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FEMTOSECOND LASER MARKING OF GLASS AMPOULE PRODUCTS

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Modern methods for identifying the authenticity of medical ampoule products require a high level of protection for labeled products. Classical marking methods are not able to fully protect products, since they are relatively easy to counterfeit.

A promising method for marking thin-walled transparent ampoules is the formation of structures in the bulk of the material by means of laser radiation, which have specified spectral and optical characteristics. The action of laser radiation on a transparent medium lead to its modification and a local change in the refractive index, which can be used for problems of volumetric information coding.

To test the presented technique for recording information in the volume of optical materials, a femtosecond laser microprocessing complex was developed, which is a set of hardware switched by means of cable electrical and fiber-optic communication channels. For the layer-by-layer formation of a topological pattern of structures, a software module was developed that allows you to set the parameters of sample processing and generate an executable command code for the technological complex.

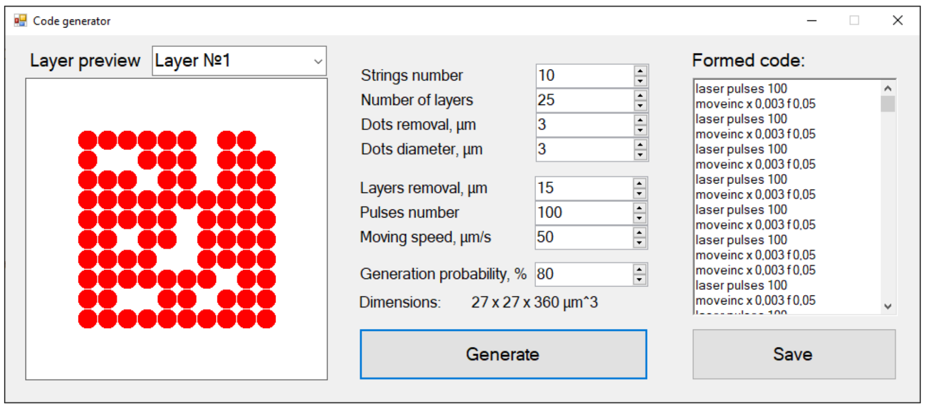

Fig. 1. Interface of the module designed to form the optical structures topology.

Such a processing procedure implies the successive impact of femtosecond laser pulses trains on a given section of a transparent solid medium, followed by a shift in the X-Y plane, or along the Z axis (Fig. 2). Layer-by-layer recording of structures is carried out from bottom to top (from the volume of the sample to the surface).

Structures were recorded using a 100X microobjective with a numerical aperture of 0.72. The average laser radiation power was 4 mW. The formed structures are a hollow spherical region in the volume of quartz glass. The minimum size of the generated dots can reach 0.8 µm, depending on the laser radiation power.

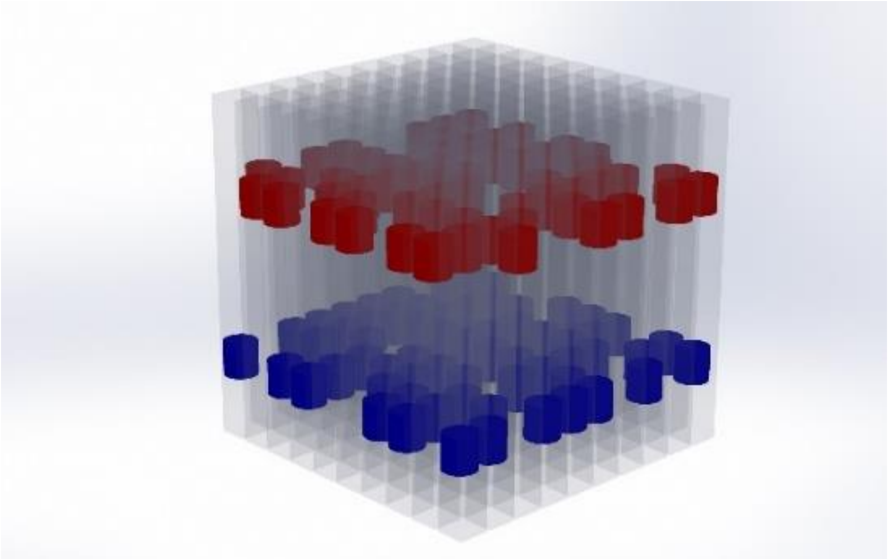

Fig. 2. Multilayer recording model in the material volume.

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