EXPERIMENTAL STUDY OF LASER TREATMENT OF Ti_3AlC_2 MAX PHASE*

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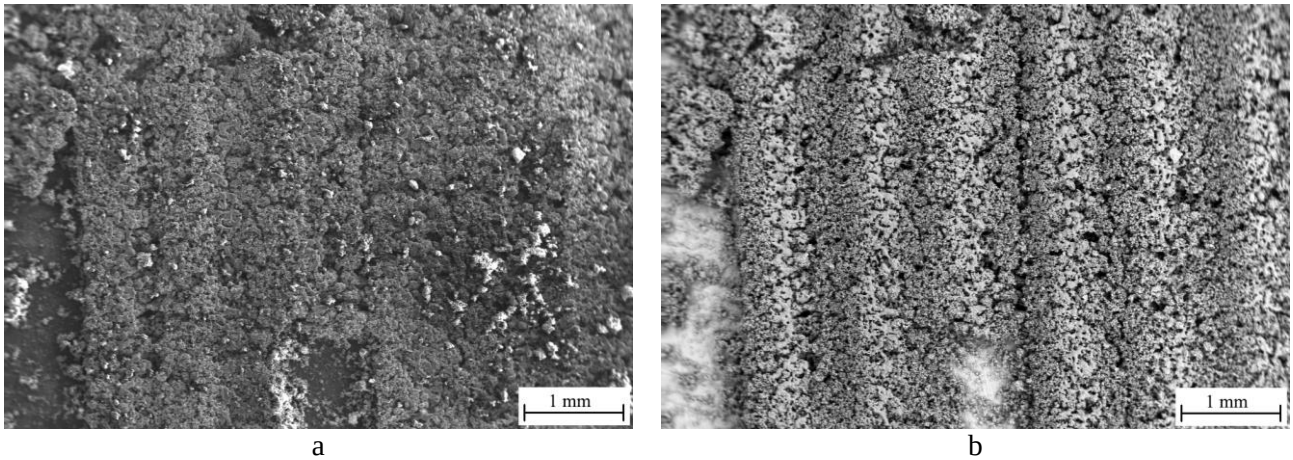
Ternary carbides and nitrides, called MAX phases, form a new class of materials that has very specific properties, combining the properties of both metals and ceramics [1]. Some of the most promising MAX phases are formed in the Ti-Al-C system. The materials of this system can be used as materials with high strength and deformation resistance, including cyclic loadings [2]. The chemical etching of aluminum in MAX phases forms the so-called MXenes, which, due to their nanolaminate structure, can be used for storing electric energy or hydrogen [3, 4].

Bulk samples from the powder of the MAX phase Ti_3AlC_2 were obtained by selective laser sintering (SLS). A comprehensive structural-phase study was carried out using optical and electron microscopy techniques, as well as XRD and EDX analysis. This study allowed to describe the elemental and phase composition, as well as the morphology of both the initial powders and bulk SLS samples. Modes of selective laser sintering are established at which the maximum presence of the MAX phase in the samples after SLS is observed.

It was found that at a laser power of 60 W and a scanning speed of at least 100 mm/s, the maximum appearance of the MAX phase in the samples after SLS is observed.

The laser scanning speed affects the sintering of the powder between the tracks and between the layers, so it must be varied simultaneously with the distance between the tracks and the thickness of the bulk powder layer.

In the center of the laser beam, the maximum destruction of the MAX phase with the formation of titanium carbide is observed (Fig. 1). The highest recorded content of the MAX phase of Ti_3AlC_2 in the sintered layer is 95%.



a b

Fig.1. Surface of Ti_3AlC_2 powder after laser treatment at 60 W using SE (a) and BSD (b) detectors.

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* The reported study was funded by RFBR and Tomsk region according to the research project № 19-48-703011.