1. M. Zhou, T. Jiang, S. T. Yang, K. Ma, X. X. Xue,W. J. Zhang

Optimization utilization of vanadium - titanium iron ore in sintering based on orthogonal method. The main aim of this work was to optimize the proportions of vanadium and titanium iron ore from diverse sources in sinter mixture. Industrial V - Ti sinter was observed firstly, then 16 groups of sinter using different proportions V - Ti ore from diverse sources, designed through orthogonal method, were prepared by sinter pot, and their performances were determined. It showed that, V - Ti sinter had complex mineral compositions, particularly perovskite ($CaO \cdot TiO_2$). V - Ti ores from diverse sources had different impacts on V - Ti sinter properties. V - Ti sinter should be sprayed with proper $CaCl_2$ to improving the lower reduction degradation index ($RDI_{+3,15}$). And the V - Ti sinter mixture with 5 % DaBan (DB), 25 % HengWei (HW), 25 % YuanTong (YT), 45 % JianLong (JL) ore was optimal.

2. S. T. Yang, M. Zhou, T. Jiang, X. X. Xue, P. N. Duan, W. J. Zhang

Effect of CAO/SIO_2 ratio on melting property and strength of sinter with vanadium-titanium iron ore addition. Melting behavior is the precondition of liquid phase reaction, which is the foundation of sinter consolidation. Melting property measurement and sinter pot test were adopted to determine the melting temperature and strength of sinter with 13 % and 40 % vanadium-titanium ore addition at different CaO/SiO_2 ratio. The results showed that, the increasing CaO/SiO_2 ratio positively influences the melting property. Due to the difference of TiO_2 content, the influence of increasing CaO/SiO_2 ratio on strength appears in different curves which are not the same as prediction. The sinter strength variations were not only influenced by melting property, but also by mineral texture. The influences of TiO_2 on melting property, strength, mineral texture especially SFCA were still needed a further study.

3. A. Kmita, J. Zych, M. Holtzer, J. Mocek, S. Piasny

Ecological water-based protective coatings for moulds and cores of iron castings. The aim of the investigations was the development of the protective coating and the method of its preparation intended for foundry moulds and cores. The selection of the proper surface-active agent, allowing graphite wetting by water in order to form homogenous water composition with the remaining components of the coating, was especially important.

4. C. J. Xu, Y. X. Zeng, Z. L. Wang, J. Li, S. L. Li, X. J. Zhang

Magnetic field distribution in the electromagnetic feeding riser of rectangle steel ingot. The electromagnetic feeding method was used to improve solidification quality of steel ingot, and the feeding principle of electromagnetic riser was introduced. The distribution characteristics of magnetic field in electromagnetic riser were investigated before and after pouring steel by the measures of numerical and physical simulation. The results showed that there's a good symmetry of magnetic field distribution in electromagnetic feeding riser before pouring steel, but both symmetry and uniformity of magnetic field distribution are broken after pouring steel into riser, and magnetic induction intensity of the surface is higher than that of the inner of feeding riser.

5. G. W. Ao, M. G. Shen, Z. S. Zang, B. L. Li

Study on unidirectional solidification ingot with hollow lateral wall insulation. Hollow side wall insulation mathematical model of unidirectional solidification temperature field was carried out. With the aid of finite element analysis software ProCAST, directionally solidified ingot temperature field with hollow lateral wall insulation during the process of unidirectional solidification was simulated. The results show that the numerical simulation results are in good agreement with experimental results. The hollow side wall significantly improves the thermal insulation effect, inhibits heat transfer directionally solidified casting side wall, and reduces the lateral heat of the ingot. As the hollow side wall was used in nuclear power, large-scale steel and other special steel ingot improve the yield and quality, provide the basis of theory and application.

6. M. G. Shen, D. H. Zhang, C. Wu, Q. Xu, Q. H. Qi

Study on stirring behavior of liquid steel in bottom-blowing ladle with immersed cylinder. The ladle bottom argon blowing process has an important influence on the refining liquid steel. The effects of diameters, insertion depth of immersed cylinder and bottom gas flow rate on the flow state of liquid steel and the amplitude of liquid steel surface are numerically simulated for 150t ladle. The results show that the slag entrapment of liquid steel surface can be confined by changing the diameters and insertion depths of immersed cylinder. The effects of gas flow rate, diameter and insertion depth with immersed cylinder on the flow of molten steel in the ladle were analyzed.

7. M. G. Shen, R. T. Zhang

Study on the Influence of Groove Mold on the Character of Casting. The thermal stress coupling calculation model of initial shell in groove mold is established for temperature field and stress field calculation. The calculated results show that groove mold can improve heat transfer of casting initial shell and form peaks and valleys of temperature and stress, and the whole curve corresponding to overall number of grooves. The surface temperature of initial shell increase with the width of grooves increase, the non-uniformity of initial shell surface temperature and stress also increases. The surface temperature of initial shell decrease with the space of grooves increase, the non-uniformity of surface temperature and surface stress of initial shell increases. Groove depth has a little influence on heat transfer of initial shell surface.

8. P. Schlafka, A. W. Bydałek, M. Holtzer, W. Wołczyński

The influence of the ionic reactions on the refining secondary raw materials. The article presents the concept of refining with the use of slag activated with carbide coating. It pointed out the important role of stimulators of ionic reactions. The results of research from the melting of the CuAl-10Fe4Ni4 alloy obtained from recycled materials in metallurgical conditions were shown. The changes in the structure of the alloy depending on the nature of the used simulators were indicated. Chemical reagents used and the stimulants in the form of haloids helped to improve the molding sand exchange process. The use of chemical regent in the form of calcium carbide and stimulants has also contributed to the formation of a protective atmosphere in the furnace bottom.

9. D. Klobčar, J. Tušek, M. Bizjak, S. Simončič, V. Lešer

Active flux tungsten inert gas welding of austenitic stainless steel AISI 304. The paper presents the effects of flux assisted tungsten inert gas (A-TIG) welding of 4 (10) mm thick austenitic stainless steel EN X5CrNi1810 (AISI 304) in the butt joint. The sample dimensions were 300 ´ 50 mm, and commercially available active flux QuickTIG was used for testing. In the planned study the influence of welding position and weld groove shape was analysed based on the penetration depth. A comparison of microstructure formation, grain size and ferrit number between TIG welding and A-TIG welding was done. The A-TIG welds were subjected to bending test. A comparative study of TIG and A-TIG welding shows that A-TIG welding increases the weld penetration depth.

10. D. I. Băilă, C. V. Doicin, C. M. Cotruț, M. E. Ulmeanu, I. G. Ghionea, C. I. Tarbă

Sintering the beaks of the elevator manufactured by direct metal laser sintering (DMLS) process from Co - Cr alloy. In this paper, two prototypes of dental elevator was made by DMLS process, using a super alloy powder of Co - Cr (ST2724G), with Phenix Systems machine, type PXS & PXM Dental, one with a threaded tail and another with a cylindrical tail. The quality obtained for the elevator is better, thanks to the material used and to the manufacturing process. For the elevator prototypes there were performed some Finite element method (FEM) analysis to identify stress locations and displacements. It was realized corrosion test in artificial saliva Fusayama Meyer (pH 5,5) at temperature of 37 ± 1 °C for 24 hours and remarks the importance of post treatment after DMLS process to obtain a better corrosion resistance in vitro.

11. M. Jodkowski, J. Łabaj, J. Brzóska, D. Jama

Binder fraction reduction in non-ferrous metals concentrates briquetting process. The research results on a method of reducing the amount of binder applied during formation of metal concentrates are presented. Research was done on a model copper concentrate, which was mixed in assumed

mass fraction with binder, as well as binder with addition of waste polyols. Such mixtures were formed and tested using static compressive strength, both immediately after forming and after the assumed seasoning times: 24, 96, 192 and 336 hours. The results confirm the possibility of binder dose lowering using high-efficiency system of binder dispersing with small addition of waste polyols and by homogeneous mixing of the binder with the material. In all examined cases increase in seasoning time influenced mechanical strength of the formed shapes advantageously.

12. L. Řeháčková, R. Dudek, S. Rosypalová, D. Matýsek, J. Dobrovská

Comprehensive study of rheological and surface properties of the selected slag system in the context of its internal structure. Rheological (dynamic viscosity, flow curves) and surface properties (surface tension) of real slag system were experimentally investigated. Measurements of dynamic viscosity were performed with use of the high-temperature viscometer Anton Paar FRS 1 600. The method of sessile drop was used for measurement of surface tension. Surface tension and dynamic viscosity were measured in the temperature interval from 1 200 to 1 600 °C. The structural characteristics of the selected samples were determined by X-ray diffraction (XRD). The samples for given analysis were prepared by quench cooling. Experimentally determined values of dynamic viscosity and surface tension were compared with the results of X-ray diffraction phase analysis.

13. L. Čamek, P. Lichý, I. Kroupová, J. Duda, J. Beňo, M. Korbáš, F. Radkovský, S. Bliznyukov

Effect of cast steel production metallurgy on the emergence of casting defects. The paper documents metallurgical possibilities of high alloy cast steel production in open induction medium frequency furnaces and an electric arc furnace in a gravity die casting foundry. The observation was focused on the emergence of gas defects in steel castings. The content of gases achieved during the metallurgical processes was evaluated for every unit of the production equipment and the casting ladle before casting into disposable sand moulds. The sand mould area was considered to be constant. The aim was to evaluate the current metallurgical possibilities of affecting the content of gases in high alloy cast steel in the current technical conditions of the foundry.

14. S. Medić, J. Groš, A. Horvatić, Ž. Kondić, L. Maglić

Measurement of casting parameters in $ZnAlCu_3$ molds created by additive technology. This paper examines the parameters of casting $ZnAl_4Cu_3$ alloy (volume, castability, density and occupancy of the mold) in mold made additive technology. Molds made by additive technology are: cheaper in production of a small number of castings, geometrically more accurate and faster made. From obtained results of this paper it is clearly seen that printed mold must be protected with thermal coating because liquid adhesive of powder otherwise evaporates during casting and creates additional moisture in the mold, as it was noted.

15. A. Issagulov, N. Ospanov, A. Bayssanov, Ye. Makhambetov, D. Issagulova

Studying possibility of smelting refined ferromanganese grades using silicon aluminum reducer. In the given article there are presented the results of smelting refined grades of ferromanganese using silicon aluminum reducer. There is established the possibility of smelting medium-carbon ferromanganese of the FeMn80C20LP grade (ISO 5446-80). The extent of extraction and effective use of basic elements reaches 51,1 – 51,2 % of manganese, 54,5 - 59,8 % of silicon and 82,5 – 89,5 % of aluminum.

16. P. V. Kovalev, S. V. Ryaboshuk, A. Z. Issagulov, V. Yu. Kulikov, Sv. S. Kvon, Y. P. Chsherbakova, G. I. Sultamurat, M. V. Jironkin

Improving production technology of tube steel grades in converter process. Nature of formation and evolution special features of nonmetallic inclusions during ladle refining of converter HSLA steels for pipelines have been studied. Nonmetallic inclusions of the $CaO\text{-}Al_2O_3\text{-}MgO$ system, close to calcium monoaluminate $CaO{\cdot}Al_2O_3$ with up to 5-6% of MgO, have been found as favorable from morphology point of view. These small inclusions nucleate on endogenous MgO substrates at sufficient high content of calcium in steel melt. Hot rolled plates can be rejected due to the coarse calcium bi- and hexa-aluminate inclusions ($CaO{\cdot}2Al_2O_3$ and $CaO{\cdot}6Al_2O_3$), usually containing exogenous MgO. These coarse inclusions form under calcium deficiency conditions, especially in the case of longtime steel holding in a ladle.

17. I. Špička, M. Heger, O. Zimný, Z. Jančíková, T. Tykva

Optimizing the model of heating the material in the reheating furnace in metallurgy. The optimal operation of reheating furnaces in the metallurgical industry is subject to regularities in the work of the furnace. In practice, however, one cannot avoid downtime to some extent, which causes the deterioration of economic indicators in the furnace. The article demonstrates how to use simulation models for reducing the negative impact of downtime by correcting the temperature in individual zones of the furnace. Corrections are calculated on the basis of predictions of initial heating curves of the processed material and subsequent optimization while using the elements of artificial intelligence.

18. S. Gil, W. Bialik, J. Ochman

Analysis of fuel savings in metallurgical furnaces with protective atmosphere. In the paper, a case of improvement in energy efficiency of a rollway-continuous furnace used for heat treatment in production of cold-drawn tubes as well as gas savings resulting from application of modern burners for radiant tubes was considered. For the investigated furnace, energy balance calculations were performed for the currently operating status as well as following replacement of burners for modern devices with better parameters of combustion and recuperation, which showed a significant reduction in fuel consumption. The burners ensure uniform temperature distribution along the radiant tube, stable operation, high energy efficiency (also in high temperature furnaces) and low emissions.

19. J. Tušek, D. Klobčar

Tungsten inert gas (TIG) welding of aluminum alloy en AW-AlZn5.5MgCu. The paper presents the results of tungsten inert gas (TIG) welding of aluminium alloy 7075-T6 in the butt joint, with single-V edge preparation. The sample dimensions were $100 \times 75 \times 20$ mm^3. The TIG welding was done with 2 mm diameter filler wire made of 5183 (AlMg4,5Mn) at four preheating temperatures. During the welding a temperature was measured at six locations with thermocouples. For successfully welded samples tensile test were done and microstructure of base metal, heat affected zone and weld was analysed. The welds brake at heat affected zone between base metal and the weld. The optimal preheating temperature was at 200 °C.

20. A. Macháčková, P. Kuchta, Z. Klečková R. Kocich, J. Szwed

Numerical simulation of the heat treatment of the weld for steam generator. Heat treatment of the weld of the steam generator is investigated in this paper. Annealing is realized by system of heating elements that are placed on casing of the generator. An experiment using real parameters and a computational fluid dynamics analysis using COMSOL Multiphysics software were performed. Experimental data were compared with results of the analysis. Boundary conditions for numerical prediction had been derived on basis of results obtained from a supplementary calibration experiment. There was good correlation between predicted and measured data. Based on results it can be stated that 67 heating elements with heating output of 60-70 % of maximum range is sufficient number for required heat treatment.

21. C. Narayanaswamy, K. Natarajan

Optimization of casting defects analysis with supply chain in cast iron foundry process. Some of the foundries are in need of meeting production targets and due to the urgency they ignore the rejections. The objective of this paper is to analyze the various defects, [1] from molding process in a cast iron foundry. The Failure Mode Effects Analysis (FMEA) in quality control [2-6] with suitable supply chain for mold making process considering rejection rates are identified and analyzed in terms of Risk Priority Number (RPN) to prioritize the attention for each of the problem. The optimum levels of selected parameters [7] are obtained in this analysis.

22. J. Korol, M. Kruczek, M. Pichlak

Material and energy flow analysis (MEFA) – first step in eco-innovation approach to assessment of steel production. The main goal of the study was to evaluate material and energy flow analysis (MEFA) of steel production. The application of umberto universal software to devise MEFA for the steel production was presented. The material and energy flow analysis of steel production includes a range of technologies through each unit process in integrated steelmaking route in Poland. Modelling MEFA helps a high level of technology to be reached through the effective use of resources and energy.

23. A. Kujawinska, M. Rogalewicz, M. Pilacińska, A. Kochański, A. Hamrol, M. Diering
Application of dominance-based rough set approach (DRSA) for quality prediction in a casting process. The main subject of the paper is a problem of capability assessment of a production process for manufacturing products fulfilling certain requirements. The paper presents theoretical assumptions of the DRSA method for classification of a process state based on so-called process state measures (e.g. process parameters, diagnostic signals, events). In the paper, results of application of the proposed methodology for assessment of capability of the nodular cast iron casting process are presented.

24. R. Radić, Ž. Milošević, S. Jurić, S. Čudić
Flotation of ores and waste waters. World generally requires a very high standard of pollution control, and mining companies pride their organisations as being examples of excellence in this field. Hydrometallurgical mining processes decrease the production of gas and solid pollutants into the atmosphere and maximize the recirculation of solvents at every level of waste waters treatment. The extra electrowinning of metal using the circular hydrometallurgical process ensures that the maximum amount of mined metal is recovered. Reducing pollution helps to improve company profitability.

25. K. Kaczmarska, B. Grabowska, D. Drożyński, A. Bobrowski, Ż. Kurleto, Ł. Szymański
Modified polysaccharides as alternative binders for foundry industry. Polysaccharides constitute a wide group of important polymers with many commercial applications, for example food packaging, fibres, coatings, adhesives etc. This review is devoted to the presentation of polysaccharide application in foundry industry. In this paper the selected properties of foundry moulding sand and core sand containing modified polysaccharides as binders are presented according to foreign literature data. Also, author's own research about effect of using moulding sand binder consisting of modified polysaccharide (modified starch) or its composition with non-toxic synthetic polymers are discussed. Based on technologies taken under consideration in this paper, it could be concluded that polysaccharides are suitable as an alternative for use as binder in foundry moulding applications.

26. J. Łuczak, R. Wolniak
Integration of quality, environment and safety management systems in a foundry. The management systems in the Foundry in question were integrated by means of a quality management system according to ISO 9001 standard. This means that the quality management system is a basic management structure in the enterprise, into which elements of environment management and work safety management have been incorporated. In pre4sented paper we describe some problems of management system integration in metallurgical industry.

27. D. Wilk-Kołodziejczyk, B. Mrzygłód, K. Regulski, I. Olejarczyk-Wożeńska, K. Jaśkowiec
Influence of process parameters on the properties of austempered ductile iron (ADI) examined with the use of data mining methods. The article presents opportunities offered by the data mining analysis as applied to studies of the effect of process parameters on the mechanical properties of ADI. The applied methods of regression trees and cluster analysis allow for the detection of relationships between parameters and also allow determination of strength and form of the impact of different factors. The results of this study allow the creation of knowledge bases for systems supporting the decision-making process in technology.

28. E. Kardas, Z. Skuza
Evaluation of effectiveness of raw materials and materials use in a blast furnace department of a steelworks. The paper analyses the quality of raw materials used in the production of blast furnace pig iron. The ferruginous sinter and pellets are the basic raw materials used in the process. The paper presents the impact of those raw materials quality on the effectiveness of the blast furnace process. The process effectiveness will be specified by means of selected process parameters.

29. J. Burja, F. Tehovnik, F. Vode, M. Godec, B. Arh, J. Medved
Precipitation of metallic chromium during rapid cooling of Cr_2O_3 slags. The slag systems of $CaO\text{-}SiO_2\text{-}Cr_2O_3$ and $Al_2O_3\text{-}CaO\text{-}MgO\text{-}SiO_2\text{-}Cr_2O_3$ were analyzed. These slag systems occur in the production of stainless steel and are important from the process metallurgy point of view. Synthetic slag samples with different chromium oxide content were prepared and melted. The melted slag samples where then rapidly cooled on large steel plates, so that the high temperature microstructure was preserved. The samples were analyzed by scanning electron microscopy (SEM) and X-ray diffraction (XRD). The precipitation of different chromium oxide phases was studied, but most importantly the precipitation of metallic chromium was observed. These findings help us interpret industrial slag samples.

30. B. Gal, K. Granat, D. Nowak
Effect of compaction degree on permittivity of water-glass containing moulding sand. The presented basic research was aimed at determining a correlation between compaction degree of moulding sand and its permittivity ε_r at $2{,}45 \cdot 10^9$ s^{-1}. The measurement results make a basis for mathematical description of a multilayer technological system as is a combination of moulding sand and foundry instrumentation. Analysis of the results shows that compaction significantly influences permittivity of the sandmix containing water-glass, because permittivity value increases with increasing compaction degree.

31. A. Vaško, J. Belan, L. Kuchariková, E. Tillová
Low and high frequency fatigue tests of nodular cast irons. The paper deals with the comparison of fatigue properties of nodular cast iron at low and high frequency cyclic loading. The specimens from three melts of nodular cast iron with different microstructure and mechanical properties were used for experiments. Fatigue tests were carried out at low and high frequency sinusoidal cyclic push-pull loading (stress ratio $R = -1$) at ambient temperature ($T = 20 \pm 5$ °C). Low frequency fatigue tests were carried out using the fatigue experimental machine Zwick/Roell Amsler 150HFP 5100 at frequency $f \approx 120$ Hz; high frequency fatigue tests were carried out using the ultrasonic fatigue testing device KAUP-ZU at frequency $f \approx 20$ kHz.

32. A. Kmita, J. Żukrowski, K. Hodor, H. Smogór, M. Sikoram, Sikora
Zinc ferrite nanoparticles as perspective functional materials for applications in casting technologies. In this article it discuss on possible application of magnetic oxide nanoparticles, namely non-stoichiometric zinc ferrite nanoparticles as a functionalizing agent in foundry processes. Thermal analysis showed a weight loss of the sample at 1 273 K in an amount of 7,7 %, which is a result of the following processes taking place in different temperature ranges. Upon its thermal treatment $Zn_{0.4}Fe_{2.6}O_4$ decomposes to zinc oxide and iron (III) oxide (first stage) and next to iron (II,III) oxide and oxygen (second stage). The degree of decomposition was expressed as Fe^{2+} / Fe_{total}. Mössbauer spectroscopy showed that the over 30 % of Fe^{3+} present in starting material was reduced to Fe^{2+}.

33. R. Ulewicz, P. Tomski
The effect of high-frequencies loading on the fatigue cracking of nodular cast iron. The article presents the results of fatigue tests using high-frequency loading of nodular cast iron. Nodular cast iron GJS-500-7, GJS-600-3 and cast iron ADI with a tensile strength of $R_m = 1\,125$ MPa were used for the tests. The fatigue tests were conducted on a resonance testing machine. For the cast iron grades under investigation, fatigue characteristics in high and ultra-high-cycle regions were experimentally determined. After the completion of the tests, the fractographic analysis of fatigue fractures was made with the aim of determining the fatigue crack initiation location and the fracture mechanism.

34. W. W. Mao, C. X. Li, H. Lu, H. Li
Investigation of gaseous desiliconization in basic oxygen furnace (BOF). In this paper, the gaseous desiliconization during slagging by limestone and lime in a Basic Oxygen Furnace (BOF) were studied by thermodynamic analysis. The results showed that part of the silicon in molten iron could volatilize into SiO in both slagging modes, but by using different methods. In the limestone slagging mode, CO_2 from limestone could massively oxidize the silicon in molten iron into gaseous SiO in the hotspot zone. In the lime slagging mode, SiO can be reduced from SiO_2 in slag. Both methods are dependent on the hotspot zone. The SiO amount generated from the former method is larger than the latter is.

35. B. Arh, F. Tehovnik, J. Burja, F. Vode
Change of mould flux properties during continuous casting of ferritic stainless steel. During the continuous casting of stainless steel the performance of the mould powder is a key factor in this process. The content of Cr in the steel is up to 18 %, high corrosion resistance of the steel is improved

with Al addition, up to 4 %. The aim of the paper was to study the change in physical properties of the casting powder, due to reactions between Al in the steel with SiO_2 in the mould flux during continuous casting. In order to identify the change in the ability of lubrication casting slag with time, depending on the increase in the content of alumina in the slag. On the basis of these results, the most suitable casting powder for continuous casting of ferritic stainless steel with high aluminium content was determined.

36. X. J. Zhang, C. J. Xu, Z. Y. Wang, J. Li, L. W. Zhang, X. D. Peng

Studying as - cast microstructure of the cold core (CC) ingot. In this study, the mechanism of the formation in structure of Cold Core ingot which is prepared by cold core casting method in lab is studied. The structure of the CC ingot is obtained by optical microscopy and macroscopic examination. And finite element simulation result is used to illustrate the heat transfer process of the CC ingot. The results indicated that the macrostructure of the CC ingot is consists of diffusion layer, chilling solidified layer, directional growth, isometric layer and isometric fine grain region layer. In addition, forced heat transfer patterns of the CC ingot affects the orientation distributions and boundary structures of the crystallites combining on the results of the computer simulation, and the influence on the microstructure can be observed clearly under the microscope.

37. J. Cárcel-Carrasco, M. Pascual, M. Pérez-Puig, F. Segovia

Comparative study of TIG and SMAW root welding passes on ductile iron cast weldability. This work compares the weldability of ductile iron when: (I) a root weld is applied with a tungsten inert gas (TIG) process using an Inconel 625 source rod and filler welds are subsequently applied using coated electrodes with 97,6 %Ni; and (II) welds on ductile iron exclusively made using the manual shielded metal arc welding technique (SMAW). Both types of welds are performed on ductile iron specimen test plates that are subjected to preheat and post-weld annealing treatments. Samples with TIG root-welding pass shown higher hardness but slightly lower ductility and strength. Both types of welding achieved better ductile and strength properties than ones found in literature.

38. Q. Yue, C. B. Zhang, X. Z. Wang

Mathematical simulation for effects of flow control devices in two-strand slab tundish. Fluid flows in a two-strand tundish for slab continuous casting were performed with mathematical simulation methods. The molten steel flow velocity fields in the tundish with a turbulence inhibitor, dam, and weir were numerically calculated. Simulation results showed that the tundish with a turbulence inhibitor with no opened holes has similar flow characteristics to the tundish with dam and weir. These results are essential to optimizing the turbulence inhibitor, dam and weir parameters for slab continuous casting tundish.

39. P. Besta, P. Wicher

The optimization of the production of sinter as the feedstock of the blast furnace process. The performance of the sintering process can be increased by means of various procedures. One of the options is increasing the permeability of the sintering charge and improving the gas-dynamic conditions during the combustion. This can be achieved by dosing coarse sinter on the sintering strands. This article analyzes a research conducted in order to experimentally verify the impact of the use of coarse sinter on the performance of the sintering process.

40. T. Kovalyova, E. Eremin, S. Arinova, I. Medvedeva, A. Dostayeva

Enhancing surface roughness of castings when sand-resin mold casting. In this connection, studies aimed at improving the obtaining process of high-quality castings of mining equipment are relevant. At the same time there is a need for studying physical and mechanical relationship of mixes in which a resin from various factors is bonding (rate and time of thermal impact for mixture, rate of the enclosed load of mix in the course of forming, etc.). In particular, there is reasonability of increasing the mixture pressure in the manufacturing process of a mold [1-3].

41. E. Kolczyk, Z. Miczkowski, J. Czernecki

Some aspects of model calculations of converter slag reduction process. A numerical method was used to study influence of the charge mass change on the process of converter slag reduction. A numerical simulation was performed with three different quantities of reduced slag. The relation between changes of Cu_2O concentration and duration of the reduction process as well as between the rate of Cu_2O reduction in the slag and Cu_2O concentration were analysed. It was found out that the duration of the process is proportional to the amount of the treated charge. The rate of Cu_2O reduction from converter slag decreases with the process duration and increases with increasing concentration of Cu_2O in the slag.

42. T. Lis, K. Nowacki, K. Łakomy

Determination of physico-chemical properties of fine-grained waste from the cleaning of iron casting. In the European Union one of the most important activities is the recovery and recycling of waste including foundry waste. In the article waste arising from production of iron casting was presented. Selected physic-chemical properties of iron-bearing waste were defined. Opportunities of waste management are related to their chemical construction as well as some physical properties. On the basic the results of research the solutions of foundry waste management were proposed.

43. L. Kuchariková, E. Tillová, J. Belan, A. Vaško, I. Švecová

Quantitative assessment of aluminium cast alloys` structural parameters to optimize ITS properties. The present work deals with evaluation of eutectic Si (its shape, size, and distribution), dendrite cell size and dendrite arm spacing in aluminium cast alloys which were cast into different moulds (sand and metallic). Structural parameters were evaluated using NIS-Elements image analyser software. This software is imaging analysis software for the evaluation, capture, archiving and automated measurement of structural parameters. The control of structural parameters by NIS Elements shows that optimum mechanical properties of aluminium cast alloys strongly depend on the distribution, morphology, size of eutectic Si and matrix parameters.

44. J. Bocan, M. Sidorová, M. Šofranko

Thermodynamic study of metal sulphides conversion to oxides in hydrometallurgy. This paper presents thermodynamic study of the conversion of metal sulphides to oxides of the CuAg sulphide concentrate as a final product after mechano-chemical leaching of tetrahedrite. The conversion of sulphides to oxides is carried out by oxidation leaching in NaOH solution. The thermodynamic calculation was performed for the sulphide concentrate containing the following sulphides: CuS, $CuFeS_2$, FeS, Sb_2S_3, As_2S_3, Bi_2S_3 and HgS. Based on the change of Gibbs free energy ($\Delta G°$) and the equilibrium constant (K), conversion of metal sulphides to oxides from the qualitative assessment of the chemical reaction can occur as the result of the thermodynamic reaction abilities.

45. R. Klempka

Design of C-type passive filter for arc furnaces. The article presents an example of power supply system modernization in one of Polish steelworks. For the existing power system containing 3rd harmonics filters it was necessary to design a C-type filter for the 2nd harmonics. Two design methods have been presented. The first method is based on the assumption concerning the desired harmonic current flow of filter adjustment between the filter and power grid. The second method was based on using a genetic algorithm, searching for the R_1 resistance value of the filter. Applying the genetic algorithm makes it possible to take into account the broad spectrum of the electrical environment where the filter will be working.

46. B. Gajdzik

Prognostic modeling of total steel production and according to production technology in Poland. The publication presents the prognostic modeling of steel production in Poland by 2020. Based on the general framework predicting, an attempt was made to adjust the model to empirical data, which were related to the size of steel production in Poland. Two prognostic approaches were used. The first approach included determination of prognoses for total steel production on the basis of empirical data for the 1990-2014 period. The second approach used empirical data for the volume of steel production according to production technologies for the 2000-2015 period. Prognoses until 2020 were determined in both cases. Thus obtained prognoses were related to changes observed on the global steel market.

47. M. N. Dudin, N. A. Voykova, E. E. Frolova, J. A. Artemieva, E. P. Rusakova, A. H. Abashidze

Modern trends and challenges of development of global aluminum industry. This article overviews complex study into modern trends and challenges of development of global aluminum industry. Dynamics, structure, and segmentation of global aluminum market are discussed in terms of sys-

tematic analysis. On this basis strategic map of the industry has been plotted and five forces of competition on global aluminum market have been determined which will influence directly on functioning and development of aluminum producing companies.

48. B. Gajdzik

Prognostic modeling of total global steel production. The objective of this publication was to present the results of prognoses for steel production volume in the world. This work was created on the basis of statistical data. The volume of total steel production in the world from 2000 to 2015 was used in order to create the prognosis. The prognoses were created until 2020 – for a period of 5 years. Econometric methods were used to execute the prognoses. The minimum value of error (square root) was assumed as optimisation criterion of the point value of a prognosis. Individual prognoses were grouped according to change scenarios for the studied phenomenon, taking into account the trend nature.

49. M. Warzecha, A. M. Hutny, P. Warzecha, T. Merder, B. Jędrysiak

Methodology of inclusions removing from steel flowing through the tundish. Obtaining high quality steels mainly depends on the quantity of non-metallic inclusions contained into it and this, in turn, to a large extent on the structure of the flow in the tundish. Optimization of the flow of liquid steel through the tundish makes it possible to control the trajectory of inclusions and thereby to improve the conditions of their outflow into the slag layer. The following article presents an analysis of research opportunities of the inclusions distribution and removing process from the steel flowing through the tundish, resulting in reconstruction of the own research facility.

50. G. D. Liu, K. Liu, F. Xing

Magnesite base desulfurizer of metallurgical physical chemistry research. This topic put carbon thermal vacuum method in combination with magnesium based desulfurization technology with magnesite reduction of magnesium vapor directly on hot metal desulphurization. This is a new type of desulfurization technology, the retrieval related literature at home and abroad was not reported in the recent ten years, according to the relationship between heat of desulfurizer preparation MgO style content can reach 50 %.It was found that the desulfurizer sample with 50 % MgO content was in accordance with the requirements, without adding flux, but its viscosity did not meet the requirements; adding 1 % flux (CaF_2), the sample viscosity was significantly reduced, and about 1 400 °C sample viscosity suitable for hot metal pretreatment desulfurization.

51. W. Z. Lv, K. Liu, L. Y. Wang, Y. H. Pan

Multiphase flow numerical simulation of ladle bottom powder injection. Numerical simulations were performed on bottom injection of calcium oxide particles through double nozzle porous bricks into a 300 *t* hot metal ladle. The distribution characteristics of the calcium oxide particles in the ladle were predicted and analyzed. The modeling results show that, when the bottom blown porous bricks are located symmetrically off-centre by 1 / 2 ladle bottom radius and the injection speed of the calcium oxide particles is 7 *m / s*, an optimum distribution of the calcium oxide particles in the hot metal bath in the ladle can be achieved. This will provide a reference for evaluating the feasibility of applying bottom injection of the calcium oxide powder into hot metal ladles for desulfurization in the actual production process.

52. Z. S. Zhang, R. T. Zhang, M. G. Shen, G. W. Ao

The simulation study on central porosity of 450 mm diameter steel electrode ingot. In this paper, cooling plan is optimized to solve the central porosity problem of 450 mm diameter steel electrode ingot. The central porosity of ingot in corresponding cooling plans is calculated by the finite element analysis software ProCAST. The results show that in the plan of independent riser and strengthened cooling in lower ingot part, the central porosity has been significantly reduced.

53. Y. J. Zhang, L. B. Wu, H. Y. Zhao, X. D. Hu, W. Y. Zhang, D. Y. Ju

Adaptive fuzzy control design for the molten steel level in a strip casting process. This paper studies the adaptive fuzzy control problem of the molten steel level for a class of twin roll strip casting systems. Based on fuzzy logic systems (FLSs) and the mean value theorem, a novel adaptive tracking controller with parameter updated laws is effectively designed. It is proved that all the closed-loop signals are uniformly bounded and the system tracking errors can asymptotically converge to zero by using the Lyapunov stability analysis. Simulation results of semi-experimental system dynamic model and parameters are provided to demonstrate the validity of the proposed adaptive fuzzy design approach.

54. M. G. Shen, Z. S. Zang, K. P. Shu

Mathematics Simulation And Experiments Of Continuous Casting With Strip Feeding In Mold. Steel strip feeding technology can reduce the degree of superheat of the molten steel, change the solidification order of the molten steel; raise the equiaxed crystal rate of the slab and improve the continuous casting quality. The paper establishes the mathematical model of heat transfer and temperature field of casting billet of steel strip feeding in continuous casting mold. Results show that if Plate Billet is 1 000 mm × 220 mm and the steel strip is 100 mm × 3 mm, feeding position of parallel is 250 mm from the narrow side. When the feeding speed is 3,6 m/min, the superheat degree can be reduced by 5 °C, and the solidification length can be reduced by 2,9 m. When the feeding speed is 6 m/min, the superheat degree can be reduced by about 9 °C, and the solidification length can be reduced by 3,7 m. The results of the test in a steel plant are in good agreement with the experimental results.

55. C. Tian, Q. H. Pang, Z. J. He, J. H. Zhang, X. T. Zhao

Effect of microwave irradiation on reactivity of metallurgical coke in CO_2 atmosphere. Influence of microwave irradiation on gasification behavior and crystallite parameters of coke samples was studied in this research. The results indicated that microwave irradiation have significant influence on the carbon structure and the reactivity of coke in CO_2 atmosphere. The thermogravimetric results showed that the temperature of coke at different conversion rates of 10 %, 20 % and 30 % were reduced by 20 °C, 30 °C and 50 °C respectively. Simultaneously, microwave irradiation may lead to variation in lateral size and stacking height of crystallite and subsequently reduce the gasification reaction rate of coke in CO_2 atmosphere.

56. H. Di, Z.J. He, J.H. Zhang Q.H. Pang

Experiment study on the effect of iron ore sinter behavior with adding biomass. This paper focused on the effect of sinter behavior with biomass. The changes of the relevant performance indexes of this sinter behavior, emission laws of harmful gases in flue gas emissions and the mechanism of emission reduction was studied in this paper.The results showed that, when the biomass amount is 0,28 %, the sinter index can meet production requirement, the porosity of sinter increased by 18,5 %, the sinter reduction degree increased by 2,66 %, the SO_2 emissions of harmful gases in the flue gas reduced by about 14 %, the amount of NO_x about 19 % lower.

57. Z. C. Lv, K. Liu, N. Luo, W. Z. Lv

Feasibility study on high temperature electrolytic desulfurization in hot metal pretreatment. Hot metal pretreatment desulfurization is an important way in metallurgical industry, and Mg as a desulfurizer is widely used in the steel industry. In this paper, magnesite based desulfurizer that the ratio is 63 % MgF_2, 12 % CaF_2, 18 % NaF and 7 % MgO is used and at the molten iron temperature, magnesite based desulfurizer molten salt system is electrolyzed and the counter electromotive force and cell voltage is measured. The results of X-ray diffration(XRD) analysis of the desulfurization reaction products show that the counter electromotive force and the cell voltage of the magnesite desulfurizer is linear with current; MgO is electrolyzed and generated Mg, but other substances are not electrolyzed; The generated Mg is successfully desulfurized. All those indicated that it is feasible for magnesite based desulfurizer electrolytic desulfurization at the temperature of molten iron.

58. W. Z. Lv, K. Liu*, G. Y. Zhang, Z. C. Lv

Study on physical and chemical properties of new desulfurizer magnesite. In the hot metal pretreatment conditions, the direct current electric field is applied to study the new desulfurizer of magnesite to achieve the goal of in situ desulfurization instead of metal magnesium. A total of three desulfurizers were selected and the melting point, viscosity, primary crystal temperature, density and conductivity were measured and analyzed. The results can be shown that 18 %NaF-63 %MgF_2-12 %CaF_2-7 %MgO is the study of the latest desulfurization agent.

59. J. X. Guo, L. L. Zhang, W. B. Dai, L. Y. Qi, D. Q. Cang

NOx and ultrafine particle emission characteristics in a new steel slag modification device. Two density-separated Chinese coals and steel slag were prepared and then combusted in a modification furnace with different excess air ratio. Non-staged and Fuel-staged combustion experiments were compared under different pulverized coal mixing ratios. Thus, in the fuel-staged combustion experiments, the concentration of NOx in the flue gas was found to greatly decrease under a bitumite: anthracite mixing ratio of 1:1 and an air excess coefficient of 1,2 under the fuel-staged ratio is 15:85. The flue gas temperature was as high as 1 615ºC, while the NOx concentration in the flue gas was as low as 320 mg/m^3. Compared with the other types of burners, the experimental combustion device designed herein efficiently reduced the NOx emissions ca. 80 %. Fuel-staged combustion has a significant effect on reducing particulate matter (PM) emissions, and a suitable coal ratio was also beneficial for reducing particulate matter emissions.

60. Y. Wang, X. Ai, S. Li, H. Li, H. Liu

Optimization of six strand tundish based on inclusions motion. Inclusion transport and the influence of structural parameters of baffle holes on inclusion removal rate are discussed. The physical modeling experiments give two optimal integrated tundish structural parameters of baffle holes. From the further study of Inclusion trajectories, the tundish should be optimized in the structural parameters of baffle holes in the condition of height 300 mm, angel 30 ° and diameter 20 mm.

61. Z. C. Lv, K. Liu, J. W. Qiu, G. Y. Ma, C. P. Liu

A study on experiment and numerical simulation of heat exchanger in heating furnace. In this paper, air preheater is used the research object and its heat transfer law is studied by experiment and numerical simulation. The experimental data showed that with the increases of inlet air velocity, the comprehensive heat transfer coefficient and heat transfer efficiency increase, but the temperature efficiency decreases and the resistance loss on the air side increases. The numerical simulation results showed that the larger the diameter of the tube, the better the heat transfer effect. When horizontal spacing in the range of 290 - 305 mm and longitudinal spacing is 70 - 90 mm, the heat transfer effect is best. The optimized heat exchanger structure is that diameter is 60 mm, horizontal spacing is 300 mm, longitudinal spacing is 90 mm. As the inlet air flow rate increases, the heat transfer efficiency increases, but the temperature efficiency decreases and the resistance loss on the air side increases.

62. J. C. Weng, W. J. Shi, H. S. Xie

Effect of Ce on stainless steel performance during electroslag remelting (ESR). Three electroslag remelting heats were carried out by using a 1-ton argon atmosphere ESR furnace under three kinds of slag containing different Ce_2O_3 content. Specimens were taken at electrode and each ingot for analyzing the inclusions by scanning electron microscope - energy dispersive spectrometer (SEM-EDS). After heat treatment, the tensile and impact of each steel product was measured to study the effect of Ce content on steel performance. The results show that the non-metallic inclusions content was largely reduced in each ingot compared with that in electrode, and the ingot containing 0,05 % Ce has the best steel cleanliness and performance, while the ingot containing 0,13 % Ce has the worst steel cleanliness and performance.

63. T. Karkoszka

Determination of the key operational features in the steel continuous casting processes. The processes of continuous steel casting should be realized in a way ensuring obtaining the designed quality properties of the cast. The basis of the balanced development, however, cause that the tendencies toward the continuous casting improvement are directed toward the minimizing its negative influence on the environment. The subject of the analysis is, considering the risk assessment, identification of the key-operational-features in the continuous casting process. The proposed methodology is of the utilitarian characteristics and can find the application in each organization which due to the operational monitoring wants to eliminate the defects and the environmental impacts within the realized processes.

64. L. H. Feng, X. B. Kang, H. K. Liang, G. L. Liu, C. Sun

Simulation study on the jet characteristics of coherent jet oxygen lance used in basic oxygen furnace (BOF). Coherent jet oxygen lance is a new type of oxygen lance. In this paper, numerical study on the jet flow of coherent jet oxygen lance was carried out with different protective gas out the circular gap around the steel supersonic oxygen lance nozzle. The simulation results showed that the protection gas density was smaller, the oxygen core length was longer. High temperature carbon dioxide and hydrogen gas had the same protection effect on the main oxygen core length. The main oxygen core length increased as the increasing of the temperature and the pressure of the carbon dioxide protection gas. The result of this paper provides a theoretical basis for the design of the coherent jet oxygen lance used in BOF.

65. L. H. Feng, M. Y. Zhu, X. B. Kang, L. Luo

Simulation study on the solute elements micro-segregation at solid-liquid interface of continuous casting steel slab. Based on the Fick second law and the law of conservation of mass, one-dimensional mathematical model on micro-segregation with dendritic crytals growing during the solidification of liquid steel was established. The effects of solute elements on the interdendritic segregation, zero strength temperature, and zero ductility temperature of the steel were discussed with the model used, in which the transition of ferritic/austenitic solidification was considered. The results show that carbon content has a great influence on interdendritic segregation at the solidifying front. Zero ductility temperature decreases with the content of manganese and phosphorus increasing. In order to avoid the cracks, the content of manganese and phosphorus should be controlled in production.

66. G. Q. Liu, K. Liu, C. Y. Tang, L.Cheng

Efficient extracting vanadium from stone coal by co-roasting with sodium chloride and biomass. In this paper, biomass was selected to replace coal as additives during vanadium extraction. Roasting experiments were performed to characterize the effects of biomass on extracting vanadium of stone coal. The results indicated that kalium in biomass catalyzed the formation of potash feldspar but inhibited the generation of insoluble anorthite selectively, and effectively improved the vanadium leaching rate. The optimal roasting conditions were determined when 30 % biomass was added into stone coal, roasting at about 820 °C for 2 hours with 6 % sodium chloride. Under the optimal condition the vanadium leaching rate was 44,6 %.

67. G. Q. Liu, K. Liu, Y. K. Gao, G. Chen

Co-pyrolysis kinetics analysis of stone coal and biomass for vanadium extraction. In this paper, co-pyrolysis of stone coal and biomass was performed. The activation energy of pyrolysis was analyzed, and the mechanism of biomass on the stone coal pyrolysis was discussed. The results show that biomass contributed to the pyrolysis of stone coal. The optimum pyrolysis heating rate of the biomass and stone coal was 25 °C/min and 20 °C/min respectively. The alkaline and alkaline earth metals derived from biomass pyrolysis improved thermal decompose of stone coal, yet stone coal inhibited biomass pyrolysis under co-pyrolysis conditions. The promotion of corn stalk on the stone coal pyrolysis was better than that of sawdust.

68. A. Yu. Proidak

Properties of phosphorite ore used as a charge for the production of ferrophosphorus. The results of an electron microscopic analysis of the microstructure of chemical composition of both phosphate substance and mineral varieties of the phosphorite gangue from Ukrainian deposits have shown that phosphate substance represents a mineral (45.23% Ca, 15.67% P, 27.87% O, 3.77% F, 4.05% Si) that casehardens industrial minerals. The results of petrographic analysis of mineral varieties extracted from phosphorite ore by magnetic and flotation beneficiation methods are analyzed. DTA and TGA methods have been used to observe the behavior of phosphate substance heated from 50 to 110 ° C. The changes in the parameters of the crystal lattice of phosphate substance have been studied by X-ray crystallography. The basic aspects of multi-phase beneficiation process for phosphorite ore from Ukrainian deposits that presupposes magnetic concentration with further beneficiation of nonmagnetic product by the flotation method have been considered. The concentrate yield included 41.7%, the useful component (P2O5) included 27.2%, and the useful component extraction was 70.45%

69. A. M. Selegej, I. G. Tarasevich, M. O. Rybalchenko, V. I. Golovko

Parameter calculation in charging material movement through elements of loading devices of blast furnaces. Ore loading is key for modern blast furnace performance as its formation allows parsimonious equipment use. Ore loading depends on stock surface geometry on the furnace top. Various methods controlling stock shape exist, with major ones being an opening mode of bunker sliding shutter in bell-less loading devices and a mode control-

ling spinning tray spreader parameters. Stock shape depends on movement trajectory of charging material flow through loading device elements. While calculating flow movement, such parameters as charging material level, speed of descending flow and physical/mechanical characteristics are considered. Charging material movement as a material standpoint is not used in calculation. It would be impossible otherwise to account for major factors related to ore loading performance. Our method is applicable to calculating overloading elements of conical loading devices.

70. O. Derevianko, G. Šimunović
Modeling of chaotic regimes in devices for evacuation of metal alloys. The Ruhrstahl-Heraeus device designed to remove nonmetallic inclusions and gases from metal alloys in liquid condition. Based on experimental values of time series, a nonlinear model of the Ruhrstahl-Heraeus device for predicting chaotic regimes was developed. The proposed method enables to shorten the transition time to active phase of melts processing of metal alloys.

71. U. Synytsina, Y. Synytsin, H. Linnyk
Management in the system of providing the efficiency of the activity of the metallurgical enterprise. The problem of efficient management of the metallurgical enterprise in the modern conditions of management becomes especially relevant, since the consequences of a highly competitive environment become critical and threaten its existence.The latest global financial and economic crisis, which has had a negative impact on metallurgical enterprises, has a global character, due to a multitude of objective and subjective reasons, which are associated with very serious negative consequences for the world economy and national economies. The main features of management in modern conditions of management are: maximum consideration of the provisions of modern concepts of sustainable development; orientation to innovative development; effective interaction between the state and the enterprise, as the development of the company is aimed not only at the profit, but also on the development of intellectual potential, the maximum use of the achievements of scientific and technological progress, environmental protection and other priority areas.

72. A. Tarakanov, V. Lyalyuk, D. Kassim
Ensuring of the Required Metallurgical Characteristics of Unfluxed Pellets. The metallurgical properties of roasted unfluxed pellets are the function of the maximum roasting temperature, the proportions of silica introduced by silicates and quarts, and the quantity and composition of glassy silicate binder in the pellets. The mineral formation is decisive in the thermal strengthening of unfluxed pellets produced from concentrates with different mineral composition. The microstructure of the final pellets confirms it.

73. A. Tarakanov, V. Lyalyuk, D. Kassim
Problems of the Blast-Furnace Operation with Wet Blast. Wetting the cold-blast line has two maine goals: (1) to change the moisture content so as to control the thermal state of the blast furnace; (2) to reduce the extreme temperature in the tuyeres so as to optimize the smelting conditions, usually in the absence of injected fuel additives. Constant wetting of the blast undermine the stability of the lining and the metal framework of the air heaters. A method of moisture supply that eliminates condensation in the cold-blast line is proposed.

74. A. Tarakanov, V. Lyalyuk, D. Kassim
Blast-Furnace Operation with Chunk Anthracite. In order to replace expencive coke, various fuels are added to the blast: pulverized coal, natural gas, coke-oven gas, fuel oil, ets. A lesscommon alternative is to introduce chunk anthracite through the charge hole. The use of chunk anthracite may considerably reduce the coke consumption and the production costs of the hot metal in circumstances where pulverized-coal injection is not employed and its introduction would require the use of high-quality iron ore and coke. Chunk anthracite proves especially effective where there are constaints on the furnace productivity on account of production problems, and plant economics must be improved. With the developed technology, in some months, the anthracite consumption rose to 72,8 kg/t of hot metal, with a decline in coke consumption to 400 kg/t of hot metal.

75. A. Tarakanov, V. Lyalyuk, D. Kassim
Problems of the Pulverized-Coal Ingection in a 5000-m^3 Blast Furnace. Numerons problems are encountered in the introduction of pulverized-coal ingection at a 5000-m^3 blast furnace. To resolve those problems, changes are proposed in the number and diameter of the air tuyeres, the batch distribution in the mouth, and the gas flux in the hearth. The position and size of the combustion zones determines the position and parameters of the disintegration ellipsoids and hence the character of the gas flux in the bed. In order to eliminate the strong peripheral gas flux in the case of pulverized-coal injection, coordinated regulation of the blast-furnace process from above and from below is required. The stable nonuniformity of the blast flow rate over the hearth circumference may be eliminated by introducing bidirectional connection of the annular air line to the straight line.

76. V. Bochka, A. Dvoiehlazova, A. Sova
Influence of a type of the flux additives on the technological and economic indicators of the sintering. Fluxes play a significant role in solid and rare-phase sintering processes, which effects on the mineralogical composition and strength of the agglomerate. However, traditional fluxes have certain disadvantages, the main of which is the unevenness of their distribution over the height of the sintered layer. The use of complex flux can eliminated this disadvantage. The research of the replacement of limestone in the composition of sinter charge by the complex flux was conducted. The results were in the 8,37% increasing of the sinter quality yield, the 2,96% increasing of the sinter strength, and the 16,02% increasing of the specific productivity.

77. V. Bochka, A. Dvoiehlazova, A. Sova, I. Vitez
Technology of the complex flux production. Considering the increasing the efficiency of agglomerated production of, it is urgent to develop a technology of the complex flux of high quality obtaining. As a result of the research carried out in the laboratory of the Metallurgy Department of the cast iron, NMetAU, was found that in order to obtain a complex flux, it is necessary to use limestone with a size of 3-10 mm in the amount of 75% of the total mass of the charge, iron ore concentrate in an amount of 25% of the total mass of the charge. Then solid fuel with a particle size of 0-5 mm and in the amount of 8-9% of the total mass of the charge is added to the obtained combined granules. The obtained charge is sintered on a conveyor machine by the sinter technology.

78. V. Bochka, A. Sova, A. Dvoiehlazova
Modeling of the mechanical processing of an agglomerate in the drum type device. The mathematical model of destruction of agglomerate at the stage of mechanical processing in the drum type device is developed. It is shown that the magnitude of the destruction energy is largely determined by the size of the drum, the speed of rotation, the number and width of the shelves, the degree of material loading, and the length and angle of the device. The equation of multiple regressions of the influence of each factor on the magnitude and nature of the energy of destruction is obtained, which allows us to choose the parameters of the device to ensure that obtained the agglomerate of the required size and strength.

79. V. Bochka, A. Sova, A. Dvoiehlazova
Influence of structural and technological parameters of the drum type device on the mechanical processing of agglomerate. Preparations of the qualitative agglomerate for the blast furnace provide mechanical processing with simultaneous action of forces of impact, abrasion and splitting. The research of the influence of the structural and technological parameters of the drum type device on the physical model is executed. The results of the studies were compared with the estimated data of mathematical modeling, which confirmed its reliability. This makes it possible to use a mathematical model to create an optimal technological mode of mechanical processing, which ensures not only the destruction of agglomerate by impact, but also the provision of rounded shapes of pieces by friction and splitting.

80. M. Vishnevskaya, H. Shportko, H. Linnyk
On the rationalization of the industrial structure of the industrial enterprise. Deviations of the actual state of the system from calculated values are possible at any industrial enterprise at any time. Small deviations are inevitable, because at the planning stage it is practically impossible to take into account all possible risks, as well as their consequences, and the state of the system of production elements in their interrelationship. Therefore, it is not the fact of deviations from the given indicators that is important, but their magnitude and available capabilities of the enterprise for their rapid elimination. Often, the solution to this problem lies in the rationalization of the organization's production structure. Since the effectiveness of operational regulation of production processes largely depends on the production structure and dispatching equipment of the enterprise. At the same time, awareness of the problem, planning and selection of management techniques and decision methods, taking into account efficiency criteria, implementation and fol-

low-up control are key components of the rationalization of the production structure. The mechanism of improvement of which should be based on the system approach, and meet the principles of continuity and economy. In addition, rationalization of the production structure should be carried out in accordance with and taking into account the overall system of enterprise management.

81. A. Y. Zimoglyad, V. V Kovtun, A. I. Guda

Dependence of metal films friction coefficient on pressure during thermal spraying in vacuum. Thermal spraying of metal films in vacuum is used for depositing metallization layers. As example metal films can serve as a metallized packaging film to protect against the statics of microcircuits. Also, thermal spraying is actively used in microelectronics and optics. In optics this method makes the antireflective and reflective coatings. Based on the experimental data, the dependence of the coefficient of friction on pressure was found. The lower the pressure when applying the film, the lower the coefficient of friction of this film. The obtained data require additional study, since, most likely, this dependence lies in the structure of the obtained films.

82. D. O. Musunov, Y. V. Synehin, L. S. Molchanov, S. V. Zhuravlova

Study of central porosity formation by method of physical modeling. Based on the basic principles of the similarity theory and an experience accumulated in this subject, the authors proposed similarity numbers and calculated scales to simulate the processes of billet solidification that take place at the final stages of solidification, which lead to the formation of an internal defect – central porosity. After the series of experiments with low-melting materials it was defined that central porosity in continuously cast billet is formed when the closing angle of liquid core is less than its critical value. The results allow establishing rational regimes of secondary cooling of the billet, temperature and speed regimes of steel casting on CCM which prevent the formation of central porosity and other accompanying defects.

83. K. G. Niziaiev, O. M. Stoianov, O. V. Ryzhkin

The use of ozone for the afterburning of carbon monoxide in an oxygen furnace. In steel production, the most urgent problem today is increase the energy efficiency of the process. One solution may be to increase the proportion of postcombustion of CO to CO_2 up to 50% by the use of ozone on the second circuit or the tier of an oxygen lance. This based on high reactivity of ozone with CO at high temperature, where the Gibbs energy values for O_3 and O_2 at 1800 K are -272.62 kJ and -174.27 kJ, respectively. CO with O_3 would be more fully burned in the slag-metal emulsion below the level of the oxygen lance. The additional energy will change the ratio of scrap / hot metal from 25/75 up to 34/66 %.

84. A. Koveria, L. Kieush, I. Bogdan

Effect of biomass additives on the caking and caking capacity of coal blend to coking. The effect of biomass additives (soft wood, straw and sunflower husks) on the swelling properties and the Roga index of coal blend have been studied. These two methods characterize caking and caking capacity of coals and their blends for coking. It has been found that biomass additives in the amount of 1, 3 and 5% by weight have not significantly affect on changing properties of the coal blend. The indices of the swelling index and the Roga index varied within the limits of experimental error, while there was a trend to an increase in these parameters.

85. V. Mazorchuk, D. Homenko, D. Raguz

Determining the coefficient of specific heat and thermal conductivity of porcelain rods. The variety of mold and rod materials as well as molding and core mixtures have resulted in lack of data that describe majority of forming materials. As a rule, the use of approximate values of thermophysical properties in calculations leads to a discrepancy between the simulated and actual process in castings. Therefore, the problem of determining the thermophysical properties of mold and rod materials is up-to-date. The thermophysical values of M01porcelain properties depending on the temperature range from 20 to 1000°C are determined. It is observed that the temperature increase results in the linear decrease of M01porcelain specific density from 2332 to 2302 kg/m^3, the thermal conductivity coefficient increases from 0,90 to 1,64 W / (m·°C), and the specific heat changes from 920 ... 1105 J / (kg·°C). The results of the research can be used in thermophysical calculations, in particular in computer simulation of castings solidification.

86. V. Mazorchuk, A. Zemlyanoy, M. Kostelac

Linear shrinkage of castings. The influence of the solidification conditions of metals and alloys (Sn, Al, alloy AL2, i.e. alloy of aluminum with 12 per cent of silicon) on the linear expansion coefficient value in the elastic region as well as their transition temperature from plastic to elastic state are determined. It is observed that linear shrinkage deceleration of the casting material on the side of the mold surfaces parallel to the linear shrinkage direction leads to a decrease in thermal linear expansion coefficient value. The reason for this phenomenon is the change in the structure of the casting material due to the difference in the rate of the melt solidification in the mold as well as the change in the morphology and spatial orientation of the formed crystals.

87. V. Mazorchuk, S. Repyakh, R. Usenko

The metal cast transition temperature from plastic to elastic *state.* A technique for calculating metal cast transition temperature (t) from plastic to elastic state is developed. The results of the calculations (t) for some metals and alloys °C: Al = 280; Cu = 286; Sn = 107; 3%Fe + 9%Al + 88%Cu =359; 5%Al + 95%Cu = 426; 12%Si + 88%Al = 237. The metal (alloy) is in plastic state, if it is above the temperature (t).

88. S. Repyakh, R. Usenko, M. Matiukha

Dimensions of clusters during melting and crystallization of metals. The theory is based on the assumption that the dimensions of clusters during melting and crystallization of metals have the same dimensions. In this case, the cluster size is equal to the size of the acoustic background in the metal at its melting point. Based on this, a formula is obtained for calculating the cluster size. Using the formula, we calculated the radii of metal clusters, ($r \cdot 10^9$, m): Fe =1,61; Ni = 1,73; Al = 1,56; Ti = 1,78; Pb = 2,54; Cu = 1,48; Au = 1,92; Na = 1,67; W =0,92; Cs = 2,76; Mg = 1,73; Cr = 1,44; Si = 0,74; Ge = 2,39; Ag = 1,56; V = 2,19; Sn = 1,99; Cd = 1,67; Bi = 2,01; Li = 1,43.

89. S. Repyakh, R. Usenko, C. Kostikova

The coefficient of volumetric shrinkage of pure metal upon solidification. It is empirically established that the coefficient of volumetric shrinkage of pure metal can be calculated from the ratio of the specific heat of melting of the metal to its specific heat of boiling (evaporation).

90. L. H. Ivanova, A. Moskalenko, I. Samardžić

The poured forming rolls from complex modifying cast irons. Scientifically grounded experimentally confirmed results have been got. The aggregate of their results has allowed at the level of inventions to develop high-efficiency technologies of modifying cast irons. The application of slugs, containing rare-earth metals, as the alloying elements have been offered and experimental grounded. These off-cuts and mixtures containing modifying and alloying components for casting of cast iron forming rolls have been used. Treatment of fusions by the off-cuts and mixtures allows to improve mechanical and operational properties of rolls and to utilize the off-cuts which have not use before.

91. S. Repyakh, R. Usenko, A. Stoić

The relative content of the solid phase in the temperature range of crystallization of steels. Based on the processing of graphical representations of the results of differential thermal analysis, the value of the relative fractional content of the solid phase in the temperature range of crystallization of some steels (Ψ) was calculated, which was (in fractions of unity by mass): 04Х13Н5М5К9 (content in steel, by weight: C - 0,4%; Cr - 13%; Ni - 5%; Mo - 5%; Co - 9%; Fe - remainder) - Ψ = 0,55; 07Х18Н9, 10Х18Н10Т - Ψ = 0,69; 12Х2НВФ - Ψ = 0,83; 08Х14Н7М - Ψ = 0,84; 10Х16Н3 - Ψ = 0,87, where are denoted: Х - Cr; Н - Ni; М - Mo; К - Co; Т - Ti.

92. V. Selivorstov, Y. Dotsenko, T. Selivorstova, N. Dotsenko

The use of combination technology of the gas-dynamic influence and modification for casting from alloy SC51A. In the conditions of industrial process embodiments produce a cast "rack conveyor" weighing 1.1 kg alloy SC51A tested using inoculation soot TiCN, gas-dynamic effect on the melt in the mold, the complex technology and consisting of both processes.It is established that the specified pressure range of 0.1-4 MPa. Mechanical properties of metal, produced using the technology of gas-dynamic effects, modifying TiCN, as well as the combined technology of gas-dynamic effects and modification in comparison with the corresponding properties of cast metal produced by traditional technology chill casting have defined. Found that tensile strength increases by 11-15%, hardness (HB) - 4-8%, and elongation - 27-30%.

93. Y. Dotsenko, N. Dotsenko, V. Selivorstov, T. Selivorstova
Combined technology to improve the mechanical properties of casting from alloys of the Al–Si system. Performance of the crystallization process under the influence of modification or pressure results in displacement of the non-equilibrium liquidus and solidus temperatures toward higher concentrations of the second component. Variation of the pressure during crystallization and of the quantity of the modifier results in alteration of the ratio between the phases in the structure of eutectic alloys, which influences the mechanical and service properties of the castings. The combined technology developed for the gas-dynamic treatment of the melt in a casting mold and modification provides a way to achieve a stable effect of reducing the size of the structural components, spheroidizing crystals of eutectic silicon, lowering the number of macro- and microscopic defects, and improving the mechanical properties of the cast metal.

94. O. Semenov, V. Khrychikov, V. Živković
Calculation of the kinetic of solidification of iron alloys in cylindrical iron molds. The data from experimental searching of kinetic graphs of solidification were processed with help of using the AutoCAD 2010 program. Consist of carbon various from 0.04% to 4.83%. Step of x/R (relative length) is 0.05. A 3-D graph was built due to the data of the experiment. It helps to understand particular qualities of solidification for cylindrical casing in iron chill mold. It also works for molds, which have shape of wall or sphere with next correlation: "wall" – 1, "cylinder" – 0.25 and "sphere" – 0.11.

95. Y. Proydak, E. Menyailo, V. Khrychikov
Method for calculating the duration of combined electric arc-electroslag heating of castings from hypereutectoid steel 150XHM. The physical model for calculation the duration of the directed solidification of steel 150HNM has been developed. The heating of the riser is carried out according to the step-by-step program: most electricity consumption in the first stage, corresponding to the solidification of the rigid-solid phase of casting and the maximum shrinkage of the melt from overflow; and smaller - at the stage of crystallization of a solid liquid phase. Shrinkage defects are eliminated in the upper part of the casting. Costs of metal on the deposit and reduced in 2,5 ... 3,0 times.

96. M. Vončina, J. Medved, S. Kores, A. Cziegler, J. Li, P. Schumacher
Effect of minor Zr and Mo addition on casting Al-Si-Mn-Mg alloys in as-cast and heat treated state. The influence of heat treatment on tensile properties of the Al-10Si-0,5Mn-0,5Mg (wt.%) alloy, modified with micro-additions of Zr and Mo, were examined. The optical microscopy and scanning electron microscopy as well as energy dispersive spectroscopy were employed to investigate the influence of joint addition of Zr and Mo on microstructure development. It was established that the certain combination of Zr and Mo addition to investigated Al-casting alloy can even deteriorate the mechanical properties in as-cast state, but significantly increase after the T6 heat treatment. The modified alloy formed microstructure containing Zr- and Mo-rich phases of different morphology.

97. Ye. Mukhambetgaliyev, S. Baisanov, V. Roshchin, A. Baisanov
Obtaining a complex alloy from high-silicon manganese ore and high-ash coals of Kazakhstan. The results of experimental studies on the production of a complex silicon-aluminum-manganese alloy (AlSiMn) from high-silicon manganese ore, high-ash coals of the Karaganda and Teniz-Korzhunkol coal basins and long-flame coal from the Shubarkol field are presented. The phase constituents of the alloy are determined. The resulting alloy is stable from self-deposition. It is proposed to use a complex alloy for deoxidation and alloying of steel, and also as a reducing agent in the production of refined ferromanganese grades.

98. I. Mamuzić
Model of fast cooling processes. Fast cooling by different specific cooling technologies are enough of ten used in modern metallurgical industry, because it provides unique proporties of metal productions. Fast cooling evidently implies large temperature difference during relatively short times. That is why thermal effect of cooling localized in space. The proposed model reduces an initial strongly nonlinear heat conduction problem to series of boundary value problems for ordinary differential equations. The proposed approach is illustrated by several calculations.

99. R. Križanić
Thermal protection in metallurgical processes. A mathematical model of the considered systems is proposed in the present work, the active inclusions are considered as point source (sink) of heat with nonlinear intensity. Distribution of active thermal protective inclusions in systems different geometrical shapes under different additional requirements are analyzed as a result of the proposed model application.

100. I. Mamuzić
Future of metallurgical industry. Global warming, which is one of the most important problems of present stage of humanity development. To satisfy new ecological requirements, metallurgical industry must extremely reduce amount of heating, use pressure-tight system of water cooling, use dust collectors. The listed requirements are quite usual in ecology, but there is one non- conventional, according to which an effluent must be distributed on enough large area.

101. V. Živković
Energy source in space metallurgy. Space metallurgy, fast development of which forecasts in the nearest future, requires sufficiently more powerful sources that existing ones, and authors are not sure that semiconductor systems, using at the moment, can provide necessary ening in vacuum is built. Several different modes of metal melting by sunny radiation are calculated.

102. N. Devčić
Problems of space metallurgy. The aim of the present work is to list technological problems of space metallurgy, which don`t have analogs in terrestrial metallurgy. The technologies of modern terrestrial metallurgy were develped on the base of five thousand years experience, space metallurgy doesn`t have such base. Opportunities to organize a rolling process is very restriced too in space. Instead of the listed processes new technologies must be developed by theoretical way.

103. N. Raguž
Temperature and thermoelastic stress-strain fields. A general mathematical model of the considered phenomena is developed in the present work. In absence of phase transitions, the temperature field is described by enough simple analytical respresentation. The stress-strain state in this case can be described analytically too. If there are phase transitions, the problem must be calculated numerically. Boundary element method is used for this aim in the present work. Corresponding calculation are continued till limit of proportionality of the metal.

104. I. Mamuzić
Metal motion during filling in ingot mould. Calculation of free-surface flow with deflections leads to great computational difficulaties, concerning quickly changing shape of calculation domain. To avoid the mentioned difficulties, mathematical model of the flow must be maximally simplifield, for example, till potential ideal fluid flow. Boundary element method is applied for numerical solution of the problem. Free surface motion is calculated by Euler sheme. Calculations for several ingot mould shapes are made to illustrate the proposed approach.

105. G. Šimunović
Ultrasound and liquid metal. Ultrasound is used in different technologies to intensify head and mass transfer processes and some chemical realition however nevertheless a lot of attempts ultrasound technologies are practically not used in metallurgy. Nevertheless a lot of difficulties concerming realization of ultrasound action on liquid metal it gives a unique opportunity to accelerate some processes, especially in microgravity conditions. Mathematical and numerical models of ultrasound handling, including ultrasound cavitations, on liquid metal are developed.

106. V. Živković
Low of liquid metal. Multiphase flows occur on different stages of liquid metal technological working. A. Lagrangian mathematical model of this multiphase flows is proposed in the present work. It is based on individual analysis of motion of discrete phase objects (solid particles or bubbles). The

proposed model gives an opportunity to consider with high accuracy sedimentation floating of discrete phase objects and phase transitions and chemical reactions on their surfaces.

107. I. Vitez
Phase particles in liquid metal. Dissolution oft he powder is main object oft he present investigation. Let as ansume that particles of the second phase are distributed uniformly. Thus the "particle-in-cell" principle can be used for mathematical model construction. For enough small particles the calculation are reduced to simple numerical solution of heat conduction and diffusion equations.

108. A. Akberdin, A. Kim, R. Sultangaziyev
Mathematical model of charts melt viscosity of the CaO-SiO_2-Al_2O_3- MgO. Experimentally using electric vibration viscometer and the method of design of experiments on the simplex studied the melt viscosity of the system AaO-SiO_2-Al_2O_3-MgO. Developed its mathematical model and computer program that allows calculation of viscosity in the temperature range 1 573 – 1 823 K. Using the model diagrams are constructed in the form of isothermal sections of the tetrahedron on MgO. It is concluded that the use of the model is more efficient that Chart, so it does not require a complex geometric constructions tetrahedron when the viscosity values, and, more over, can be use din automatic process control in real time.

109. Z. Y. Xu, B. W. Li
Oxidation behavior of silicon and niobium in niobium – bearing hot metal by bottom – blown oxigen. The oxidation behavior of Si and Nb in Nb-bearing hot metal was studied by the bottom-blown oxygen, using a vacuum – induction furance. The smeltin process was carried out with and whithout slag addition at oxygen flow rate of $0{,}4x10^{-3}Nm^3$/min to $0{,}6x10^{-3}Nm^3$/min. The results show that niobium is massively oxidized and go into slag while phosphorus content is changeless, and sulfur content decreased in hot metal when silicon content decreases to lower that 0,01 %. Niobium oxide is rich in the slag, thus niobium could be recovered from hot metal.

110. D. Yessengaliyev, A. Issagulov, S. Baisanov, A. Baisanov, N. Ospanov, D. Issagualova
Aggregate tests for smelting refined ferromanganese grades using silicon aluminum reducers. In the given article there are presented the results of smelting refined grades of ferromanganese using silicon aluminum reducer. There is established the possibility of smelting medium-carbon ferromanganese of the FeMn90C20 and FeMn90C20LP grades (ISO 5446-80). The extent of extraction and effective use of the basic elements reaches 61,0 % of manganese, 71,7 % of silicon and 91,9 % of aluminum.

111. K. Nowacki, T. Lis
Qualitative characteristics of foundry dusts. Recycling has become a top priority research task in highly developed countries, addressed from the perspective of environmental protection as well as cost-effectiveness of products. In many countries, including Poland, landfilling is still commonly accepted as a method of choice for waste neutralisation. This paper presents results of studies on the environmental impact of iron-bearing foundry waste in the event of its landfill disposal.

112. Górka J., Wyględacz B., Żuk M.
Effects of shielding gas pureness on quality of orbital TIG welded austenitic stainless-steel joints. Aim of this research was determination of effects of shielding and backing gas pureness on quality of welded joints produced from austenitic stainless-steel grade X5CrNi8-10 (1.4301) pipes Ø 50.8 x 1.5 mm by orbital TIG welding without use of additional material. In case of stainless steel, it is of importance not only to shield molten metal pool, but as well protection of welded joint root from oxygen, which causes formation of colorful oxide layers. Presence of oxidized layer primarily decreases corrosion resistance of stainless-steel. Root of welded joint was at first protected with Argon 5.0 pure, then argon-atmospheric air mixtures were used. Quantity of residual oxygen in gas mixture was selected based on Danish Force Technology Institute report 93.34.

113. M. Kostelac
Surface morphology of plasma nitrided layer of steel. Surface morphology changes of the layer on austenitic strainless steel plasma trided for different times at low temperature (400-450 °C) were studied by in situ SEM observation. The results show that nitriding does not modify the annealed twin, grain size and shape.

114. A. M. Brovman
Modern superalloys in heat and power engineering. In this paper, the requirements for materials with improved high temperature performance will be considered in the context of three types of power generation system being developed to operate with greatly reduced emissions and with high levels of efficency. The limitations of existing materials will be outlined and the need for materials with higher temperature capabilities and good fabricability will be discussed.

115. S. V. Konovalov, D. V. Zagulyaev, V. E. Gromov, Y. F. Ivanov
Effect of yttrium oxide modification of Al-Si alloy on microhardness and microstructure of surface layers. Microhardness, structure and phase state of silumin modified by coating with yttrium oxide when electroexplosive alloying were analyzed. Appropriate processing modes were estimated according to the results of research. The study on the structure and phase composition was carried out for the processing mode, which increases microhardness of the surface layer more than twice. The coatings with a thickness of 50-80 μm are highly rough and porous, they have a sub-micro- and nanoscaled multiphase structure with particles of silicon, Y_2O_3, YSi_2 and $Y_2Si_2O_7$ as strengthening phases, and alloying elements (silicon, yttrium, and oxygen) don't tend to spread homogenously in them. This work was financially supported by the state task of Ministry of Education of Russian Federation No. 3.1283.2017/4.6.

116. J. Li, C. F. Zhang, R. M. Yin, W. H. Zhang
Monte carlo simulation of anisotropic growth of grains during liquid phase sintering for ceramics. An improved two-dimensional Q-State Monte Carlo Potts model for describing anisotropic growth of grains of ceramics is established. The sintering additives, pores, and second-phase particles introduced into the ceramic matrix have been fully considered in the new algorithm. Using this model, the influence of the second-phase particles on the microstructural evolution of ceramics with elongated grain morphology are investigated. Results show that the addition of the second-phase particles obviously hinders the anisotropic growth of grains, thereby resulting in a slightly decreased average grain size and grain growth exponent. The preliminary investigation indicates that the simulation results are in good agreement with the existing sintering kinetic theory.

117. Andoko, P. Puspitasari, F. Gapsari
Fatigue crack growth behaviour of nodular cast ironsubjected to two-step austempering. In this study, the material was initially reheated at 260°C for 10 minutes, and then the temperature was increased to 280°C, 310°C, and 340°C with the holding time of 60 minutes and 120 minutes. The results of these treatments showed that slower fatigue crack propagation occurred at the austempering temperature of 340°C with 60-minute holding time than those at lower temperatures (280°C and 310°C) and with longer time (120 minutes). These results were corroborated through a fracture surface analysis. The fracture surface of the material austempered at 340°C for 60 minutes was ductile, while the one austempered at lower temperatures and longer time tended to have brittle fractures.

118. A. Z. Issagulov, T. S. Makaev, M. K. Ibatov, Sv. S. Kvon, V. Yu. Kulikov, A. M. Dostayeva
Effect of reducing agent's nature on the microstructure and certain properties of 30CrNi_2Mo high-quality steel. 30CrNi_2Mo high-quality steel is a heat-hardenable steel. This quenched-and-tempered steel has high strength properties, sufficiently good plasticity and hardness. It is used to manufacture component parts that work in a complex-loaded condition under the action of alternating loads. The classical way of heat treating for this steel is quenching with subsequent high tempering, as a result of which the structure of alloyed sorbitol type is formed. The experiment results allow us to state that killing with the new FS45A15 aluminum ferrosilicon reducing agent has a beneficial effect on the formation of a fine-grained structure.