

IMPLEMENTATION PROCESSES OF PLASTIC FORMING PRODUCTS OF EUTECTIC COMPOSITE MATERIALS OF THE SYSTEM TI-TiB₂

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Abstract

Peculiarities of forming details from eutectic composite materials of Ti-TiB₂ system are considered

Keywords: alloy, eutectic, plastic deformation, structure.

An effective direction in increasing the strength of engineering structures is the use of high-strength structurally-heterogeneous eutectic-strengthened materials, including eutectically strengthened, for example, titanium alloys of the Ti-TiB₂ system.

The presence of a solid ceramic eutectic TiB₂ provides an increase in the strength of the alloy by 10-15%, as well as the stability of mechanical properties at high operating temperatures. The main disadvantage of quasi-composite structural-non-uniform material is the reduction of plastic properties to 2-3%. The reason for this is the colonial structure of the reinforcing component of the eutectic TiB₂, which blocks all the sliding systems during plastic deformation.

To improve the plastic properties of the quasi-composite material of the Ti-TiB₂ system, an approach has been developed that includes the two-stage processing of the material of the original structure.

At the first stage, the material is treated in conditions of large deformations of the shear, for example, the method of intense plastic deformation. In the authors' work, a method of processing screw extension extrusion (Patent of Ukraine No. 64346 dated November 10, 11) was proposed and treatment regimes for eutectic quasicomposite material based on titanium alloy BT 8 were developed.

Theoretical and experimental studies were carried out to substantiate the processing regimes. They showed that as a result of plastic deformation, the solid phase of TiB₂ eutectic is crushed. In this case, the size of the particles decreases in proportion to the increase of displacement deformations during processing. At the boundaries of the breakage of the solid phase TiB₂, damage occurs due to the creation of a comprehensive compression under hot plastic deformation. Plasticity of the metal under standard tests increases to 12-15%.

At the second stage, the preform with the modified structure is treated with plastic deformation to provide the shape of the product.

Processed in the production conditions, the process of compression of blades of compressor gas turbine engine from the eutectic material of the Ti-TiB₂ system based on the titanium alloy BT8. It was shown that the implementation of the process provides an increase in mechanical properties in relation to the casting structure by 10 - 16% in the cast part of the blade pen, and in the body of the pen of the blade - by 12 - 17%.

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ПРОЦЕСИ ВПРОВАДЖЕННЯ ПРОДУКТІВ ПЛАСТИЧНОГО ФОРМУВАННЯ ЕВТЕКТИЧНИХ КОМПОЗИТНИХ МАТЕРІАЛІВ СИСТЕМИ ТІ-ТІВ₂

Анотація

Розглянуто особливості формування деталей з евтектичних композитних матеріалів системи Ti-TiB₂

Ключові слова: сплав, евтектика, пластична деформація, структура.

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