1. **A.S. Eldarkhanov, N.S. Uzdieva, N.D. Aisungurov.** Grozny Ingotless casting — rolling of high-strength aluminum alloys

Abstract. This paper presents results showing the possibility of producing thin-sheet billets from a wide range of aluminum alloys using the twin-roll casting method. During the research, an analysis of design and technological solutions of currently known methods of continuous casting and rolling of sheet metal products was carried out. In a laboratory installation for two-roll metal casting, physical and technological parameters (temperature and casting speed, heat removal intensity, etc.) were developed to ensure a stable process for producing sheet workpieces of small thickness (1-5 mm) from the aluminum alloys under study.
Improvements in roller casting technology have made it possible, for the first time in metallurgical practice, to produce cast sheet blanks from wide-interval aluminum alloys EN2024 (Д16) (≥ 130 °C) and EN7075 (B95) (≥ 160 °C).
At the initial stage of research, the influence of the intensity of heat removal from the solidifying metal on the primary structure of the cast workpiece was studied. It is shown that, regardless of the cooling rate, for all studied aluminum alloys the basis of the structures, on which the level of mechanical characteristics of the metal in cast workpieces depends, is the -phase. It has been established that with an increase in the cooling rate to a level characteristic of roller casting, the –phase in cast billets has a more uniform fine-grained structure. In this case, small inclusions of dispersed intermetallic and eutectic phases, which are present in the structure of cast billets, are evenly distributed over their cross sections. As is known, there is a hereditary relationship between the primary structure of cast billets and the quality of the final metal product, which was confirmed by the higher level of strength characteristics of strips obtained by rolling experimental billets.

Keywords: roller casting, aluminum alloy, crystallization, cast billet, structure, properties.

2. **K.V. Nikitin, D.M. Yudin, S.V. Harchenko.** Integration of additive manufacturing tools into the technological process of die casting

Abstract. The competitiveness of shaped casting, as the main product of foundry production, is determined by an optimal combination of various factors. Shaped castings of responsible purpose are widely used in fundamental industries. As a rule, such castings are obtained by special casting methods. Die casting refers to high-precision casting methods that provide high dimensional and geometric accuracy. However, the high labor intensity, material intensity and duration of the technological process, implemented using traditional technologies, causes only 1.5 % of castings obtained by casting according to smelted models in the total share of castings in mechanical engineering. Currently, additive technologies based on the principle of direct supply of energy and material (Fused Deposition Modeling) are used to obtain castings based on smelted models, which allow optimizing the process and reproducing models of more complex geometry. However, the removal of the materials used from the refractory ceramic shell occurs only by burning, which entails the use of additional energy costs, the formation of toxic gases and carcinogenic substances. The tasks of increasing the efficiency of obtaining castings due to the development of technology for obtaining models of shaped castings by means of additive manufacturing are becoming urgent.

Keywords: 3d printing, extrusion, additive technologies, wax, model, die casting, refractory ceramic shell.

3. **V.A. Korovin, K.A. Maslov, M.A. Geyko, S.V. Belyaev,A.A. Garchenko, V.F. Shevyakov, A.I. Demchenko.** Investigation of the ways of fi ltration of a high-alloy alloy at the site of electric arc melting during casting of ingots.

Abstract. Schemes for installing filters, both in a casting bowl and in a ceramic funnel, are considered.

The results of melt filtration on the condition of the casting bowl and the filter in it are presented. Comparative results of filtration during casting of alloys in the area of electric arc melting on microstructures are shown.

Keywords: filtration, casting bowl, ceramic funnel, microstructure, electric arc melting, high alloy, ingot.

4. **S.A. Kulikov, F.I. Rudnitsky, V.A. Shumigay, Yu.A. Kulikov.** Control of properties of core mixes manufactured by Cold-box-amine-process

Abstract. The article considers the strength issues of foundry cores manufactured by the Cold-box-amine process. It is shown that the properties of the core mix can be controlled by adjusting the formulation. Examples of the influence of binders' consumption on the properties of the mixes are given: a decrease in resin and polyisocyanate leads to a decrease in strength and a decrease in life. In addition, the minimum consumption of binders varies from manufacturer to manufacturer. Recipes of mixes with special additives are given, which allow, by reducing the strength of the mix, to ensure the completeness of the polymerization reaction.

Keywords: sand, core mix, properties, control.

5. **A.V. Chaykin.** Elimination of defects of110G13L steel castings obtained by remelting

Abstract. Defects occurring due to gas shells, presence of chemical burns, and non-compliance of mechanical properties with the requirements of NTD have been often observed at factories producing castings from 110G13L steel by remelting. The reasons for the above defects are increased concentrations of FeO and MnO, as well as uncontrolled impurities found in steels smelted by remelting. To eliminate the listed defects, three stages of steel refining during melting have been used: early induction of slag during charge melting; increasing the efficiency of diffusion deoxidation of steel; out-of-furnace ladle treatment of the melt with an all-purpose refining mixture (ARM). Three stages of melt treatment have ensured metal purification from MnO up to 3—5 %, FeO up to 0.3—0.6 %, and from other uncontrolled impurities. As a result, steel microstructure has become much cleaner from of non-metallic inclusions and very similar to the microstructure of steel smelted by oxidation method. It has allowed to increase the mechanical properties of steel, bring them closer to the properties of steel obtained by oxidation, and eliminate chemical burns and defects caused by gas shells.

Keywords: steel 110G13L, remelting, refining, mechanical properties, diffusive deoxidation, out-of-furnace treatment.

6. **M.A. Kalaushin, V.M. Kalaushin.** Modifi cation of steels and cast iron with rare earth Ligatures

Annotation. The article discusses the modification of gray cast iron and steel in order to eliminate whiteness in cast iron and improve the mechanical properties of cast iron and steel in castings.

Keywords: modification, cast iron, steel, whitewash, rare earth ligatures.

7. **A.V. Shatovsky, O.M. Grudnitskiy, S.V. Konovalenko, I.A. Kovaleva, A.A. Kovalev,V.O. Morozov** Deoxidation of steel with calcium carbide. Infl uence of calcium carbide addition on steel contamination by non-metallic inclusions

Annotation. One of the main factors determining the final properties of metal products is the quantity, morphology and distribution of nonmetallic inclusions in steel. The article deals with the issues related to the use of calcium carbide in steelmaking production, instead of secondary aluminum and other deoxidizing materials, in order to improve the quality of the products. During the experimental work on the use of calcium carbide in steelmaking production, instead of secondary aluminum and other deoxidizing materials, second grade calcium carbide according to GOST 1460—81 was used.

Todetermine the contamination of steel with nonmetallic inclusions, sampling was carried out from hotrolled products obtained from continuously cast billets. According to the results, it was found that the improvement of melt deoxidation in melts using calcium carbide can be achieved by increasing its consumption. In turn, the use of calcium carbide for deoxidation of the melt upon its release from the electric arc furnace into the ladle, instead of secondary aluminum ingots of grade AB87 according to GOST 295—98, helps to reduce the contamination of steel with nonmetallic inclusions.

Keywords: properties of metal products, calcium carbide, rational deoxidation of metal, ladle treatment of steel, nonmetallic inclusions, defect level, calculated coefficient.

8. **I.A. Gruzdeva, E.V. Denisova, V.N. Kardapoltseva, S.O. Kalganova.** The use of digital technologies in the manufacture of models of artistic castings

Abstract. The study is devoted to the technologies for producing models of artistic castings: traditional technology and the use of modern digital technologies. The sequence of technological operations is given. The materials, equipment and technological parameters used for producing the presented products are described in detail. The advantages and disadvantages of both technologies are considered. It is shown that the achievements of modern science can be applied in the technology of artistic casting and allow solving any problems of industrial design of small sculpture. The artistic products presented in the article are the developed by the UrFU Department of Technical Art and Mathematics and were made as part of coursework and diploma design.

Keywords: artistic castings, investment casting, souvenir, model, 3D printing.