1. **K.V. Nikitin, D.A. Dunaev, S.S. Zhatkin, D.A. Minakov, D.G.** Chernikov Improvement of the process of volumetric electric arc surfacing of the Sv-AK5 alloy

Annotation. The results of the main directions for improving the process of volumetric electric arc welding of aluminum alloy Sv-AK5 are presented. It is shown that when studying the influence of surfacing modes (standard pulse and coldArc), it was shown that with an increase in current strength in both modes, the size of the deposited sample increases. The width of the surfacing has deviations from the specified dimensions in a large direction, which is associated with the spreading of the melt. In soldArc mode, deviations of geometric dimensions from the nominal value have smaller values. The principal possibility of creating a complex for the implementation of the hybrid technology «electric arc welding — magnetic pulse processing» is shown. The study of the microstructure of the prototypes showed that MIO has a significant modifying effect on the dendrites of the -Al alloy Sv-AK5, obtained by the hybrid process «electric arc surfacing — magnetic pulse treatment».

Keywords: additive technologies, electric arc welding, hybrid technologies, magnetic pulse treatment, inductor, additive materials, microstructure.

2. **Yu.N. Loginov, S.I. Stepanov, O.Yu. Kornienko, V.V. Popov.** Control of the modulus of elasticity of porous products obtained by additive technologies

Annotion. In some industries, an important consumer property is a reduced elastic modulus. It is noted that one of the ways to control this indicator is to modify the phase composition of the alloys, but a more significant control lever is to change the porosity and architecture of the pore space. The most modern way to achieve results is the use of additive 3D printing technologies, including selective laser melting. The limits within which it is possible to regulate the elastic modulus when controlled by the porosity parameter and the pore architecture parameter are shown.

Keywords: modulus of elasticity, additive technologies, laser melting, 3D printing of products.

3. **L.G. Znamensky, T.V. Stepanova, N.A. Zakharov**. Precision castings for oil and gas engineering

Annotation. The article analyzes the processes of manufacturing precision castings. In order to improve them, a technology for manufacturing ceramic cores from inorganic, environmentally friendly domestic materials has been developed. Development efficiency was achieved through the use of aqueous metallophosphate binder «Inorganic» and domestically produced mullitized materials. Using the methods of quantitative X-ray phase analysis, derivatography and dilatometry, the composition and properties of molding materials were studied, and the physical and mechanical characteristics of the resulting ceramic cores were determined. Pilot and industrial tests of the developed technology at LITPRO LLC, Chelyabinsk showed the possibility of reducing the defects of narrow-channel solid-cast impellers and improving the quality of their manufacture.

Keywords: lost wax casting, cold-hardening cores, ceramic core, «Inorganic» binder, mullitized materials, precision casting, oil and gas complex.

4. **Yu.I. Gutko, V.V. Voytenko.** Experimental impact study of ultra-fi ne metal powders on technical characteristics and physical properties of foundry sodium silicate sand cores

Annotation. The results of the experimental impact study for the mass fractions of ultra-fine metal powders added into compositions of core mixtures on technical characteristics and physical properties of the foundry sodium silicate sand cores under influence of high temperatures during production of

metal castings are presented and discussed. The dependences for technical characteristics and physical properties of the cores on the mass fractions of ultra-fine powders based on aluminum, steel, and bronze are established. The significant reserves for improving a knocking-out ability of the cores based on promising compositions for cast iron by adding ultra-fine powders of aluminum or bronze into core mixtures are revealed. It is established that the best knocking- out ability of the cores in combination with a low outgassing rate and a high gas permeability can be achieved by combining 15.0 wt. % crushed seashell and 0.5—1.0 wt. % aluminum powder. The boundaries for reasonable use of a recycled mixture in preparation of a core mixture are determined.

Keywords: Foundry core, core mixture, knocking-out ability, technical characteristics and physical properties, outgassing rate, experiment, gas permeability, structural robustness test.

5. **N.A. Feoktistov, A.S. Savinov, A.A. Yumabaev, A.V. Monastyrsky.** Preventing the formation of cracks in the barrel of the HiCr rolling roller

Annotation. The article discusses the results of work to prevent cracking in the working layer of the barrel of the HiCr rolling roll. In the production of rolling rolls, even minor violations of the technological parameters of production can lead to cracks in the casting body. These are mainly cracks and chips formed during heat treatment as a result of the combined effect of residual stresses and deformations. To assess the factors affecting the level of residual stresses in the roll barrel, after crystallization, computer simulations were performed using SCM LP PolygonSoft. The results obtained were applied to control the stress state of the roll during heat treatment. In the process of modeling, the dynamics of temperature changes, stress — strain state over the entire volume of the roll and the level of residual stresses in the working layer are determined. The maximum temperature gradients that occur during the transition from the hotter end to the colder central regions of the working layer of the roll are determined. The greatest stresses occur in these areas. The obtained data on stresses in the casting body during the modeling process are in good agreement with the zones of cracks and chips formed after heat treatment.

Keywords: bimetallic rolling roll, combined casting mold, working layer, core, computer modeling, finite element method, stresses, deformation.

6. **A.T. Volochko, V.A. Zelenin, M.S. Kovalko, D.S. Fedorovich.** Magnesium alloys based on the Mg—Al—Mn—Ca system, additionally alloyed with Zr and La for high-speed deformation of products and semi-fi nished products

Annotation. The article presents calculations and analysis of phase equilibria in magnesium alloys of the Mg—Al—Mn—Ca system with additional alloying of Zr and La. An assessment of the influence of the degree, deformation rate, and extrusion temperature on the composition, structure, and mechanical properties of the material has been evaluated. The impact of heat treatment of deformed samples on the complex of strength and plastic properties has been investigated.

Keywords: magnesium deformable alloys, alloying of magnesium alloys with refractory and rare-earth metals, phase equilibria, phase diagram, ligatures, extrusion.

7. **V.P. Fetisov.** Control of plasticity of high-strength condition of cold-formed pearlitic steel

Annotation. The relative narrowing of the heattreated pearlite steel billet characterizes the overall level of plastic and technological properties of the coldformed wire with large total compressions. The reduction of the interplate distance during heat treatment and during plastic deformation is increased,

and the loss during repeated drawing of the plate structure with an increase in the density of dislocations inside the cells in ferrite and an additional decrease in the mobility of dislocations when they are blocked by carbon atoms during the decay of cementite reduce the plasticity of coldformed pearlite steel.

Keywords: dispersion of perlite, lamellar perlite structure, cementite decay, deformation hardening mechanisms, mobility of dislocations.