The mechanical properties of the alloy are determined not only by the amount and dispersion of the excess phase after aging, but also by the grain size of the matrix. The coarse-grained structure is undesirable because of its negative effect on mechanical properties, especially plasticity. In this regard, the hardening temperature must be chosen so that it provides the most homogeneous solid solution, while minimally affecting the growth of the matrix grain.

To determine the optimal hardening temperature, the microstructures of the samples of the developed Mg-Zr-Nd magnesium alloy were investigated. For this purpose, the alloy was melted in a crucible induction furnace IPM-500, as well as in a gas distribution furnace according with the serial technology. The refining of the melt was carried out by VI-2 flux in a distributing furnace, from which the metal was gradually removed and the increasing additives of alloying elements Zr, Nd, Zn were introduced, and then the standard samples were poured into a sand-clay form. After casting, the samples were hardened at different temperatures: 450 °C, 500 °C, 520 °C, 540 °C.

Microstructure studies have shown that raising the hardening temperature has led to an increase in grain size. However, even the temperature of 540 °C has not led to complete dissolution of eutectic secretions along the grain boundaries.

According to the results of the microstructure study, the empirical equations of dependences of grain size (1) and the amount of excess phases (2) on the hardening temperature were deduced:

$$y = 0{,}4892\ x - 147{,}4429 \pm 2{,}22 \quad (1)$$

$$y = -\ 0{,}1119\ x + 69{,}2442 \pm 0{,}77 \quad (2)$$

Using the obtained dependencies, the optimal hardening temperature has been obtained – T_{hard} = 570 ºC. It provides a microstructure with the following parameters: the grain size of the matrix is 129...133 microns; volume fraction of excess phase – 4,7…6,2%.

Thus, the following mode has been selected as the heat treatment of the new Mg-Zr-Nd magnesium alloy: heating to 570 ± 3 °C, holding for 8 hours with subsequent air cooling and aging at 200 ± 5 °C for 15 hours with air cooling. The resulting microstructure of the alloy after head treatment had no excess eutectic precipitates, grain boundaries were clean and clearly seen. The heat treatment resulted in a high complex of mechanical properties of the alloy: the tensile strength σ_B = 286…292 MPa, the elongation δ = 5,2…5,8%.

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THE RESEARCH OF THE INFLUENCE OF COOLING RATE ON MICROSTRUCTURE AND PROPERTIES OF THE NEW Mg-Zr-Nd BIODEGRADABLE ALLOY FOR OSTEOSYNTHESIS

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The use of biodegradable magnesium alloys for implants in osteosynthesis involves the manufacture of complex shape structures with a variety of holes, threads, etc. In this regard, there is a need to use a material with an increased complex of mechanical properties to ensure the good quality of manufactured complex elements.

One way to improve the microstructure and increase the mechanical properties of the alloy is to provide the required cooling rate of casting, which is achieved by the use of various mold materials and coolants.

The simulation of the casting process with the different cooling rates and their effect on the structural parameters of the magnesium alloy were performed using ProCast^{TM} software. The calculations were performed for the following technologies: sand casting; casting in a steel mold, air cooled; casting in a copper mold, air cooled; casting in a copper mold, water cooled; casting in a copper mold, cooling with liquid nitrogen.

Casting in a metal mold is more effective than sand casting because, due to the higher cooling rate, it provides better microstructure parameters of the alloy. The secondary dendrite arm spacing (SDAS) has been reduced by almost 2 times, the spread in the values by volume also decreased. The difference was higher with increasing the cooling rate when casting in a metal mold.

Increasing the cooling rate resulted in significant grain refinement as well as a decrease in grain size deviation from the mean. So, the use of a copper mold with water cooling leads to grain refinement of the alloy by almost 2 times compared to sand casting.

Practical studies of the microstructure and mechanical properties of standard cast samples confirm the calculations made using ProCast^{TM} software. The average grain diameter of the matrix for sand casting was 177 μm, for casting in a steel mold with air cooling – 88 μm, for casting in a copper mold with air cooling – 60 μm, for casting in a copper mold with water cooling – 31 μm, for casting in a copper mold with cooling with liquid nitrogen – 11 μm.

As a result, the improvement of the microstructure parameters of the Mg-Zr-Nd magnesium alloy has led to the improvement of the complex of mechanical properties of the alloy after heat treatment (Table 1).

Table 1. Mechanical properties of Mg-Zr-Nd magnesium alloy at different cooling rates

Technology	Tensile strength, MPa	Relative elongation, %
Sand casting, air cooled	231,1	3,4
Steel mold, air cooled	241,7	5,4
Copper mold, air cooled	246,2	5,8
Copper mold, water cooled	253,6	6,1
Copper mold, cooling with liquid nitrogen	305,4	16,0

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INTERCULTURAL COMMUNICATION AS A FACTOR FOR SUCCESSFUL PROFESSIONAL ACTIVITIES

Today's job market requires university graduates and future specialists who possess a high level of professional training and certain skills of effective communication. These two elements of success performance in their professional activity can provide an opportunity to find a well-payed job, career advancement and thus a person can satisfy their professional and social needs.