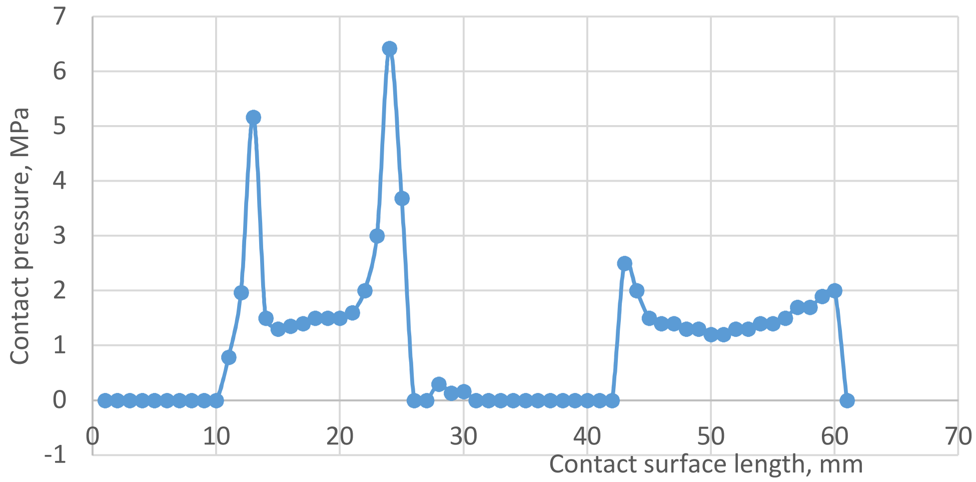

Fig. 1. Dependences of the value of the contact pressure along the contact length of the cuffs

Fig. 1 shows the distribution of contact pressure in the cuff, the surface length from 10 to 25 mm corresponds to the proposed cuff, and at a length of 42 to 61 mm corresponds to the standard cuff.

Therefore, the proposed cuff better seals the connection under the pressure of the working environment, better seals the connection when there is no pressure due to the elastic properties of the elastic ring installed in it.

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DEVELOPMENT OF RATIONAL HEAT TREATMENT MODES FOR BIODEGRADABLE MAGNESIUM ALLOY

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A new biodegradable magnesium alloy of the Mg-Zr-Nd system with the following chemical composition was developed: 3,1…3,15% Nd, 1,22…1,3% Zr, 0,6…0,7% Zn, the rest – Mg. For this alloy, there is a need to choose the rational modes of heat treatment, which will allow to provide the optimal complex of mechanical properties.

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.

отношением массы отливки к массе жидкого металла (ТВГ). Это может достигаться такими способами: применением закрытых прибылей взамен открытых; использованием прибылей шарообразной формы; теплоизоляцией прибылей; созданием избыточного давления в полости прибыли; установкой проточных наружных холодильников и др.

Уменьшение массы отливок достигается в металлургическом переделе: снижение количества неметаллических включений и газов в отливках; внедрение новых форм модифицирования, раскисления, обессеривания; применение внепечной обработки металлов.

Эффективность литья, определяемая КИМ, может быть улучшена повышением геометрической точности отливок.

Особое место в повышении эксплуатационной надёжности отливок и сближение свойств литых и кованых заготовок занимает композиционное литье, которое имеет большие возможности по уменьшению отходов металла, трудовых затрат, материалоемкости машин. Решающими для этой технологии являются контактные процессы, осуществляющие связь между элементами, составляющими композицию.

При разработке новых технологических процессов и совершенствовании существующих при перевооружении литейных цехов целесообразно активно внедрять нанотехнологии, позволяющие резко повысить механические и служебные свойства отливок, а также синтезировать новые, более эффективные и производственные процессы на базе аддитивных технологий с использованием 3D-принтеров.

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