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STRUCTURAL AND PHASE CHANGES IN HIGH-TEMPERATURE SUPERCONDUCTING CERAMICS DUE TO LASER RADIATION

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The present paper deals with investigation of the mechanism of changing a phase composition and a surface structure of targets made of high-temperature superconducting Y-Ba-Cu-O-base ceramics after impulse laser annealing ($\tau = 1-6 \mu\text{s}$ and 25 ns , $\lambda = 1.06$ and $0.7 \mu\text{m}$). A density of radiation power, q , varied from 10^4 to $10^8 \text{ W}\cdot\text{cm}^{-2}$. Bearing in mind that at high temperatures thermochemical and thermodiffusional processes proceed at a target surface, air, oxygen and liquid nitrogen were taken as chemically active surrounding media. As samples, use was made of superconducting tablets moulded from the powder $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ manufactured according to the sol-gel fabrication route or by a solid-phase synthesis and of the powder-base films deposited onto alumina ceramic substrates by a stenciling technique. A transition temperature of samples to a superconducting state found by a change in their magnetic susceptibility depended on the method of manufacturing the original material and was equal to 85 K (the sol-gel technique) and to 97 K (the solid-phase synthesis). A phase composition and a surface structure of targets before and after laser radiation were studied by the X-ray diffraction method and metallographic examination. A spectral composition of plasma jets above a plasma action zone was examined by a quartz spectrograph.

Laser annealing allowed in some cases the improvement of surface quality, pore curing and stabilization of a high-temperature superconducting phase.