Photon Doppler velocimetry of ejecta from shock-loaded samples
ARSENIY KONDRATYEV, A. ANDRIYASH, S. KURATOV, D. ROGOZKIN, Dukhov Research Institute of Automatics (VNIIA), M. ASTASHKIN, V. BARANOV, A. GOLUBINSKII, D. IRINICHEV, V. MAZANOV, S. STEPUSHKIN, V. KHATUNKIN, Russian Federal Nuclear Center - All-Russia Research Institute of Experimental Physics — The report addresses the problem of recovering the ejecta parameters from PDV data. The results of PDV-measurements of ejecta production from shock-loaded Pb samples are presented. Shockwaves were generated by a flyer-plate accelerated up to 3 km/s. Depending on the sample thickness, the shock-breakout pressure varied from 23 to 45 GPa. The ejecta transport occurred in air. Spectral profile \( E(\omega) \) of heterodyne beats underlies our analysis of the experiments. Under the assumption that ejected particles are disordered, the profile square \( |E(\omega)|^2 \) is subject to the transport equation which accounts for multiple scattering and absorption of the probing beam in the ejecta cloud. We solve the transport equation with the discrete-ordinate code. Adjusting the free surface velocity, the optical thickness and the parameters of the velocity distribution of the ejecta scattering coefficient, we gain a good fit of the calculated profile to the PDV-measured one. Such an approach enables us, based on the ejecta optical model, to recover the areal density and the density-velocity distribution from PDV data, e.g., to determine how this distribution changes in time due to the particle slowing-down in air.

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