На величину модуля упругости разрабатываемых сплавов сильное влияние оказывает и температура плавления. Чем ниже будет температура плавления, тем меньше будут силы связи атомов в твердом состоянии, а, следовательно, и ниже модуль упругости.

Для получения нужного сплава системы TI-NB-ZR, необходимы дальнейшие исследования основных варьируемых параметров аддитивной машины.

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THE DEVELOPMENT OF ADDITIVE TECHNOLOGIES FOR PRODUCTION OF CERAMIC COMPONENTS AND PARTS OF A NEW TYPE BY MEANS OF SELECTIVE LASER MELTING

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Increasing demands for range and intensity of maneuvering hypersonic vehicles at the moment is hampered by the complex dependent factors: weight, heat resistance and mechanical strength of structural materials at elevated temperatures. Existing to date technology of hot pressing and conventional sequential molding followed by sintering of ceramic materials, can not provide the required characteristics of the structural parts for hypersonic vehicles. This is especially true of hollow ceramic parts of cellular structure. Technology of production of ceramic units and parts by selective laser fusion, which refers to the additive technology will enable the engineering industry to solve complex materials science problems and to create a programmable structural material of cellular structure. Therefore, the formation of products on the basis of ceramic materials is developing in the direction of use of the additive technologies.

The significance of the problem being solved with the use of additive technologies from the perspective of overcoming technical, technological, resource, environmental limitations relevant to the areas of development of the country is formed by the set of advantages of additive manufacturing technologies over traditional machining of workpieces. So, for example:

- a significant savings when production is started. The data required to start the production, can be stored digitally, and reproduced without material cost;
- ability to make amendments at any stage by a simple adjustment of the CAD file;
- customization production line: additive technologies allow to make party, in which every object (item) may be different from the previous one.
- the effectiveness of additive technologies is the increase in utilization of material, reduced weight and lower cost parts through the optimization of the technological cycle.
- ecological purity of production, since the space of additive machines are generally closed and includes in its design the filtration system, all the gases passing through the chamber is filtered from particles of powder. Unused powder during the process is sent back to the head of the production cycle.

It should be noted that the analysis of modern trends of development of the relevant area of science and technology shows a rapidly growing segment of additive manufacturing refers to production technology of ceramic components and parts by means of selective fusing.

Thus, the proposed project is fully consistent with modern trends in the field of additive technologies and the development of the aerospace industry, and contributes to the solution of questions of import substitution in the domestic market and has export potential.

The project will develop new materials micro and nano structured type, which ensures the creation of goods by means of additive technologies for operation in extreme conditions. The materials will be used in new high-tech industries and provide substantial (more than 30 %) to increase the thermal stability of the products.

In addition, the project will be developed production technologies of ceramic components and parts of hypersonic vehicles by means of selective laser melting behaviour and methods of diagnosis of processes and obtained products. The same will determine the best modes of fusing ceramic materials depending on particle size distribution.

In the course of the project it is expected to obtain at least two results, capable of legal protection is itself modified powdered ceramic material and a useful additive model to streamline the installation.

The object of this project is the technology of production of ceramic units and parts by selective laser fusion with the use of innovative methods of diagnostics of processes and obtained products. This technology relates to new processes layer-by-layer combining materials to create the object and, according to foreign classification ASTM F2792-12a, in the course of the project will create a technology called "Powder bed fusion" - the fusion of material into a pre-formed layer.

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ПОЛУЧЕНИЕ ТИТАНОВЫХ ОБРАЗЦОВ МЕТОДОМ ЭЛЕКТРОННО-ЛУЧЕВОГО СПЛАВЛЕНИЯ

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Введение. Электронно-лучевые технологии на сегодняшний день помимо всего прочего применяются в технологии трехмерной печати металлических изделий, где деталь формируется за счет послойного сплавления металлического порошка сфокусированным пучком электронов по заданному алгоритму. В процессе воздействия на порошок, особенно при построении крупногабаритных изделий, могут образовываться массивные ванны расплава и возникать явления, приводящие к формированию сложного рельефа поверхности детали, что является недопустимым. Таким образом, при электронно-лучевой обработке поверхности необходимо подобрать такой способ модуляции луча, который бы не приводил к формированию сложного рельефа поверхности, при этом обеспечивал сохранение или повышение значений прочностных свойств. Целью данной работы являлось исследование морфологии поверхности наплавленного электронным лучом многослойного образца из титанового порошка на стальную заготовку, а также морфологии самой заготовки, обработанной электронным лучом и сравнение ее твердости с твердостью необработанной заготовки.

Материалы и методика эксперимента. Упрочнение поверхности проводили на подложке из стали 12Х18Н10Т, отдельно на аналогичную подложку наплавляли слой