

Absorption Flash in Laser Evaporation of Oxide Materials

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The sharp absorption of laser radiation effect during the heating of oxide ceramic materials by continuous laser radiation at a moderate power density has been experimentally found. The phenomenon was manifested as a sharp temperature drop of an irradiated sample surface. Absorption flash was theoretically predicted in [1]. They showed that the absorption flash arose due to a formation of erosive plasma near a sample under powerful laser radiation. A difference between the predicted effect and the phenomenon detected in our experiments, is that the absorption flash in our experiments was observed in the regime of molecular evaporation without a formation of erosive plasma. Our experiments show that the effect of absorption flash is caused by the shutter effect of the condensate droplets arising due to threshold condensation of the supercooled vapor near the target in an atmosphere of inert gas. It has been shown that the homogeneous vapor condensation in the electromagnetic field of laser radiation differs from the classical vapor condensation. The condensate droplets actively interact with the laser radiation. The sizes of the droplets are limited due to laser evaporation. Avalanche growth of a number of the droplets with certain sizes, determined by the power of the laser radiation, takes place at the homogeneous vapor condensation point in the electromagnetic field of laser radiation. Threshold formation of a number of the condensate particles above the sample leads to the absorption flash. Applied aspects of the discovered phenomenon, for its use in the production of nanopowders of refractory oxides, are discussed.

[1] G.G. Vilenskaya and I.V. Nemchinov, *Reports of Academy of Sciences* **186**, 1048 (1969).