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

A. Stepanenko, A. Alifanov, N. Rumak, T. Khatko, A. Tomchenko, V. Khatko

JOURNAL DE PHYSIQUE IV
Colloque C7, supplément au Journal de Physique III, Vol. 1, décembre 1991

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

A.V. STEPANENKO, A.V. ALIFANOV, N.V. RUMAK, T.N. KHATKO, A.A. TOMCHENKO and V.V. KHATKO

Physical and Engineering Institute of Academy of Sciences of the BSSR, Zhodinskaya 4, Minsk SU 220730, USSR

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 (τ = 1-6 μs and 25 ns, λ =1.06 and 0.7 μm). A density of radiation power, q, varied from 10^4 to 10^8 $W \cdot cm^{-2}$. 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 $YBa_2Cu_3O_{7-x}$ 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.