Laser ablation of a multilayer target with layers of nanometer thickness

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Multilayer products made of ultra-thin layers are widely used in modern science and technology. Laser exposure is used as one of the promising methods of processing such products. In this work, we study the ablation of a multilayer target of alternating layers of nickel and aluminum.

A physical model is constructed, numerical simulation is performed, and experiments are carried out. The experiences are unique. Firstly, the reflection coefficient is measured. Secondly, the experiments were conducted in parallel with two different lasers with different diameters of the focusing spot.

The first (when the laser radiation intensity increases from zero) breakdown occurs in the thickness of the first nickel layer, the second near the boundary of this layer and the first layer of aluminum.

The threshold and depth of the first break obtained as a result of numerical (hydrodynamic) modeling correspond to experimental results with an accuracy of about 10%

This allowed us to refine the model of two-temperature states and determine the strength of nickel. It is explained why, with an increase in the absorbed fluence, first the upper layer breaks in the multilayer.