

Study of homogenization processes of microstructure low-density materials

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The results of experiments on determining the time of homogenization of low-density heterogeneous materials under their irradiation with pulsed laser radiation are presented. The time of homogenization was conditioned by the beginning of a macroscopic movement of material, which was fixed due to the change in the pattern of radiation scattered by the heterogeneous material. In the studies, the laser radiation with a pulse shape in the form of a trapezoid with a half-height duration of 2.3–3.9 ns, a front and a cutoff with a duration of about 2.2–3.9 and 1–1.5 ns was used. The irradiation intensity varied from 1.1×10^{12} to 1.7×10^{13} W/cm². In the experiments the materials with the density of 16 and 33 mg/cm³ were used. Radiation reflected from the target into the aperture of the focusing objective and outside it, at angles up to 30°, was diagnosed. A streak camera was used, which recorded the parameters of scattered radiation with spatial and temporal resolution. The main stages of the homogenization process were determined. They include the stage of ionization of the structural porous elements, the movement of plasma between the structural elements and the macroscopic movement of plasma of the material as a whole. In the experiments with the low-density heterogeneous materials, up to intensity of 3.8 TW/cm², no macroscopic motion of the plasma was detected. The homogenization time was determined only for the pulse with an intensity of 11.7 TW/cm², it was approximately 2.5 ns.