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MODERN TECHNOLOGIES OF MANUFACTURE OF BIODEGRADABLE MAGNESIUM BASED ALLOY FOR OSTEOSYNTHESIS

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Recently,the use of implants, capable of dissolving in the internal environment of the organism became widespread in osteosynthesis. They are made of various types of polymers and ceramics, as well as of magnesium alloys.

Magnesium is a very promising biodegradable material. Its advantage over most polymers and ceramics is higher mechanical properties, which are very close to the properties of bone tissue. In addition, magnesium and its products of corrosion have excellent biocompatibility. Despite its advantages, pure magnesium is very fragile and has insufficient tensile strength. The indicated disadvantages complicate the use of magnesium implants. The additional alloying and the development of an optimal chemical composition of the new alloy can improve physical and mechanical properties of magnesium implants.

Biodegradable implants have to provide the necessary mechanical properties and ensure the required biodegradation rate. The absence of toxic effects on a living organism is also important. Despite the prospect of magnesium, the number of works devoted to the systematization and clarification of the role of alloying elements in magnesium based alloys is extremely limited. Therefore, a rational choice of alloying elements for the development of new alloys based on magnesium with increased properties and technologies that provide high-quality casting is an urgent task.

When smelting magnesium alloys, complex processes of interaction between the materials of the charge and the alloying components, fluxes, protective environments and modifiers occur. Therefore, for the qualitative casting, the role of technological factors in smelting, pouring and heat treatment of magnesium alloys is crucial. It was established that improving the quality of magnesium alloy castings, including the application of properly selected process conditions of melting, pouring and developing rational crystallization regimes, provides a significant increase in their performance characteristics.

The final stage in the improvement of magnesium alloys is heat treatment, which is carried out both for removing internal stresses (T2 – annealing) and for increasing mechanical properties (T1 – aging, T4 – quenching, T6 – quenching + aging). The main purpose of heat treatment is to create a heterogeneous structure with highly dispersed emissions of the strengthening phase, which is decisive in the use of alloys at elevated operating temperatures.

Precipitation hardening of magnesium alloys is achieved in most cases in the result of aging, based on homogenization and hardening from the area of solid solution and subsequent high-temperature leave, which leads to the decomposition of a supersaturated solid solution with the separation of particles that block slip dislocations and increase the yield point.

Improvement of mechanical and special properties of magnesium alloy castings due to optimal application of charge materials and rational technologies of high-quality casting can significantly expand the application of these alloys in the field of medicine providing the possibility of manufacturing more reliable structures of more complex forms.

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THE INFLUENCE OF SN AND PB ON STRUCTURE FORMATION AND MECHANICAL PROPERTIES OF Mg-Al-Zn ALLOY

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Cast magnesium alloys are one of the lightest structural materials. It allows them to be used extensively in aviation engineering. The march of technological and scientific progress leads to complication of the design and the number of structural elements of engines and aggregates, which leads to an increase in their mass. Currently, the efforts of the global aviation industry are aimed at expanding the use of parts made of magnesium alloys for units and aggregates, instead of existing aluminum and steel castings, to reduce their mass. At the same time, the requirements imposed on them are constantly increasing. Therefore, increasing the physical and mechanical properties of magnesium alloys, which do not contain scarce and expensive components, is an urgent task.

The effect of alloying magnesium alloy ML5 with fusible metals of the 4th group of the Mandeleev's periodic system (Sn and Pb) is poorly studied. These metals have favorable factors in relation to magnesium (minimal difference in atomic diameters and electronegativity) and, consequently, can form solid solutions, strengthening the metal matrix. An analysis of the state diagrams of Mg-Sn and Mg-Pb showed that they are eutectic type diagrams with limited solubility of these elements in solid magnesium and form supersaturated solid solutions. All these factors lead topositive effect of Sn and Pbon the properties of magnesium alloys.

In this work, we have studied the influence of Sn and Pb on the structure and properties of castings of magnesium alloy ML5.