STUDY OF THE MICROSTRUCTURE OF SYNTHESIZED LAMINATES*

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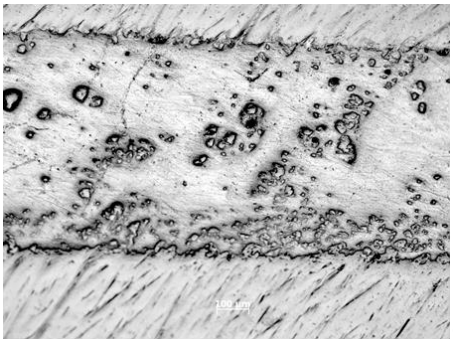
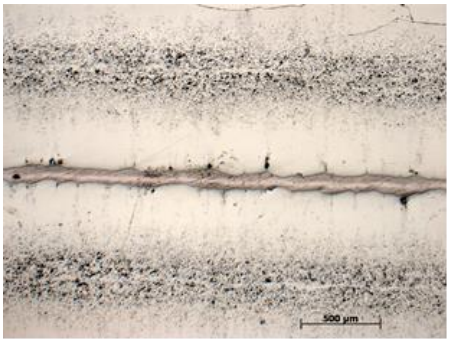
Advanced structural and multifunctional materials include metal-intermetallic laminates (MIL) [1], which have useful properties and characteristics, such as high temperature resistance, high oxidation resistance, good creep resistance and others, making them attractive for use in many industry fields. The study of diffusion processes, the formation of intermetallic layers, and the study of the microstructure of synthesized composites play an important role to obtain such materials.

This work is devoted to microstructural studies of metal - intermetallic laminates Ti-Al_3Ti obtained by several methods [2, 3].

Titanium (VT1-0) and aluminum (8011) foils with a thickness of 0.3 and 0.15 mm, titanium (0.5 and 0.6 mm) and aluminum (1 mm) plates (the same grades), titanium powders, and aluminum (ASD-4) were used in the experiments. A titanium–titanium tri-aluminide laminate composite was obtained in a thermal explosion mode by the method of reaction sintering, reaction pressing, explosion welding with further sintering. The synthesized samples were studied by X-ray diffraction (DRON-2, CuK radiation), metallography (Axiovert 200M), and X-ray spectrometry (CAMECA).

The studies showed that the most suitable structure of a laminate is formed using the explosion welding of titanium and aluminum plates with further reaction sintering in a muffle furnace. Fig. 1a shows a microstructure of the laminate composite after explosion welding. Fig. 1b demonstrates narrow titanium layers and wide intermetallic layers (Al_3Ti) obtained after reaction sintering. All intermetallic layers in the central part contain darker regions which are a two-phase material with an increased porosity.


a



b

Fig. 1. Microstructure of the laminate composite after explosion welding (a) and reaction sintering at T = 700ºC for 6 hours (b).

Thus, four approaches to the obtaining of Ti-Al_3Ti metal-intermetallic laminates were implemented. The structure and composition of the samples were studied by X-ray diffraction, X-ray metallography and X-ray spectrometry. The conducted studies can be used to obtain laminate composites with a required layer thickness.

REFERENCES

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