Abstracts of Papers from Foundry Journal

1 Status and Tendency of Development for Cast Low Carbon Martensitic Stainless Steel

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Abstract: A survey of material development, chemical composition, microstructure and properties of cast low carbon martensitic stainless steel in recent years was presented. The developing tendency of this steel is to decrease the contents of gases, inclusions and residual deleterious elements in steel, to optimize the microstructure and the processes of casting, welding and heat treatment.

Key words: low carbon martensitic stainless steel; microstructure; properties

2 Development of Dynamic Refining Technology and Its Application in Superalloy

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(State Key Laboratory of Materials Modification & School of Materials and Engineering, Dalian University of Technology, Dalian 116024, Liaoning, China)

Abstract: The grain refining is an effective method to increasing low-cycle fatigue life of superalloy, so the fine grain casting technology becomes the main research field of cast superalloy. In this paper, the principle and characters of dynamic refining technology were briefly...
introduced, the dynamic refining technology and its application in the superalloy were reviewed, and the development prospect of superalloy dynamic refining technology was predicted.

**Key words:** superalloy; dynamic method; grain refinement

### 3 Cyclic Heat Treatment for Microstructure Evolution of LC9 Aluminum Alloy

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**Abstract:** A new cyclic heat treatment method was presented for the semi-solid billets of LC9 aluminum alloy. The cyclic heat-treatment process was studied, and the evolution of microstructure was observed, and the effect of technological parameters on cyclic heat treatment on the microstructure of LC9 aluminum alloy was investigated. The results show that under the cyclic heat-treatment process, a semi-solid ingot of LC9 aluminum alloy with fine and uniform dendrites was obtained, which is close to the requirement of semi-solid forming. After holding 10 min at 620 °C and repeated treatment for three times, the average grain size of LC9 aluminum alloy can reach 25 μm. But too high temperature and too long holding time will lead to grain coarsening.

**Key words:** cyclic heat treatment; semi-solid forming; microstructure evolution; grain growth; aluminum alloy

### 4 Effect on Microstructure and Mechanical Properties of Al-Si-Mg Alloy with Sn-cooling Copper Mold

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**Abstract:** The melt of casting Al-Si-Mg aluminum alloys was cast into the mold cooled by Sn, then bar samples with a diameter of 10 mm were prepared. Microstructure and mechanical properties of the alloy were studied. The results show that the microstructure with grain size of 5 mm could be obtained by Sn-cooling copper mold technique, which was refined 35.7% than that of water-cooling copper mold (8 mm); micro-hardness (HV5) was increased by 17.8% (Sn-cooling copper mold: 80 HV0.05; water-cooling copper mold: 60 HV0.05) and ultimate tensile strength (UTS) was increased by 22.9% (Sn-cooling copper mold: 220 MPa; water-cooling copper mould: 179 MPa). Therefore, Sn-cooling copper mold technique could obviously refine microstructure, improve mechanical properties of alloy, and have a potential of practical application.

**Key words:** Sn-cooling copper mold; grain size; cooling rate; microhardness; tensile strength

### 5 Effects of Rare Earths and Strontium Composite Additions on Microstructure and Properties of AM60 Magnesium Alloy

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**Abstract:** The effects of rare earths and strontium composite additions on the microstructure, mechanical properties and hot cracking resistance of AM60 magnesium alloy were investigated. The results show that rare earths react with AlMn, or AlMn(Fe), phases in AM60 magnesium alloy which serve as the heterogeneous nuclei in the melt to form AlRE-Mn ternary phases, and reduce the amount of heterogeneous nuclei in the melt, thus leading to the grain coarsening. When rare earths and strontium are respectively added into AM60 magnesium alloy, strontium can counteract the grain coarsening caused by rare earths additions and reduce the harmful influence of grain coarsening on the mechanical properties and hot cracking resistance. As a consequence, it improves the yield strength at elevated temperatures.

**Key words:** AM60 magnesium alloy; rare earths; strontium; grain size; mechanical properties; hot cracking

### 6 Study on Homogenization Process for a New Type Heat Resistant Aluminum Alloy

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**Abstract:** Based on differential thermal analysis (DTA) and microstructure observation, the effect of different kinds of homogenization treatment on microstructure and mechanical properties of a new type heat resistant aluminum alloy was investigated. The results show that after homogenization treatment, in which the temperature is close to the melting point of non-equilibrium eutectic phase, the alloy obtains a fine grain boundary and the dendrite segregation is almost eliminated; the composition distributes uniformly. The second phase solutes into the Al matrix. The alloy's tensile strength is about 470 MPa and the elongation is about 8%-10%.

**Key words:** Al-Cu-Mg-Ag alloy; homogenizing annealing; microstructure

### 7 Influence on Microstructure & Mechanical Properties of Hypereutectic Al-18%Si-Mg Alloy with Rare Earth Modification

**LIU Ping**

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**Abstract:** SEM was used to observe the changes of the microstructure in hypereutectic Al-18%Si-Mg casting alloys with different amount of rare earth additions. At the same time, the effect of rare earth on the crystallizing behavior of Mg2Si phase and its mechanical properties were discussed. It was found that Mg2Si phase nucleates on the surface of the eutectic Si flakes in the fully modified alloys, growing as net or skeleton shape, however, very few and fine Mg2Si particles are isolated at the boundaries of eutectic cells in the fully modified alloys. Rare earth plays an important influence on the crystallizing behavior of Mg2Si phase in Al-Si-Mg alloy and its mechanical properties. It is thought to be related to the modification degree of α (Si) and eutectic Si phases.

**Key words:** hypereutectic; Al-Si-Mg casting alloys; rare earth modification; Mg2Si

### 8 Experimental Studies on Rheocasting Processing of A356 Alloy

**FENG Peng-fa, TANG Jing-lin, LI Shuang-shou, ZENG Da-ben**

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**Abstract:** Using the independently developed thin plate sample with five steps and rheocasting mould, a new rheocasting process of A356 alloy, which slurry preparation system and component shaping systems are apart, is experimentally studied. The results show that with the proper crucible structure and coating composition, the semi-solid alloy slurry could be smoothly transferred from the slurry preparation equipment to the rheocasting shot chamber by the slurry preparation crucible; under the rheocasting processing (boost pressure of 180 MPa, mould temperature of 200-220 °C), the tensile strength and elongation of samples could be increased by 11.6%-18.2% and 42.5%-50% respectively compared with those of traditional liquid die casting ones; and under proper rheocasting process, the semi-solid alloy slurry flows smoothly, and microstructures of samples are so dense and free of pores that the samples have the potential of strengthening by heat treatment.

**Key words:** rheocasting, slurry preparation system; component shaping system; A356 alloy

### 9 Advance in Study on Corrosion Behavior of Die-Casting Magnesium Alloy

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**Abstract:** The paper reviews the corrosion types of die-casting magnesium alloy and effects of medium on corrosion behavior and action of various alloying element in the process of corrosion. It is found that the understanding of corrosion behavior and mechanism
of the die casting magnesium alloy is still obscure and the research on the corrosion under co-existence of contact corrosion and stress corrosion is under improvement. So, it is urgent job to have better understanding and further research in those areas. Finally the suggestions are put forward on adding alloying element to decrease the content of inclusions and modify the microstructure of alloys, developing new type of corrosion resistant magnesium alloys.

Key words: magnesium alloy; corrosion behavior; corrosion protection

10 Influences of Nd on Tensile and Fatigue Fracture Mechanism of Die Casting Magnesium Alloys

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Abstract: The new rare earth compound Al, Nd, phases are formed with different amount of Nd additions in die casting AZ91D magnesium alloys, thereby the microstructure is refined and mechanical properties are improved. But when addition of Nd reached 1.5%, the mechanical properties of the alloy are decreased. The tensile fracture surfaces of AZ91D+0.5Nd alloys possess the toughness fracture features of quasi-cleavage, lacerated ridge and dimple, etc., but its fracture mode is brittle fracture. The fatigue crack of AZ91D alloys containing Nd initiates at the hole or inclusions under surface or subsurface. The fatigue crack propagation region is composed of some small facets. The most clear fatigue striations appear at the alloy of containing 1.0% Nd. The fatigue fracture surface shows the mixture of quasi-cleavage and dimple fracture. The quasi-cleavage step, river shape, trans-granular and along-granular cracks exist in the local fracture surface.

Key words: die casting magnesium alloy; Nd; tensile fracture; fatigue fractures

11 Investment Casting Technique of Heat Resistant Steel Tray and Prevention of Defection

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Abstract: The tray is a typical frame-shaped casting, and it is demanded to have high heat resistance, good resistance to heat impact and resistance to crack. Through using different casting techniques, and combining with a simulated analysis on pouring system using CASTsoft, an investment casting CAE software, the sound castings are obtained.

Key words: investment casting; heat resistance; CAE; air hole; crack; shrinkage hole; shrinkage porosity; casting technology

12 Study on Synthesis Reaction of TiC Particles in Molten Casting Al-4.5%C Alloy

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Abstract: In-situ composite of TiCp/Al-4.5%Cu were fabricated via self-propagating reaction of the preform in molten casting Al-4.5%C alloy. The thermodynamic analysis and procedure of formation of in-situ reinforced phase TiC was also conducted. The experimental results showed that the tensile properties of TiCp/Al-4.5%Cu in-situ composites have been improved remarkably compared with the Al-4.5%Cu matrix. TiC particles, average grain size of 0.15 mm, are characterized by little round plate and they are dispersed homogeneously in the matrix of α-Al, with no harmful phases formed. A new synthesis mechanism of TiC was proposed: Al reacts with Ti and C in turn to generate Al,Ti and Al,C. Much heat is released simultaneously in these two reactions, which induces the reaction between Ti and C to form TiC. As intermediate products, Al,Ti and Al,C are inevitably replaced by TiC for their unstable on thermodynamics.

Key words: in-situ; composites; TiCp/Al-4.5%C; self-propagating reaction; synthesis mechanism

13 Research and Development of CAD System Specified for Casting Numerical Simulation Software

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Abstract: The research and related technology for developing CAD system specified for numerical simulation based on OpenGL was introduced, and modules of gating systems, risers and chills, etc. were developed. It is indicated that this system has many advantages such as high stability and safety, friendly interface and simplicity of operation, and the practical application of the numerical simulation technology was promoted effectively.

Key words: numerical simulation; STL; OpenGL; solidification modeling

14 Numerical Simulation for Casting Process of Double-metal Composite Bend Pipe Based on Artificial Neural Network

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Abstract: A casting technology of double-metal composite bend pipe is presented. The application of numerical simulation optimization in casting process is investigated based on artificial neural network, and a gradienti-descent algorithm of error back-propagation with adaptive learning rate and momentum is applied. The solidifying temperature of double-metal composite bend pipe is tested by thermocouples, and taking the data obtained from the testing results of temperature field as sample, the temperature distribution during filling and solidification is simulated. By contrasting the data of simulation with those of testing, the maximum relative error of simulation is 2.1%, therefore the theory basis is presented for updating design and technology.

Key words: double-metal composite bend pipe; casting; artificial neural network; numerical simulation

15 Quantitative Measurement of Compacted Graphite Cast Iron Melt Quality

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Abstract: The closed-loop control of melt quality is the best method for the production of high quality CGI. In this process, after pre-treating, the melt quality of compacted graphite iron is measured and assessed rapidly and precisely, and some corrective adjustments can be carried out when needed to meet production requirements. The freezing segment of a cooling curve is picked out as the token of melt quality. When two curves are closely similar, the microstructure differences of corresponding samples under the same cooling condition can be neglected. Therefore, the use of cooling curves integrated with quantitative metallography, pattern recognition and database technology can be used to quantitatively predict CGI melt quality, and paving the way for closed-loop control of CGI melt quality.

Key words: compacted graphite iron; melt quality; vermicularity

16 Mold Temperature and Homogenizing Treatment’s Influence on Microstructures and Properties of As-cast Mg-12%Li-Al Alloy

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Abstract: The experiment was carried out by using lithium flux cover and argon protection in an electrical resistance furnace. The ingots of super light Mg-12wt%Li-1wt%Al as-cast alloy were melted and cast successfully in the condition of 720°C pouring temperature and 100°C, 200°C and 300°C mould temperature, and homogenized by annealing. Through the microstructures and mechanical properties analysis, the results indicate that the ingots of super light Mg-12wt%Li-1wt%Al as-cast alloy cast in the condition of 300°C mould temperature has good as-cast microstructures and properties. And when the alloy was treated in the annealing condition of 450 K × 5h, its microstructures are uniform and have better mechanical properties.

Key words: super light Mg-12Li-Al as-cast alloy; homogenization; microstructures; mechanical property
17 Coarsening Behavior of Si Particles in Powders of Rapidly Solidified Al-Si Alloy

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Abstract: The original and heat treated powders of Al-12.8%Si alloy were studied by different scanning calorimeter and electron microscope. The result showed that two successive changes of microstructure appeared at different temperatures. At 156℃ the supersaturated Si started to separate out from the primary α and structural coarsening of Si particles took place at 340℃. The coarsening behavior was still existed with the increase of the heating temperature. Otherwise, coarsening mechanism was studied and proved to be according with the classical LSW theory.

Key words: rapid solidification; powders of Al-Si alloys; coarsening behavior of Si particles

18 Research on Wear Resistance of Surface Modified SiC Nano-Powders Reinforced Grey Cast Iron

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Abstract: Grey cast iron samples reinforced by surface modified SiC nano-powders were prepared under industrial condition by pour-over method namely prior to iron liquid tapping into the pouring ladle, the SiC nano-powders was placed into the ladle. The mechanical properties and microstructures of samples with different content of SiC nano-powders as well as the wear resistance under oil lubrication were investigated. Compared with the samples without SiC nano-powders, the reinforced grey cast iron was characterized by finer microstructure and markedly improved mechanical properties and wear resistance. When the content of SiC nano-powders is 0.1%, the tensile strength of reinforced material is increased by 22.7%, and the wear resistance is much better than that of original material. The improvement of wear resistance of reinforced materials is the result of SiC nano-powders addition together with self-lubrication effect of graphite.

Key words: surface modified SiC nano-powders; grey cast iron; microstructure; wear resistance

19 Study on Sticking Together of Novolac Resin for Shell Process

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Abstract: Novolac resin synthesized by conventional process will stick together in high temperature and high humidity environment, and result in adversely effect on performance of resin. The phenomenon of sticking is analyzed by Infrared spectrum, and it indicates that in high temperature and high humidity environment, reactive points of resin attract water into the resin system. The water reduce force among molecular chains and result in slipping among them, which is the sticking together of resin. To reduce the tendency of sticking together, we use phosphoric acid as a catalyst for synthesizing resin. The results indicate that phosphoric acid may not only be a catalyst to adjust the pH value of system, but also esterify phenol hydroxyl in resin, which reduces reactive points that attract moisture in the resin. With appropriate addition of phosphoric acid, we can obtain novolac resin with narrow distribution of molecular weight, better property of anti-sticking together and high enough tensile strength. And there is no evident relation between sticking temperature and soften point of this resin.

Key words: novolac resin; sticking together; phosphoric acid

20 Effect of Ambient Temperature and Used Sand Temperature on Clay Molding Sand Performances

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Abstract: It is very important to guarantee the quality of clay moulding sand stable in mass production of clay sand casting. There are a lot of factors influencing the moulding sand performances, and two of them are ambient temperature and used sand temperature in production line. The authors used the production data from the Jiangling Casting Plant to analyze the effect of ambient temperature and used sand temperature on clay moulding sand performances, and influence of the change of ambient temperature and used sand temperature on the casting defects. According to the situation that too high temperature of the used sand and high rate of casting defect in production line at present, some suggestions on improving moulding sand quality and lessening casting defects are proposed.

Key words: clay moulding sand; quality of moulding sand; casting defects; used sand temperature; ambient temperature

21 Effect of Electromagnetic Stirring on Structure of Semi-solid Al-20%MgSi Alloy

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Abstract: The structures of Al-20%MgSi hypereutectic alloy were investigated under different stirring voltage, and the hardening mechanism was studied. The results indicated that the particles of α-Al phase, which were non-existent for non-stirring casting of Al-20%MgSi hypereutectic alloy, appeared and the primary MgSi cluster became bigger, and it was also found that the hardness of Al-20%MgSi hypereutectic alloy under electromagnetic stirring was greatly improved.

Key words: electromagnetic stirring; primary MgSi; hardness

22 Effect of Subnano-SiO2 on Harden Time of Silica Sol Shell Mold

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Abstract: The experimental study on harden time of silica sol shell mold with addition of 15% NH4Cl and subnano-SiO2 was run. It is found that the harden time of silica sol shell mold is decreasing with the increasing of NH4Cl adding amount, while reducing first then raising and reducing again with the increasing of subnano-SiO2 adding amount. But when subnano-SiO2 was added individually, the effect on silica sol is unobvious. Only when it is added together with NH4Cl, can harden time of silica sol shell mold be shorten several to dozens times compared with that of NH4Cl addition. The experimental results show that subnano-SiO2 plays a role of accelerating solidification and hardening of silica sol shell mold, so as to reduce the adding amount of NH4Cl.

Key words: subnano-SiO2; silica sol shell molding; harden time

23 Design of Machine Molding Casting Pattern for Rear Axle Housing

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Abstract: This article describes how to choose reasonable parameters such as the shrinkage allowance/contraction coefficient), technique pad and machining allowance, etc. when casting grey iron housings, in order to keep the size of casting meet the demands of its machining, and finally get qualified components.

Key words: shrinkage; technique pad; machining allowance

24 Size Assurance of BF Cooling Stave during Manufacture

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Abstract: Due to some problems of size accuracy existing during cooling stave manufacturing in our company, some methods are adopted such as using experienced data, pattern operation and reasonable inserted piece. And a good result was obtained finally.

Key words: cooling stave; pattern; inserted piece; size assurance
1 Some Development of Induction Melting and Electromagnetic Shaping for Special Alloys

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Abstract: Induction melting and electromagnetic shaping for liquid metal is a material processing technique without mould (or crucible), which has advantages of no contamination and short processing cycle. The principle and characteristics of some typical methods of induction melting and electromagnetic shaping were discussed. The development trends of those induction melting and electromagnetic shaping techniques were also prospected. Because electromagnetic shaping and directional solidification integrates together the melting of metal, no contact electromagnetic shaping of melt and controlling of solidification structure, so it is considered to be suitable for shaping special alloys which are high melting-point, oxidizable and liable to react with mould material.

Key words: special alloy; cold crucible induction melting; electromagnetic levitation; magnetic suspension melting process; electromagnetic shaping and directional solidification

2 The Study Development on LFC Coating of Magnesium Alloys

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Abstract: The differences between LFC coatings of magnesium alloy and cast steel, iron, aluminium alloy were analyzed. The development was presented and some aspects of study on LFC coating of magnesium alloy were given.

Key words: magnesium alloy; LFC; coating

3 Alloy Materials for Passage Flow Parts of Slurry Pump

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Abstract: Passage flow parts of slurry pump are subjected to erosion corrosion and sometimes cavitation corrosion. On the basis of extending the working life, decreasing the adding amount of noble alloy elements, using alternate alloy elements, and adopting working surface strengthening technology can reduce the material cost. Available new materials for passage flow parts of slurry pump are high, super high and medium chromium cast irons, corrosion resistant alloys and cermets. Corrosion resistant alloys include nickel-chromium alloy and tungsten cobalt titanium alloy. There are two kinds of preparing methods for cermets, i.e. overall strengthening and surface strengthening, and the surface strengthening includes chemical heat treatment, physical vapor deposition and plasma spraying.

Key words: slurry pump; alloy; materials; application

4 Study on High Strength Cast Aluminum Alloy for High Voltage Switch Shell

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Abstract: In order to enhance the property of cast alloys used for high voltage switch shells to meet the demand of extra-high voltage power transmission for shell materials, study on high strength cast aluminum alloy was carried out. On the basis of AISI10Mg alloy, effect of alloy element Cu, and modifiers RE and Sr on alloy mechanical properties after heat treatment was investigated. The result showed that the addition of RE can increase both the tensile strength and elongation of AISI10Mg alloy after heat treatment; Cu can enhance the tensile strength but decreased the elongation greatly; Combined with 1%RE, the addition of Sr can obviously improve the elongation and increase tensile strength further. With 1%Zn, 0.15%Ti, 3%Cu and the combined addition of 1%RE and 0.015%Sr, the mechanical properties of AISI10Mg alloy after heat treatment are σ₅ = 570 MPa, δ₅ = 2%, which can meet the demand for property of high voltage switch shell.

Key words: high voltage switch shell; AISI10Mg; mechanical property; combined modification of RE and Sr

5 Research on High Hardness High Chromium Compound Cast Iron Rolls

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Abstract: An advanced process of three times pouring and two times compounding is used to improve the low tensile strength in the compound layer and the core of high chromium compound cast iron rolls. By optimizing composition design and effective modification for outer layer and middle layer material, the tensile strength, fracture toughness and wear resistance of material are improved. At the same time, high hardness and low residual austenite content are also obtained successfully through quenching and twice tempering.

Key words: high chromium compound cast iron; high hardness; rolls; modification

6 Effect of Solidification Condition on Secondary Dendrite Arm Spacing of A357 Alloy under Counter-Pressure Casting

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Abstract: The effect of counter-pressure casting parameters on secondary dendrite arm spacing (SDAS) of A357 alloy was studied. It was found that sand mould with chill has the strongest influence on decreasing SDAS. SDAS is small when the distance from bottom is small because of the chilling effect. There is no obvious effect of pressure on decreasing SDAS. In order to obtain castings with 1TS greater than or equals to 20 MPa, SDAS must be less than 55 μm, namely, local cooling rate Vc, greater than or equals to 0.23℃/s.

Key words: counter-pressure casting; secondary dendrite arm spacing; A357 alloy

7 High Temperature Strengthening Effect of Trace RE on Industrial Al-Si Piston Alloy and Its Microstructural Analysis

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Abstract: The effect of trace RE on high temperature strength and microstructure of ZL109 piston alloy was investigated by means of tensile testing, SEM, EPMA, etc. The results show that trace RE, acting as trace-alloying elements, can increase the high temperature ultimate tensile strength (UTS) of ZL109 piston alloy. After the addition of RE with Ce, the number of AlNiCu intermetallic phases in ZL109 alloy increase. It is also shown that a kind of granule shape Al-Ce-La-Ni-Cu-Si RE-rich compound forms in alloy, which provides a new idea for further strengthening ZL109 alloy.

Key words: Al-Si piston alloy; RE; high-temperature strength; microstructure

8 Thermal Fatigue Research of Ni-Based Infiltrated Layer on Copper Substrate

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Abstract: The effect of trace RE on high temperature strength and microstructure of ZL109 piston alloy was investigated by means of tensile testing, SEM, EPMA, etc. The results show that trace RE, acting as trace-alloying elements, can increase the high temperature ultimate tensile strength (UTS) of ZL109 piston alloy. After the addition of RE with Ce, the number of AlNiCu intermetallic phases in ZL109 alloy increase. It is also shown that a kind of granule shape Al-Ce-La-Ni-Cu-Si RE-rich compound forms in alloy, which provides a new idea for further strengthening ZL109 alloy.

Key words: Al-Si piston alloy; RE; high-temperature strength; microstructure
Refinement of Aluminum Ingot of AZ91D Magnesium Alloy

Abstract: Thermal fatigue property of Ni-based infiltrated layer on copper substrate has been investigated. Oxidation only happened on the surface of infiltrated layer when thermal cycling times was less than 20, and no cracks was observed. While, micro-cracks appeared at the interface between the infiltrated layer and the substrate, as well as on the surface of the infiltrated layer when the thermal cycling times was beyond 50. The thicker the infiltrated layer was, the earlier the micro-cracks appearing. The corrosion pit appeared at the interface between the infiltrated layer and substrate and the damage mechanism of infiltrated layer tested was stress corrosion.

Key words: Ni-based infiltrated layer; thermal fatigue; stress; corrosion pit.

9 Effect of Pulsed Magnetic Field on Solidified Structure of AZ91D Magnesium Alloy

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Abstract: The influences of cooling rate, magnetic density and discharging frequency on the solidified structure of magnesium alloy AZ91D under pulsed magnetic field were studied, and the related mechanism was also discussed. Under the pulsed magnetic field, the solidified structure of AZ91D magnesium alloy is refined markedly. The dendrite morphology of the primary phase is changed and the rosettes primary α-Mg phase is formed. The network of eutectic phase is discontinuous and the amount of eutectic phase distributing on grain boundary decreases. With the decreasing of cooling rate of melt and the increasing of magnetic density or discharging frequency, the grain size of magnesium alloy AZ91D decreases.

Key words: magnesium alloy AZ91D, pulsed magnetic field, solidified structure

10 Effect of Ultrasonic Power on Density and Refinement of Aluminum Ingot

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Abstract: Relationship between the occurrence of porosity in ingot and the factors such as the intensity of ultrasonic vibration were discussed. Moreover, the mechanism of the porosity formation and the effect of ultrasonic power on structure refinement of aluminum ingot was studied. The results show that the threshold value existed during the occurrence of cavitation in the melt by the output power of ultrasonic vibration. The degasification was effective only when the output power above threshold value. Inversely, the degasification was ineffective, therefore the gas content in the ingot was increased and the density was decreased.

Key words: ultrasonic power; ingots; porosity; grain refinement; aluminum alloy

11 Application of UG’s Second Development Technology in Automatically Forming of 3D Solid Molding of Roughcast

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Abstract: According to the idea of parametric design in 3D solid molding software, information on the parts’ dimension, configuration and requirement of manufacture should be input computer, then be analyzed by the second development software. At last, the system exports the 3D solid molding draft automatically, which can provide important evidences for foundry tool design in cold machining, and at the same time can transform to the rough casting draft and casting method draft easily and quickly.

Key words: 3D solid molding; parametric design; casting rough; Unigraphics NX; second development

12 An Evaluation Model for Porosity of Spheroidal Graphite Iron

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Abstract: The paper studied the effects of carbon equivalent, inoculation and casting modulus on porosity of spheroidal graphite iron using a series of castings. The result reveals that higher carbon equivalent and more inoculation will reduce the porosity. And for the hypereutectic and eutectic spheroidal graphite iron, their area ratio will increase with decreasing of the casting modulus, but for the hypereutectic spheroidal graphite iron the results becomes opposite. A regression model has been developed with the parameters of carbon equivalent, inoculation and cooling rate at the eutectic temperature. The model provides a new method to quantify the porosity of the spheroidal graphite iron.

Key words: spheroidal graphite iron; porosity; mathematical model

13 Evaluation of Iron Casting Comprehensive Performance Based on Improved Grey Relational Grade

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Abstract: A grey relational grade analysis model of iron casting comprehensive performance evaluation was proposed. It took iron casting bending strength, impact toughness, HRV of matrix, HRV of carbides, HRC of material as comprehensive performance parameters, and judged iron casting quality according to its grey relational grade between evaluating sample and the ideal sample. To solve the problem that existed in traditional grey relational analysis on weights distribution and determination, an improved grey relational grade analysis method was applied. The influence of evaluation index on evaluation objective was embodied by giving different weight, which determined by information entropy of sample. It can avoid subjective influence, so the result of iron casting quality evaluation was more scientific and rational.

Key words: iron casting performance; evaluation; grey relational grade; weights; information entropy

14 Measurement Method of Filtering Effect for Foam Ceramic Filter

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Abstract: In order to solve the difficulty of measuring the foam ceramic filter quality, the measurement method of filtering effect for foam ceramic filter has been developed. Based on the method of coloring up on the casting surface and image analysis by MATLAB software, the measurement method has been built and used in process control. The filter quality of different foam ceramic filter can be compared effectively by this method.

Key words: foam ceramic filter; measurement method; image treatment

15 Analysis of Graphite Particles Distribution in Spheroidal Graphite Cast Iron Based on Multi-fractal Theory

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Abstract: In order to describe the distribution condition of graphite particles in spheroidal graphite cast iron, a description method based on multi-fractal theory was proposed. It is through picking up the distribution characteristics of graphite particles’ distribution density with the Matlab Fractal tool box to describe the un-spheroidal of graphite quantificationally. The width of multi-fractal spectrum and the D-value between maximum and minimum subset dimension reflected the distribution condition of graphite particles. The analytical results of graphite particles images in spheroidal graphite cast iron specimens with different content of cerium indicate that the multi-fractal analytical
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method is reliable and practical.
Key words: spheroidal graphite cast iron; multi-fractal; distribution uniformity

16 Manufacturing Technology of DN2600 Ductile Iron Pipe

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Abstract: Through studying the manufacturing technology of DN2600 ductile iron pipe, characteristic and difficulty in the production process and mould making are clarified, and the guide for mass production of DN2600 ductile iron pipe is given.
Key words: centrifugal ductile iron pipe; mould making; production process; defect prevention

17 Influence of Heat Treatment on Precipitation Behavior of 1Cr22Mn15N Stainless Steel

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Abstract: The paper investigated the influence of temperature and time on carbides (nitrides) precipitation of 1Cr22Mn15N stainless steel by metallographic and electron microscope in the course of solution plus aging treatment. The results show that the Cr6C2 precipitation has many kinds of distribution shapes along the grain boundaries in the experimental temperature range, including granulation, worm, layer and chrysanthemum shapes, and vegetates into inner-crystal, but most of α-phase precipitations are granular. The corresponding isothermal precipitation kinetics curves of nitrides and carbides were obtained. The nose-top temperature of Cr6C2 precipitation is about 850°C, and the corresponding aging time is 100-180 s. The precipitation of nitrides and carbides scarcely takes place over 950°C, and the critical cooling rate of no precipitation is 3.5°C/s. The educts are mostly Cr7C3 and the longer the aging time, the more the precipitation of Cr6C2. A small amount of α-phase also precipitate with the increasing of ageing time. Hydrogen mainly exists in the form of Cr6C2 supersaturated interstitial atom.
Key words: aging treatment; stainless steel; educts

18 Erosion-corrosion Behavior of Cast High Alloy Stainless Steel in Water-sand Medium Containing Dilute Sulfuric Acid

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Abstract: Effect of Cr-Ni-Mo composition on microstructure of cast high alloy stainless steel was studied by EPMA and SEM. Erosion-corrosion (E-C) behaviors of four kinds of high alloy stainless steels containing different Cr-Ni-Mo chemical composition were compared in simulated strong-erosion and weak-corrosion medium (0.1M H2SO4 + 10%H2O2) by using self-made E-C apparatus and SEM. The microstructure of wear tracks of the samples after E-C. The results show that Cr and Mo significantly promote the precipitation of α-phase, while Ni restrains the precipitation of α-phase. The characteristics of E-C for cast high alloy stainless steels in simulated medium represented that erosion is dominant and corrosion is subordinate, at the same time strong interaction exists between corrosion and erosion. The σ-phase does not decrease corrosion resistance of high alloy stainless steels, but can improve markedly E-C resistance.
Key words: cast high alloy stainless steel; α-phase; erosion-corrosion

19 Study on “White Punctate Segregation” in High Intensity ZL205A Alloy Large-Sized Casting

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Abstract: “White punctate segregation” had been discovered in ZL205A alloy large-sized casting by X-ray detection, which can’t be abated or eliminated by adjusting foundry technique and heat treatment. It was studied in this paper by testing the mechanical properties and analyzing the microstructure and chemical components, and the forming mechanism and solutions were discussed too.
Key words: ZL205A alloy; segregation; mechanical properties; microstructure; forming mechanism

20 Influence of Pouring Temperature on Primary Austenite in Semi-Solid Hypoeutectic High Chromium Cast Iron

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Abstract: Semi-solid slurries of hypoeutectic high chromium cast iron were prepared by inclined cooling plate method. Influence of pouring temperature on the size and shape of primary austenite in semi-solid hypoeutectic high chromium cast iron was studied. The results showed that molten metal was highly chilled by the inclined cooling plate under the lower pouring temperature. The primary austenite nucleated significantly in the super-cooling molten metal to form almost all the fine and roundish grains. With the increasing of pouring temperature, the super-cooling degree of molten metal and nucleation rate of austenite decreased, which lead to much more dendritic grains. When the temperature further increased, grains didn’t grow in the form of dendrite but to every directions to obtain coarse and equiaxed austenite grains.
Key words: pouring temperature; inclined plate; hypoeutectic high chromium cast iron; semi-solid

21 Character of Used Sodium Silicate Bonded Sand under Different Temperature

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Abstract: The physical morphology and mechanical property of residual binder film on used sodium silicate bonded sand under different temperature were studied systematically. The results of simulated experiments are coincident with those of sand sample experiments. The residual strength of the used sodium silicate bonded sand under 520°C is the lowest between 320°C-520°C. And the physical morphology of the binder film presents many bigger or smaller holes under the same temperature. Further more, the working life under this temperature is near to that of the raw sand basically. Therefore, heating used sodium silicate bonded sand under 320°C-520°C before reclamation would improve the effectiveness of dry reclaiming greatly.
Key words: temperature; used sodium silicate sand; physical morphology; mechanical property

22 Effects of Alloy Elements on Medium Silicon Heat Resistant Cast Iron and Its Application in Cast Aluminum Mould

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Abstract: Adding different alloys combination of RE, copper and titanium, then through inoculation and nodulizing treatment, we get the microstructure of ferrite plus pearlite and spheroidal graphite. It was found that adding single copper can increase the thermal conductivity and oxidation resistance of the medium silicon heat resistant cast iron; while adding RE can refine the grain and improve the adhesion of the oxide film, and increase the heat-fatigue resistance. Adding Ti can’t form spheroidal graphite easily, it worsen the distribution of graphite and increased the total amount of graphite and ferrite, which leads to the decline of strength of heat resistant cast iron. When adding copper and RE together, the regular spheroidal graphite was gained with good comprehensive properties. Finally it solved the problem that the cast Al mould can’t serve for a long time.
under high temperature successfully.

Key words: heat resistant cast iron; oxidation growth; spheroidal graphite; comprehensive properties

23 Effect of Iron on Microstructure and Properties of As-Cast High Aluminum Bronze

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Abstract: The influence of different Fe content on microstructure and properties of as-cast high aluminum bronze has been studied. Results show that with the increasing of Fe content, grain size of the alloy decreases, content of hard K-phase increases, and the shape of K-phase changes from dispersed dot to sphere and cinquefoil, the distribution of eutectoid changes from discontinuous block to isolated point which surrounds the K-phase. The strength and hardness of the alloy can be improved with proper content of Fe (4%), while the mechanical properties are deteriorated with excessive Fe content.

Key words: as-cast high aluminum bronze; Fe; microstructure; mechanical properties

24 Optimum Design of Foundry Technology for Iron Castings of Wheels

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Abstract: Some foundry technologies widely used to produce iron castings of wheels are reviewed. The shortcomings of these technologies, such as parting at middle plane and tangent pouring at flange, parting at top plane and tangent pouring at flange, and parting at top plane and pouring at risers of flange, are commented. The basic theory and key technical points of a new kind of lap gate or riser adopted to produce iron castings of wheels are discussed and its good economic results in production are also presented.

Key words: iron castings of wheels; foundry technology; lap gate; riser

25 Application of Furan Resin Bonded Sand in Foundry Production and Its Quality Control

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Abstract: The application of furan resin bonded sand in foundry and the key points for quality control were introduced from aspects of technological management, quality management as well as production management. Importance has been attached to site management and process control, gradual improvement of employees’ quality awareness and enhancement of operation throughout the production process. Only when the passive mode of management has been turned into an active one, can both the internal and external quality of products be effectively guaranteed. Meanwhile, the emphasis has been placed on the innovation and service awareness of technical and managerial staff so as to resolve the problem arising in the course of production, thus improving the technical strength and management of the company on a continual basis.

Key words: resin sand; foundry; process control; quality management

26 Application of an Intelligent Temperature Control Apparatus to Aluminum Electrolysis Holding Furnace

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Abstract: The paper introduces the performance and characteristic of KK-C intelligent temperature control apparatus. And combining with the requirement for temperature control of the aluminum electrolysis holding furnace, the thermocist control procedure of KK-C apparatus was elaborated. The application results show that this apparatus can meet the demand of production for its advantages of accurate control, nimble action, simple connection, low cost, high dependability and need no calibration and maintenance, etc.

Key words: KK-C intelligent temperature controlling apparatus; aluminum electrolysis; casting; holding furnace; thermostat control

1 Review of Research on the Corrosion Film of Magnesium Alloys

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Abstract: The poor corrosion resistance is the primary obstacle to expand the application of magnesium alloys. In this paper, the composition and structure of corrosion films of pure magnesium and Mg-Al alloys formed in atmosphere and NaCl solution are introduced. Besides, the influence of Ca and rare earth elements on corrosion film of magnesium alloys is presented and the development of anti-corrosion magnesium alloys is put forward.

Key words: magnesium alloys; corrosion film; Ca; rare earth

2 Development of Phase-Field Model Simulation during Directional Solidification of Alloys

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Abstract: This paper reviews the application of phase-field simulation on directional solidification of alloys. During simulation, two important parameters during directional solidification, the growth speed and temperature gradient, which were calculated theoretically, were adopted, and then the results of simulation were compared with the theoretical conclusion. The method of frozen temperature approximation was applied to simplify the calculation in phase-field model simulation.

Key words: directional solidification; phase-field model; growth; temperature gradient; interfacial morphology

3 Influence of Continuous Casting Processing Parameters on Friction Property of Self-Lubricate and High Wear Resistant Aluminum-Silicon Alloy

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Abstract: The effect of temperature gradient, pouring temperature and hosing speed on wear resistance of the self-lubricate high wear resistant aluminum-silicon alloy were studied using orthogonal testing method. The result showed that the temperature gradient and pouring temperature are remarkable factors in the experiment. Preparing this alloy under high temperature gradient and low pouring temperature is better to obtain the superior comprehensive properties of giving consideration to high wear resistance and antifriction performance (low friction coefficient). Its friction coefficient is only 0.135 and wearing capacity is 380.6 mg.

Key words: high temperature gradient; friction coefficient; wear resistance; gravity segregation

4 Application of Vacuum Drying in Preparing Process of silica Sol Ceramic Mold

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Abstract: Silica sol ceramic mold was prepared by using the colloidal molding technique. The materials used to prepare silica sol ceramic mold were JN-50 silica sol, silica powder and NH·OCl. Research found that there are nearly no cracks appear on surface of silica sol ceramic mold by vacuum drying. Vacuum drying process of silica sol ceramic mold gained by the experimental is drying temperature 80-100°C, drying time 5 h and vacuum 0.06-0.07 MPa. The expected values of shrinkage ratio (drying shrinkage ratio and total shrinkage ratio)and compressive strength on silica sol ceramic mold gained by the repeated
experiments are 0.97%, 1.04% and 5.05 MPa, respectively. The results show that vacuum drying can be used in preparing process of silica sol ceramic mold.

**Key words:** silica sol; ceramic mold; vacuum drying; shrinkage ratio; compressive strength

5 **Research of Surface Carburizing on Titanium Alloys by Electrospark Deposition**

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**Abstract:** It can make carburized layer on titanium alloys by electrospark deposition, and the carburized depth is about 40-50 μm. The carburized layer is mainly made up of TiC which is produced during the reaction between graphite electrode and titanium matrix. There is no clear interface between the carburized layer and matrix, and the transition of structure and component are homogeneous. The microhardness of the carburized layer of TA2 alloy is up to 2000 HV0.05, which is as 5-7 times as that of the base. And the hardness of the carburized layer shows gradient distribution.

**Key words:** titanium alloy; electrospark; carburizing; TiC; hardness

6 **Fabrication of AZ91 Magnesium Alloy Foam**

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**Abstract:** The AZ91 magnesium alloy foam with a diameter of 9 mm was fabricated by using vacuum melt infiltration and water quenching methods. NaCl salt was used as a pre-mold in this investigation. The porosity and density were 0.002 g/cm³ and 0.724 g/cm³ respectively for the AZ91 magnesium foam. The pores were evenly distributed in the material. The results of compression test show that the plastic deformation of the AZ91 magnesium alloy foam is much higher than that of the as-cast AZ91 magnesium alloy. The shear fracture occurred at low stress during the pores pressing.

**Key words:** melt infiltration; AZ91 magnesium alloy foam; fracture mechanism

7 **Influence of Solution Treatment on Shape Memory Effect and Mechanical Properties of As-Cast FeMnSiCrNi Alloy**

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**Abstract:** Before and after solution treatment, the shape memory effect of the modified Fe-Mn-Si-Cr-Ni alloy was studied. The results showed that after solution treatment the amount of stress induced ε martensite increased as compared with as-cast one. The microstructure analysis showed that the solution treatment eliminated coarse columnar dendrites and polygonal austenite grains were attained. During deformation, more martensite was induced due to no hindrance of columnar dendrites. In addition, the solution treatment could improve remarkably the elongation of as-cast alloy.

**Key words:** shape memory alloy; casting; solution treatment; mechanical properties

8 **Effect of Melt Treatment on Microstructure and Property of a Modified Inconel 718C Alloy**

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**Abstract:** Effect of melt treatment on microstructure and mechanical properties of a modified inconel 718C alloy was studied. The results show that microstructure of finer dendrite, lower segregation and less amount of Laves phase is obtained after melt treatment. Also, smaller γ’ phases with more uniform distribution precipitate in the specimen via melt treatment. Melt treatment shows no obvious effect on the 25°C and 700°C tensile strength, while it evidently improves the tensile plasticity and the stress-rupture property. Specimens via melt treatment at 1600°C for 10 minutes exhibit the best mechanical properties. But the mechanical properties fall when the melt treatment time longer than 10 minutes.

**Key words:** superalloy; melt treatment; segregation; mechanical property

9 **Effect of V/C on Thermal Fatigue Property of Cast Hot-Work Die Steel**

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**Abstract:** Thermal fatigue property of the cast hot-work die steels with different V/C was investigated with the self-restricting test method. The thermal fatigue behaviors of the cast hot-work die steel and H13 steel were also contrasted. The results indicate that the thermal fatigue of the cast hot-work die steel is a high-cycle thermal fatigue, and the thermal fatigue resistance is decided by thermal strength and thermal stability. With the increasing of V/C, thermal fatigue resistance increases first and then decreases. As V/C is 3.0, thermal stability and thermal strength of the cast hot-work die steel are improved because of dispersed VC in the microstructure, thus thermal fatigue resistance reaches the maximum. It is found that the V/C of the cast hot-work die steel is better than that of H13 steel.

**Key words:** cast steel; hot-work die; thermal fatigue; V/C

10 **Effect of TRT Process on Glass Forming Ability of Cu-Based Bulk Amorphous and DSC Study on Bulk Amorphous Alloys**

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**Abstract:** The Cu50Zr42Al8 ternary alloy rods with diameters of 3.0 mm were prepared by copper mold with suction casting method in water cooling crucible. Effects of TRT (thermal rate treatment) process on bulk amorphous alloys which be prepared by copper mold with suction casting method have been studied. It is found that the GFA (glass forming ability) of the bulk amorphous alloys can be increased by TRT process, and there is a best heating temperature. The kinetics of the non-isothermal crystallization of the Cu50Zr42Al8 by differential scanning calorimeter is studied in the mold of continuous heating. The result indicates that with the increase of the heating rate, the parameter of thermal stability and TRG increase correspondingly.

**Key words:** bulk amorphous alloys; TRT (thermal rate treatment) process; differential scanning calorimeter (DSC)

11 **Calculation and Experiment on Cavity Vacuum Pressure in Vacuum Die Casting Process**

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**Abstract:** In vacuum die casting process, the characteristic of cavity vacuum pressure curve was studied by theoretical calculation and experimental measurement through installing a vacuum pressure sensor inside the experimental die. The calculation result was proved to be consistent with the experimental one. The cavity vacuum pressure of different slow injection processes were investigated. An important parameter, the vacuum time, was indicated to have obvious influence on the quality of vacuum die castings. Based on the calculation of cavity vacuum pressure, a method was proposed to help adjusting the vacuum system and to optimize the slow injection process in a vacuum die casting to keep the cavity vacuum pressure on an appropriate level.

**Key words:** vacuum die casting; process parameter; vacuum pressure; process optimization
12 Thermal Degradation Product and Its Flame Retardant Properties of Magnesium Alloy Lost Foam Casting Pattern
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Abstract: The degradation property of magnesium alloy lost foam casting has been tested and analyzed, the results showed that the thermal degradation product of the three foam materials such as EPS, EPMPM and SMMA during magnesium alloy casting was mainly made up of styrene, a small quantity of liquid product, little molecule and some gaseous product. Through observing and analyzing the foam degradation in magnesium alloy casting, the little molecule was considered mainly composed of reductive gaseous matter with good flame retardant property.
Key words: lost foam casting; magnesium alloy; thermal degradation product

13 Effects of Pouring Temperature and Mechanical Vibration on Microstructure and Mechanical Properties of Lost Foam Casting Magnesium Alloy
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Abstract: The effects of pouring temperature and mechanical vibration on microstructure and mechanical properties of AZ91D alloy via LFC were investigated. The results showed that it is beneficial to refine the grain of AZ91D alloy via LFC and improve its mechanical properties at low pouring temperature, but the refined effect is not obvious and the change of its mechanical properties at 740°C and less than 740°C are not great. The grain of AZ91D alloy at different pouring temperature can be obviously refined by mechanical vibration, and the refined effect is the best at 740°C. Mechanical vibration can also improve the mechanical properties to a great extent, and the values of tensile strength, elongation are increased by 23.2%, 20.8%, respectively, compared with as-cast one.
Key words: AZ91D; lost foam casting; pouring temperature; mechanical vibration

14 Fabrication Technique of SiP/ZA27 In-Situ Composites and Its Mechanical Properties
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Abstract: The fabrication technique of silicon particle/SiP reinforced ZA27 in-situ composites (SiP/ZA27) and its mechanical properties were investigated. The results indicate that the size of SiP increases with the decreasing of pouring temperature at certain silicon content and also increases with the increasing of silicon content at a certain pouring temperature. A SiP/ZA27 composite with fine SiP and distributed uniformly can be obtained under an appropriate pouring temperature (750°C) and a silicon content (10 vol.%). The addition of silicon results in the formation of large number of porosities, which lead to a significant decrease in mechanical properties. The size and shape of SiP also affect the mechanical properties. The phosphor can obviously modify the SiP, and thus enhance the mechanical properties of SiP/ZA27.
Key words: in-situ; SiP/ZA27 composites; fabrication; mechanical properties

15 Microstructure and Comprehensive Mechanical Properties of SiCp/Al Composite Made by Pressureless Infiltration Technique
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Abstract: 6vol.%SiCp/Al composites were prepared successfully by pressureless infiltration. Microstructural observation on the composite indicates that the particles in the composite were quite uniform and the composite material has strain rate effect under high strain rate when compared with quasi-static strain rates. It is also found that the composites reinforced by smaller SiC particles (100 μm) have high flow stress and yield stress. Compressive mechanical properties strongly depend on the particles size.
Key words: pressureless infiltration, SiCp/Al composite; mechanical properties

16 Studies on Interface Structure and Property of Compound Rolls Cast by Electromagnetic Semi-Continuous Compound Method
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Abstract: The compound roll was produced by the electromagnetic semi-continuous compound method. High chromium cast iron was used as wear layer material and No.45 steel as axes material in the experiment. When the holding time is from 180 s to 540 s, the composition and structure morphology of bonding interface was analyzed, and mechanical property was tested around bonding interface. The result indicates that the interface is divided into the diffusion layer and chill solidified layer. The average thickness of interface is 50.95 mm in this test, and it increases gently. Elements from both materials diffuse mutually cross bonding zone of the interface, and chromium is active. With the increasing of the holding time, diffusion of chromium from wear layer toward center is more and more sufficient. The micro hardness of wear layer and axis is very different, but it changes gently at the interface. The impact toughness and the shear strength at interface increase first and then decrease slowly with the increasing of the holding time, and reach the maximum when the holding time is 300 s.
Key words: composite casting; composite interface; microscope structure; property

17 Forecast of Casting Defects with the Finite Element Analysis
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Abstract: The mathematic model in the solidification process of the casting is built up with finite element method and ANSYS software. Considering the nonlinearity of material vs. temperature and the latent heat of crystallization in the process of phase transformation, simulation was conducted to the temperature field, the temperature gradient field and the stress and strain field during the solidification process, and the distribution and changing regulation of the transient temperature fields are gained. The positions where the shrinkage cavity and shrinkage porosity may occur are forecasted, meanwhile, the method of judging the heat crack is discussed. The result shows that the simulated result is correspond to the experimental result.
Key words: solidification process; shrinkage cavity and shrinkage porosity; heat crack

18 Simulations of Temperature Fields on Ceramic Core and Ceramic Shell during Directional Solidification
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Abstract: Taking the hollow turbine blades as typical parts, the simulations of the temperature fields on blade, ceramic core and ceramic shell during directional solidification were investigated. The expansion characteristic of ceramic in the course of solidification was analyzed and the locating model of ceramic cores was designed and presented.
Key words: ceramic cores; ceramic shell; simulation of temperature fields; directional solidification

19 Effects of Sylvite Multi-Modification on Carbine Morphologies and its Distribution of High Vanadium High Speed Steel
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Abstract: The microstructure evolution of high speed steel and the distribution of carbides and the reasons for the occurrence of this phenomenon were investigated in the high speed steels containing 3-5% vanadium, 0.8-1% of cobalt, 12% of manganese, and 1.5% of silicon. The results indicated that the cementite and carbides in the microstructure were refined and the amount of these phases decreased. The intergranular carbides were transformed into the network carbides or the parallel carbides that were more distributed in the austenite. The microstructure analysis results indicated that the refined effect of sylvite was obvious in the high speed steel. With the increasing of sylvite content in the molten steel, the distribution and the amount of carbides were refined and the intergranular carbides were transformed into the network carbides or the parallel carbides. The refined effect of sylvite was more obvious in the high speed steel containing 5% vanadium.
Key words: sylvite modification; microstructure; carbides; high speed steel
Abstract: The effects of different sylvestre multi-modifications (sylvestre containing B, Ti, Zr respectively) on carbide morphologies of high vanadium high speed steel were investigated. The results show that, with the addition of multi-modification agent of sylvestre containing B or sylvestre containing Ti, not only the amount of the primary VC increase, but also the shape of the primary VC becomes much more smooth and spherical. Furthermore the distribution of them becomes more homogeneous. With the addition of multi-modification agent of sylvestre containing Zr, the amount of the primary VC is not changed, but the shape of them is modified, the eutectic carbides are broken up and refined.

Key words: high vanadium high speed steel; multi-modification; carbide morphology

20 Effect of Nd Addition on Glass-Forming Ability of Mg-Based Bulk Metallic Glasses

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Abstract: Mg65Cu25NdxY10-x (x=4, 5, 7, 10) bulk metallic glasses were prepared by a method of casting the melt into copper mould in the air, and then the effect of Nd on the glass-forming ability of these alloys was studied. The structures of as-cast alloys were analyzed with X-ray diffraction, and the glass transition, crystallization and melting behavior of the alloys were investigated using differential scanning calorimetry (DSC). It is demonstrated that the glass-forming ability of Mg65Cu25Nd5YS alloy is the best. Metallic glass strip with a critical thickness of 4.5 mm is obtained, and the supercooled liquid region ATg is about 54.5 k while the reduced glass transition temperature Tg/2 is 0.581. For the alloys with x ≥ 5, the metallic glasses exhibit a reduction of both the glass transition temperature Tg and ATg with the increasing x value. There is also a corresponding change of Tg/2.

Key words: Mg-based metallic glass; supercooled liquid region; glass-forming ability

21 Study on Heredity of A291D Magnesium Alloy with Recycled Scrap

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Abstract: The AZ91D magnesium ingot is remelted together with recycled scrap with different weight ratio in this experiment, and the microstructure and property of remelted magnesium alloy are discussed. The results indicate that the microstructure and properties of remelted magnesium alloy take on heredity with different extent when the weight ratio of added recycled scrap is different. The characteristic of the short range orderly structure atomic group of magnesium alloy is same as or resemble to that of feed materials during the melting process. Thus the atomic congestion in alloy liquid results in the heredity of magnesium alloy.

Key words: magnesium alloy; heredity; recycled scrap; remelted

22 Strengthening Action of Alloying on Mechanical Property of Heat Resistant Steel for Reduction Tank

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Abstract: The multiple alloying of low Ni type and high Ni type heat-resistant steel for reduction tank of smelting magnesium was designed. The observation of microstructure and test of mechanical property for samples indicated that the element of Mo, W, Nb and V etc. can form the carbide and nitride, which are dispersed in the matrix and effectively improve the strength of heat resistant steel at room temperature and high temperature, and at the same time the higher Ni type is beneficial for reducing the quantities of oxides at high temperature. The calculation and analysis on chemical composition also indicated that high Ni type heat resistant steel can effectively prevent the harmful δ phase from occurring.

Key words: reduction tank; alloying; harmful phase; heat-resistant steel

23 Effect of Trace Element on Compressive Properties of Ti-Si Eutectic Alloy

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Abstract: The effects of yttrium (Y), beryllium (Be), samarium (Sm), boron (B) and neodymium (Nd) on the microstructures and compressive properties of Ti-8.5wt%.Si eutectic alloy at room temperature (RT) were studied. It was shown that the compressive strength and ductility at RT can be improved effectively by addition of trace elements such as Y, Be, Sm, B, Nd, and the microstructure was also refined. The effect of boron on the compressive ductility was the most obvious. This could be the nucleation rate of the alloy improved because of the exogenous inclusion B.

Key words: trace element; Ti-Si; eutectic; compressive properties

24 Solution of Surface Decarbonization of Shaw Process Casting Die

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Abstract: The technique by which surface decarbonization of shaw process castings can be completely eliminated was introduced in detail, and the theory is discussed. The propane gas was filled into the cavity to drive away the air before pouring liquid and thus the pressure of oxygen decreases to the minimum value. The gas was filled continuously until the temperature is up to 600°C and led the die with steel cover. Then the air is isolated absolutely and the pressure of gas in the cover was decreased, so that the surface decarbonization of shaw process castings is completely eliminated.

Key words: shaw process casting; surface decarbonization; propane gas

25 Founding Forming of Aluminum Alloy Precision Pressure-Resistant Cabins with Thin-Walled Structure

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Abstract: This paper describes construction feature and material's selection of the precision pressure-resisting cabins with thin-walled structure which works under the fluid loads, and presents some typical application of the aluminum alloy founding technology in the USA's missile manufacturing, at the same time analyses counter-pressure founding forming process of the aluminum alloy water-pressure-resisting cabin with thin-walled structure.

Key words: aluminum alloy founding; thin-walled pressure-resistant cabin; precision casting; counter-pressure founding; tightness

26 Analysis on Fissuring of ZGMn13Cr2Mo Antifriction Tup

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Abstract: In this paper, analysis on the fissuring accident of ZG Mn13Cr2Mo antifriction tup is performed, and the reason is believed to lie in serious casting defects of shrinkage cavity, porosity and inclusion. In other words, when the water toughening process is applied, the operation temperature is not high enough to dissolve the carbides completely, thus uniform austenite is not obtained. Finally, the slight fissures cracks along the direction of undissolved carbide and crystal boundary, and it is proved that undissolved carbide lowers the bond strength at the crystal boundary.

Key words: antifriction tup; undissolved carbide; porosity; shrinkage cavity; water toughening process