 13 Bldg 2, Moscow 125412, Russia

[@] cpl593h@mail.ru

We are developing an experimental technique for measuring the sound velocity in expanded liquid metals at high temperatures (5–30 kK) and pressures (0.3–5.0 GPa). The study of thermophysical properties of metals in this region of states became possible thanks to the dynamic method [1]. A need in the measurements of the sound velocity for the region of states indicated above is that there are no experimental data to be compared with our results [1].
Recently, we have presented the developed by us method for measuring the velocity of sound [2], as well as the preliminary results obtained for liquid lead [3]. Comparison of our results on the velocity of sound of liquid lead for the densities 1.5–2 times lower than the normal value with literature data has shown that our values are 10–20% larger than the literature ones. We have found that this discrepancy is because the "acoustic" disturbances generated in our experiments (which can be detected reliably by the interferometer technique [3]), turns out to be not sufficiently weak and lead to an increase in the density by 10% and more (such disturbances are shock waves). In the present work we show the pressure and mass velocity behind these shock waves can be measured and the Hugoniot adiabatic of expanded liquid lead in the D-u plane (shock wave velocity-particle velocity) can be determined. From this adiabatic the value of D in the limit $u = 0$, i.e., the sound velocity, can be obtained.

[1] Kondratyev A M, Korobenko V N and Rakhel A D 2018 *J. Exp. Theor. Phys.* **127** 1074

[2] Kaptilniy A G, Kondratyev A M, Plenev A E and D R A 2018 *Vestnik Obedinennogo Instituta Vysokih Temperatur* **127** 36

[3] Kondratyev A M and Rakhel A D 2020 *XXXV International Conference on Interaction of Intense Energy Fluxes with Matter, Elbrus, Kabardino-Balkaria, Russia, March 1–6 2020*