Sound Velocity Measurements in Shocked Metals such as Ta, Mo, Cu, and Zn

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The result of measurements of longitudinal, C_L, and bulk, C_B, sound velocities are presented for shocked high-purity reference metals such as high-purity tantalum (according to TU 95 234-80), pure molybdenum (according to TU48-19-247-93), copper M1 (according to GOST1535-2016), and zinc Ts0 (according to GOST1180-2021) within the range of pressures 20...380 GPa obtained by the photoelectric method [1], [2]. A brief description of the principle of operation of the method, the setup, and the results of the experiment implementing the rarefaction overtaking technique is provided.
The general dependencies (Berch law) of the sound velocity on density behind the shock front in the solid phase are established, additionally including those in the liquid phase for Zn:
Ta: C_L [km/s] = $0.274\rho[g/cm^3]$ – 0.465 ($11 \leq \sigma_{xx} \leq 272 GPa$).
Mo :C$_L$ [km/s] = $0.521\rho[g/cm^3]$ + 1.494 ($97 \leq \sigma_{xx} \leq 381 GPa$).
Cu :C$_L$ [km/s] = $0.813\rho[g/cm^3]$ – 2.384 ($11 \leq_{xx} \leq 237 GPa$).
Zn :C$_L$ [km/s] = $0.781\rho[g/cm^3]$ – 1.491 ($49 \leq \sigma_{xx} \leq 93 GPa$).
C$_B$ [km/s] = 1.509 $\rho[g/cm^3]$ – 10.239 ($133 \leq \sigma_{xx} \leq 187 GPa$).

[1] McQueen R G, Hopson J W and Frtz L N 1982 *Rev. Sci. Instr.* **53**(2) 245–250
[2] Kozlov E, Pankratov D, Tkachev O and Yakunin A 2012 *Measurement of sound velocities in 12Kh18N10T austenitic steel in the range of longitudinal stress up to 200 GPa for calibration of elastic-plastic models* (Kiev, Ukraine, September 17-21: SWCM-2012)