



Chapter 5 Design of Gating System for Lost Foam Casting

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5.1 Overview of gating system

The gating system is the general term for the channel through which the liquid metal flows into the cavity in the casting mold.

, Inner runner and other components. Whether the design of the gating system is correct or not has a great influence on the quality of castings.

In the industry, 30% of the waste products are related to the imperfect design of the gating system and the narrow range of process adaptation.



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5.2 Basic requirements of gating system

• The position, direction and number of all runners should conform to the solidification principle or feeding method of castings. •

Fill the cavity within the specified casting time. • Provide the necessary filling pressure head to ensure the contour of the casting

and clear edges and corners. • Ensure that the molten metal flows smoothly, avoid turbulence, prevent involvement, absorb gas

and over-oxidize the metal. • Has good slag resistance ability. • When the molten metal enters the cavity, the linear speed should not be

too high to avoid splashing and scouring the mold wall. • Ensure that the metal liquid level in the mold has a sufficient rising speed to avoid

defects such as sand inclusion, scarring, wrinkling, and cold insulation. • The metal consumption of the gating system is small and easy to

clean.



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3. Basic types and characteristics of gating system

1. According to the proportion of the cross-sectional area of each unit of the gating system

The traditional casting theory regards liquid metal as an ideal fluid. According to the proportion of the cross-sectional area of each unit of the gating system, it can be divided into:

Open type, semi-closed type; think that the closed type is a filled type, and the open type is a non-filled type pouring system. Liquid metal is real

The international fluid has viscosity and resistance during the filling process. Only when the liquid metal in all the runners is under positive pressure, does it appear full.

flow state.



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3. Basic types and characteristics of gating system

1. According to the proportion of the cross-sectional area of each unit of the

pouring system, the actual calculation and pouring proof: the closed type is a filled type, and the open type is not necessarily a non-filled type.

• Closed type: $A_{\text{cup}} > A_{\text{straight}} > A_{\text{horizontal}} > A_{\text{inside}}$. The blocking cross-sectional area is on the inner runner. After the pouring starts, the molten metal is easy to fill the pouring system, and the slag blocking ability is strong, but the filling liquid flow speed is fast, the scouring force is large, and splashing is easy to occur during the lost foam casting process. It is said that the consumption of molten metal is small, easy to clean, and suitable for medium and large pieces.

• Open type: $A_{\text{inside}} > A_{\text{horizontal}} > A_{\text{straight}}$. The straight blocking surface is at the end of the sprue, and when the opening ratio of each unit is large, the metal liquid is not easy to fill the straight, horizontal and inner runners, and it is in a non-full flow state, the filling is stable, the scouring force to the cavity is small, but the slag blocking Poor ability. Generally speaking, the molten metal consumes a lot and is not easy to clean. It is often used for metal castings such as non-ferrous alloys, ductile iron and cast steel, which are easy to oxidize.

• Semi-closed type: $A_{\text{horizontal}} > A_{\text{straight}}$, $A_{\text{horizontal}} > A_{\text{inside}}$, $A_{\text{straight}} > A_{\text{inside}}$. The choke section is in the inner runner, and the cross runner section is the largest. The pouring system can be filled during pouring, but it is later than the closed type, and it has certain scum and slag blocking capabilities. Due to the large cross-sectional area of the runner, the flow rate of the molten metal in the runner is reduced, and the stability of the filling and the scouring force to the cavity are better than those of the closed type, which are used more in the design of the lost foam process.

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5.3 Basic types and characteristics of gating system

5.3.2 According to the injection position of the inner gate on the casting, it can

be divided into top pouring pouring system, middle pouring pouring system, bottom pouring pouring system and step pouring pouring system. • Top pouring

gating system: The inner runner is designed at the top of the casting, and the molten metal flows into the cavity from the top surface, which is easy to fill, which is conducive to the formation of a bottom-up solidification sequence of the casting. The feeding effect is good, and the gating system consumes less molten metal. Easy to style and clean up. However, the impact force on the cavity is large, and it is easy to produce molten metal splashing, oxidation, and easily cause defects such as blisters, pores, and oxidation slag inclusions. It is suitable for small parts with simple structures and thick-walled iron castings with high feeding requirements. Here I have to mention the rain pouring system widely used in the casting of the motor shell and the blanking pouring system for some small pieces .



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5.3 Basic types and characteristics of gating system

5.3.2 According to the injection position of the inner gate on the casting, it can

be divided into top pouring pouring system, middle pouring pouring system, bottom pouring pouring system and step pouring pouring system. •Mid-injection

gating system: The inner runner is opened at a certain height in the middle of the casting, which has the advantages and disadvantages of top-injection and bottom-injection. It is suitable for small and medium-sized alloy castings with relatively uniform wall thickness and not too large height. .





Chapter 5 Design of Gating System for Lost Foam Casting

5.3 Basic types and characteristics of gating system

5.3.2 According to the injection position of the inner gate on the casting, it can be divided into top pouring pouring system, middle pouring pouring system, bottom pouring pouring system and step pouring pouring system.

Bottom casting gating system: The inner runner is located at the bottom of the casting, and the molten metal fills the mold Stable, less impact on the cavity, not easy to oxidize , which is conducive to the discharge of the gas generated by the foam gasification out, but the temperature of the lower part of the casting is high, which is not conducive to feeding, and the consumption of metal liquid is high, if filling If the time is too long, the cooling of the front end of the molten metal is relatively strict. Heavy, seriously affecting the surface quality of castings. Foreign lost foam casting uses bottom injection type more





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5.3 Basic types and characteristics of gating system

5.3.2 According to the injection position of the inner gate on the casting, it can be divided into

top pouring pouring system, middle pouring pouring system, bottom pouring pouring system and step pouring pouring system. • Step casting system: the molten metal enters the cavity and

is layered from bottom to top, the inner runner is dispersed, the impact force of the molten metal is small, and the filling is stable . It has the advantages of bottom injection and top injection.

and the surface quality of the casting is good.



• However, the cleaning of the gating system is more
troublesome, and the process yield is low.

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4. Composition and requirements of gating system

1. The sprue cup is

used to receive the molten metal from the ladle, preventing the molten metal from splashing and overflowing, and facilitating the filling; reducing the impact of the liquid flow on the cavity; separating the slag and air bubbles to prevent them from entering the cavity; increasing the filling pressure head. a. Types: There are two types that are more practical in lost foam casting: inner cups and outer cups, which are basically funnel-shaped.

箱内浇口杯



箱外浇口杯





Chapter 5 Design of Gating System for Lost Foam Casting

4. Composition and requirements of gating system

1. pouring cup

• In-box pouring cups

The so-called in-box cup means that it is connected with the sprue before the box is embedded. We commonly use foam sprue cups and paper fiber sprue cups. The former is foam cutting or mold direct molding. Generally, more hollow ones are used. Hang the paint bake with the foam model

Dry, there are also connected after the paint is done separately.

Advantages: The advantages of this type of pouring cup are light weight, simple installation, tight connection between the pouring cup and the sprue, and it is not easy to float the box during pouring

, In addition, this type of pouring cup has a good thermal insulation effect, and it is not easy to cause the molten metal to

cool down. Disadvantages: The disadvantage of the foam pouring cup is that it is not resistant to erosion, especially when pouring large pieces for a long time, the molten metal is easy to break through the coating.

The material layer causes sand hole defects in the casting, so many manufacturers have adopted the method of wrapping refractory fiber mesh or ceramic coating.

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4. Composition and requirements of gating system

1. Pour cups & In-box

pouring cups



Many manufacturers have adopted the method of wrapping refractory fiber mesh or ceramic coating.

Chapter 5 Design of Gating System for Lost Foam Casting

4. Composition and requirements of gating system

1. pouring cup

• Out-of-box sprue

cup As the name suggests, the out-of-box cup is placed outside the sand box, that is, it is placed on top of the plastic sheet after covering it. In Hershey, it is easy to float the box during pouring, and the temperature of the molten metal in the early stage of pouring is relatively serious.



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4. Composition and requirements of gating system

1. pouring cup

pouring cup outside the box

used in real production

There are two broad

, one is a ceramic pouring

cup, the other is a pressure

Force-Formed Sand Sleeve

pouring cup



Chapter 5 Design of Gating System for Lost Foam Casting

4. Composition and requirements of gating system

1. Pour cup b. Shape and

size: Whether it is an inner

cup or an outer cup,

Generally funnel-shaped, for convenience

Generally, the opening of the pouring pair of bags is larger

, of course, the size of the casting, the pouring time, and

the gold accepted by the ladle must also be considered.

The weight of the liquid, here we recommend

A ruler that is often used for small and medium pieces

Inch



Chapter 5 Design of Gating System for Lost Foam Casting

5.4 Composition and requirements of gating system

5.4.2 Sprue The

sprue guides the molten metal downward from the sprue cup and enters the runner, the sprue or directly into the cavity . Provide enough pressure head, so that the molten metal can overcome various filling resistances under the action of gravity , fill the cavity within a specified time, and some sprues have the function of feeder feeding. In lost foam casting, we usually make the sprue into a cone with a large upper and a small lower, most of which are hollow, which is very beneficial for pouring.





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5.4 Composition and requirements of gating system

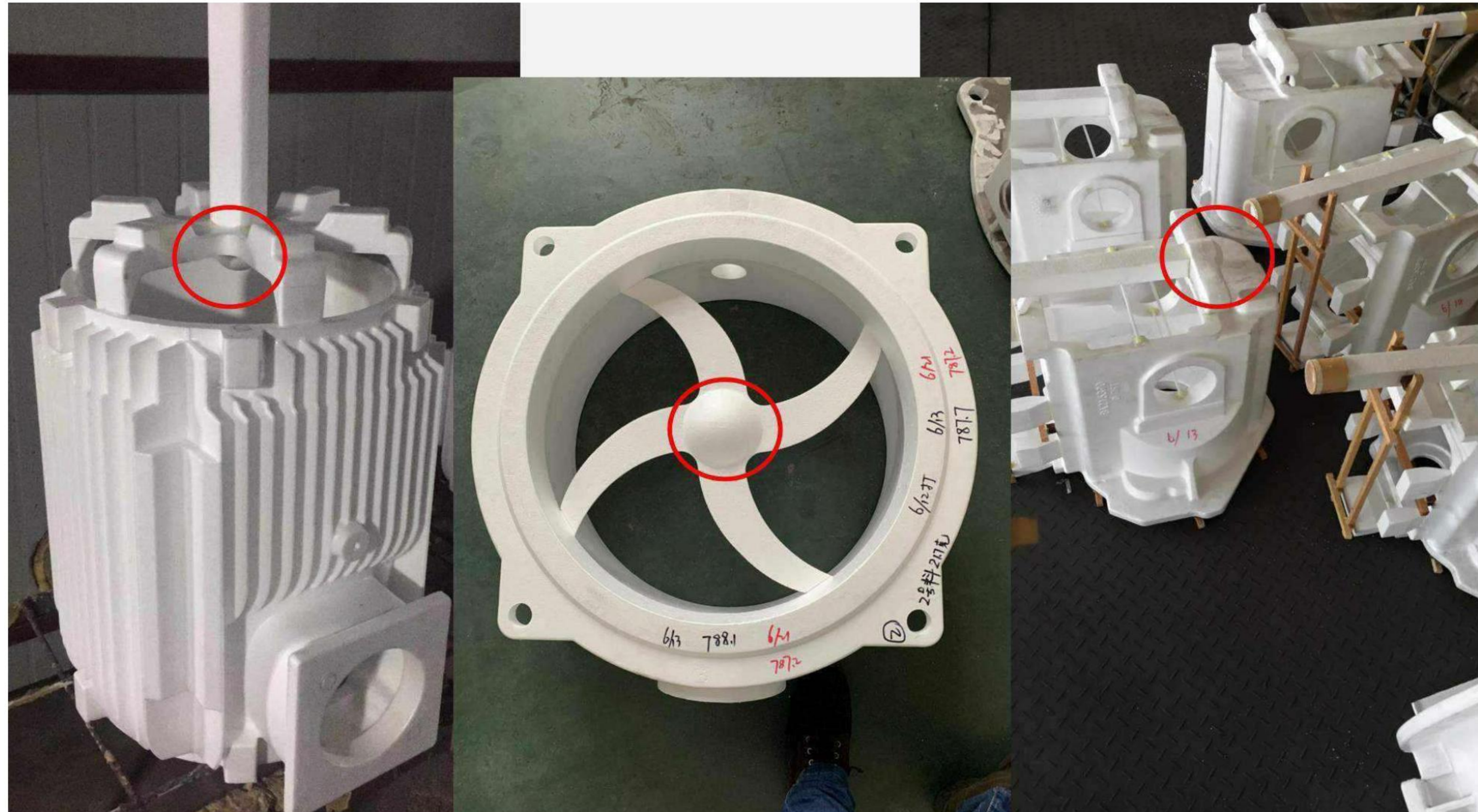
5.4.3 Cross runner

Cross runner plays a key role in the whole pouring system. It distributes clean molten metal to the inward runner, and stores the initially poured low-temperature molten metal containing gas and slag, which plays a certain role in retaining slag and floating. slag function, and ensure smooth filling. Here we want to remind the importance of setting the sprue socket. The sprue socket is generally located just below the connection between the sprue and the sprue. During the pouring process, the molten metal has a strong impact on the bottom of the sprue. , and produce eddy current and highly turbulent flow area, often causing casting defects such as sand flushing, slag holes and a large number of oxide inclusions. Setting the sprue socket can improve the flow state of the molten metal, play a buffering role, and float the bubbles in the molten metal; shorten the highly turbulent area at the corner of the sprue-runner, and reduce the turbulence at the corner of the sprue-runner. Local resistance coefficient and head loss; at the same time, it can also improve the flow distribution of the inner runner to ensure smooth filling.

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5.4 Composition and requirements of gating system

5.4.3 Runners



The sprue socket is

generally made into a hemispherical shape.



Chapter 5 Design of Gating System for Lost Foam Casting

5.4 Composition and requirements of gating system

5.4.4 Inner runner The

function of the inner runner is to control the filling speed and direction, distribute the molten metal, adjust the temperature and solidification sequence of each part of the casting, and the molten metal of the gating system has a certain feeding effect on the casting through the inner runner. , the location and number of runners on the casting should be determined in accordance with the selected solidification sequence or feeding method. The following principles should be considered when designing the inner runner: ý For castings that require simultaneous solidification, the inner runner should be opened at the thin wall of the casting. Local overheating nearby caused sticky sand. ý For castings that require sequential solidification, the runner should be set up at the thick wall and equipped with a riser. If the runner passes through the riser, the molten metal will first flow through the riser and then enter the cavity to improve the riser's capacity. Packing effect. ý For castings with complex structures, the principle of combining sequential solidification and simultaneous solidification should be used to design the inner runner, that is, the inner runner should be set according to the principle of sequential solidification for each area that needs to be fed, and the principle of simultaneous solidification should be used for the entire casting. The use of multiple inner runners to disperse the mold filling, so that the thick and large parts of the casting can be fully fed, and the occurrence of shrinkage holes and shrinkage porosity can be avoided, and the casting stress and shrinkage deformation of the casting can be reduced. ý When the wall thickness of the castings is very different, and the molten metal must be introduced from the thin wall, the cold iron and riser should be used appropriately; the pouring process can be used to replace the riser to ensure the feeding effect of the castings and improve the process yield. . ý For ductile iron castings, the gate back pumping should be taken into account in the design of the gate.



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5.4 Composition and requirements of gating system

5.4.5 Riser The

riser is a cavity in the mold for storing molten metal. When the casting is formed, the molten metal is supplied to prevent shrinkage cavities, shrinkage porosity, exhaust gas and slag collection. There are two main types of risers used in lost foam casting: feeding risers and slag collecting risers. a. Feeding riser: The design of the feeding riser should follow the solidification method of the casting, the distribution of hot spots, and the calculation of the feeding amount. It is more convenient and easier to set the riser in the lost foam casting than in the traditional casting. content, and reasonably design the shape, size and quantity of the slag collecting riser. b. Slag collecting riser: The slag collecting riser can also be set according to the traditional casting method, but here is to explain the particularity of the molten metal filling of lost foam casting . The slag collecting riser we usually design The existence of "wall effect" actually has a very small effect. For some thick-walled parts, the effect is more obvious. Its main function is to collect cold molten iron to avoid defects such as wrinkling, cold insulation, and insufficient pouring. In addition, the design size of the slag collection riser should be Judging by the wall thickness.

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5.4 Composition and requirements of gating system

5.4.5 Riser

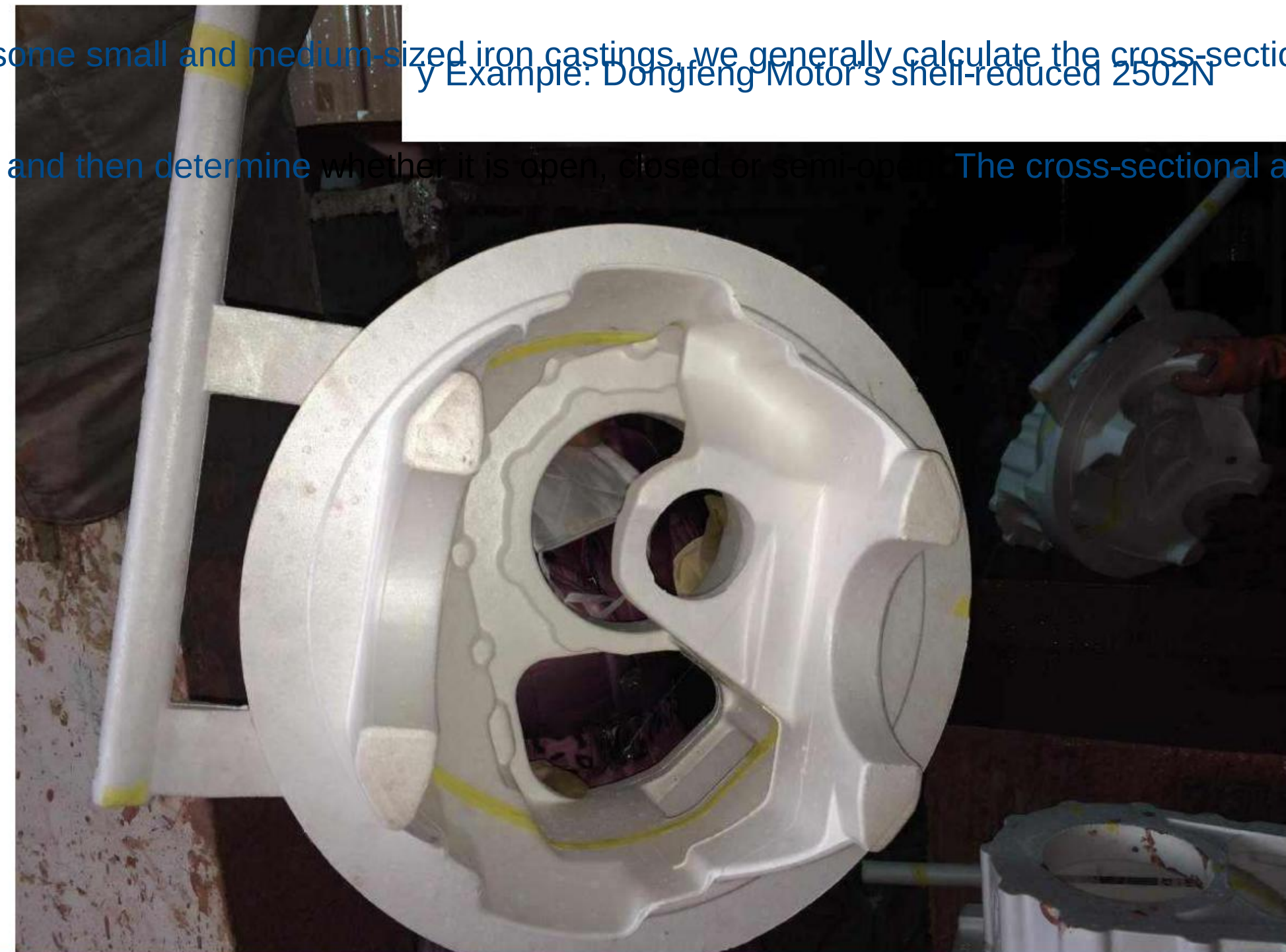




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5.5 Calculation of cross-sectional area of gating system

It is recommended that the lost foam technical engineer study the casting process design part of the "Casting Handbook", design the preliminary process through rigorous fluid mechanics calculation, and determine the final reasonable process after pouring verification, which is convenient for continuous production with high quality and quantity. Here, we share an empirical calculation method. For some small and medium-sized iron castings, we generally calculate the cross-sectional area of the inner runner, A_{in} = the square root of the weight of the casting, and then determine whether it is open, closed or semi-open. The cross-sectional area of the sprue and the runner.



Proportion coefficient 0.8-2.0



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5.5 Calculation of cross-sectional area of gating system

• Example: Dongfeng Motor's shell-reduced 2502N piece

weighs 65kg and is made of QT450-10. It requires good surface finish, no slag holes and blisters, and needs to be tested for air tightness. The following points should be considered in the process design: • The material is QT450-10, and the foam particles are made of copolymer (STMMA). • The wall thickness of the reduced shell is uneven, and the wall thickness is too large (minimum 5.5mm, thickest 40mm). In order to facilitate molding, And to ensure that the surface finish of the casting is made of 3A copolymer. • The structure of the inner cavity of the reduced shell is relatively complex. According to the principle of standing up and not lying down, standing pouring is adopted to facilitate sand filling. • The vertical pouring height is 550. It is recommended to use step pouring. The total flow of the first layer of the inner gate accounts for 2/3 of the total weight, so that the total area of the first layer of the inner gate is $S=65^{2/3}$ (square root)=6.6 The square centimeter is rounded to 7 square centimeters. In order to ensure the stable filling of the molten iron, the size of the inner gate is basically set at 8mm*90mm.

• The inner gate of the second layer mainly plays the role of supplementing the heat of molten iron (reducing the temperature gradient). Rapid filling $S=65^{1/3}$ (square root) * flow coefficient (0.8-2.0), in order to ensure the rapid filling flow coefficient Estimate 1.5-2.0, in addition, for molding and bonding convenience, use 8mm*80mm. • In order to ensure smooth filling, the ratio of the cross-sectional area of the sprue to the cross-sectional area of the inner gate is 1.2-2.0



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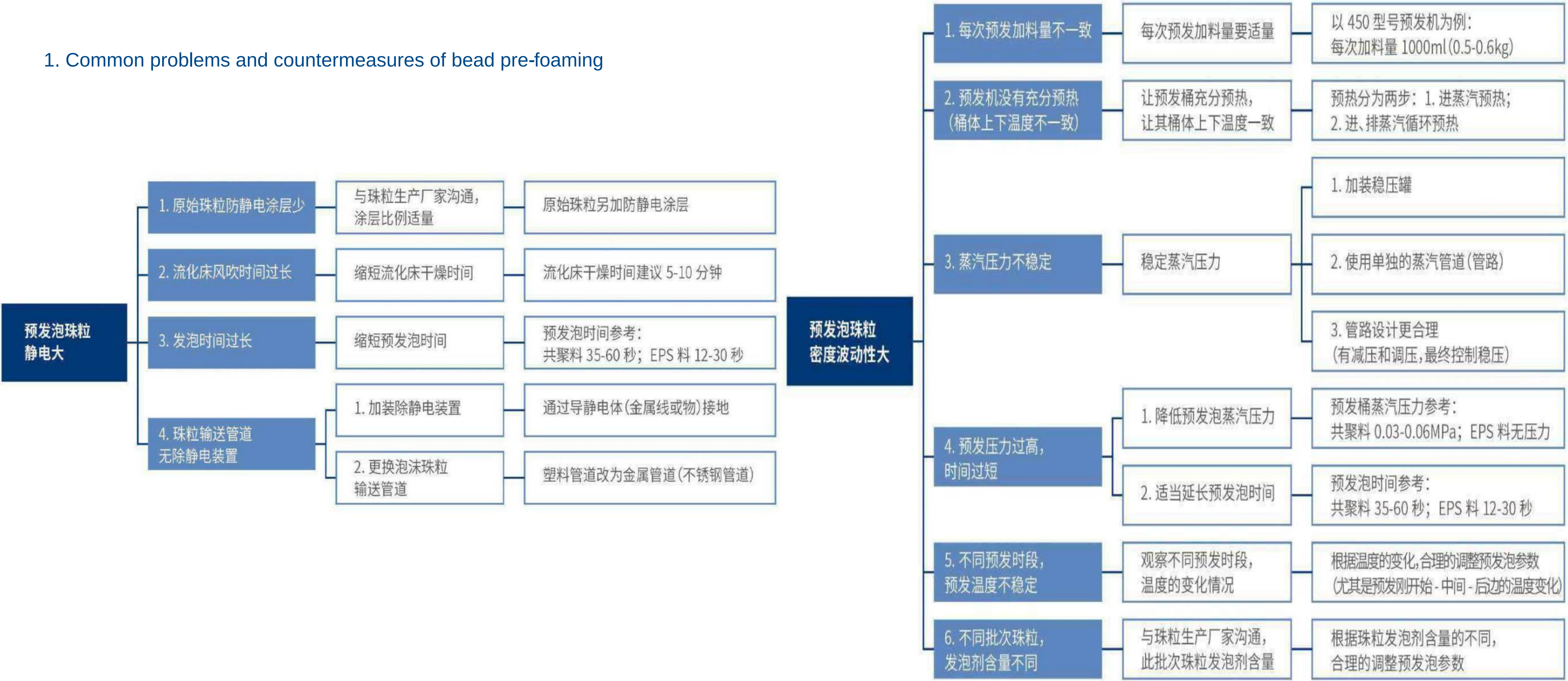
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2. Defects and countermeasures of coatings
3. Typical problems in the pouring process
4. External defects of castings



1. Analysis and countermeasures of common defects in foaming and molding

1. Common problems and countermeasures of bead pre-foaming

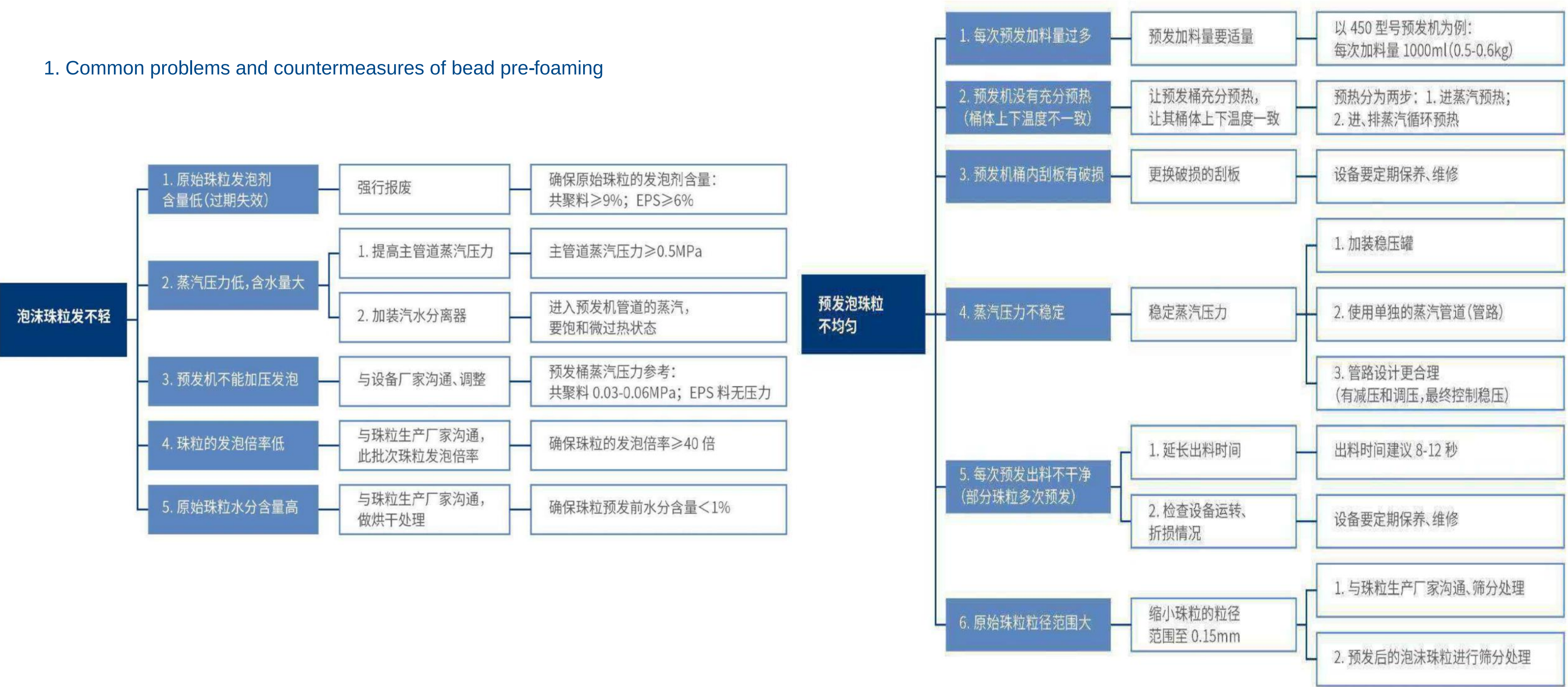




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1. Analysis and countermeasures of common defects in foaming and molding

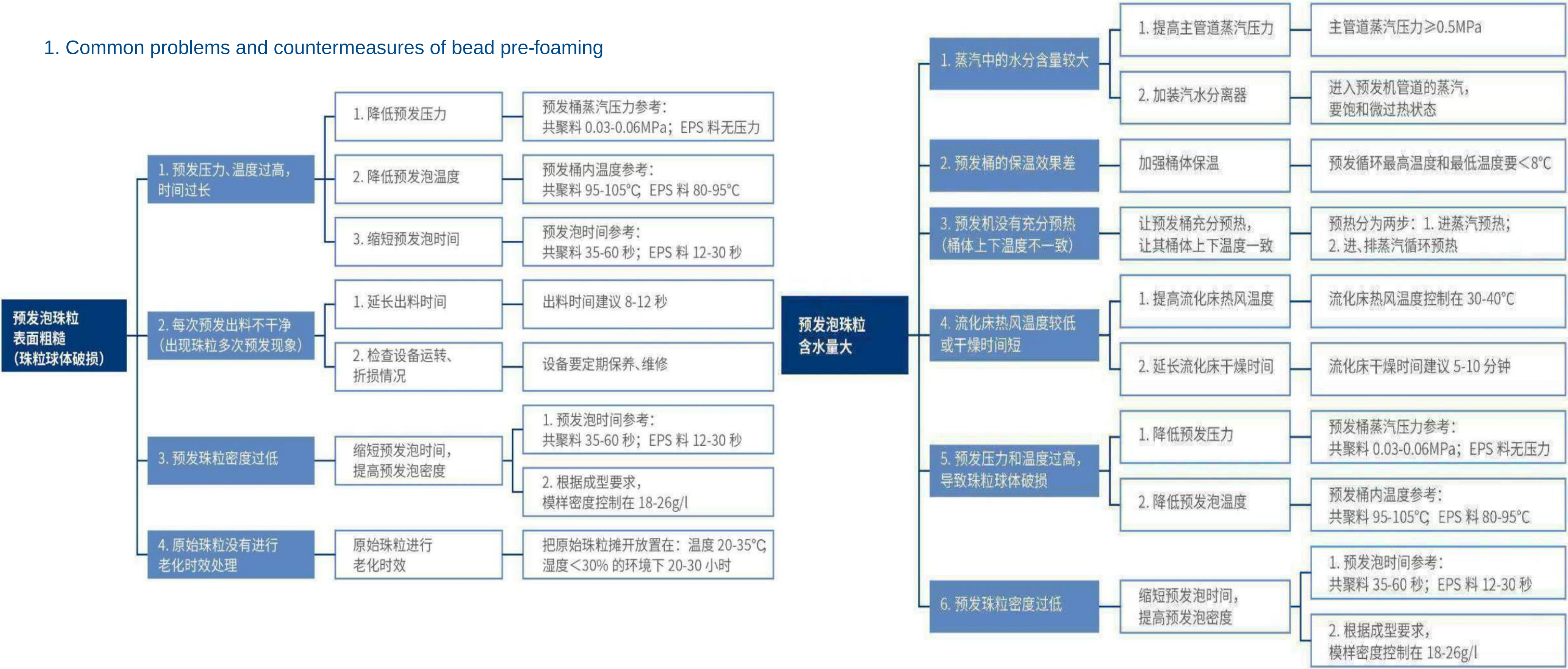
1. Common problems and countermeasures of bead pre-foaming





1. Analysis and countermeasures of common defects in foaming and molding

1. Common problems and countermeasures of bead pre-foaming

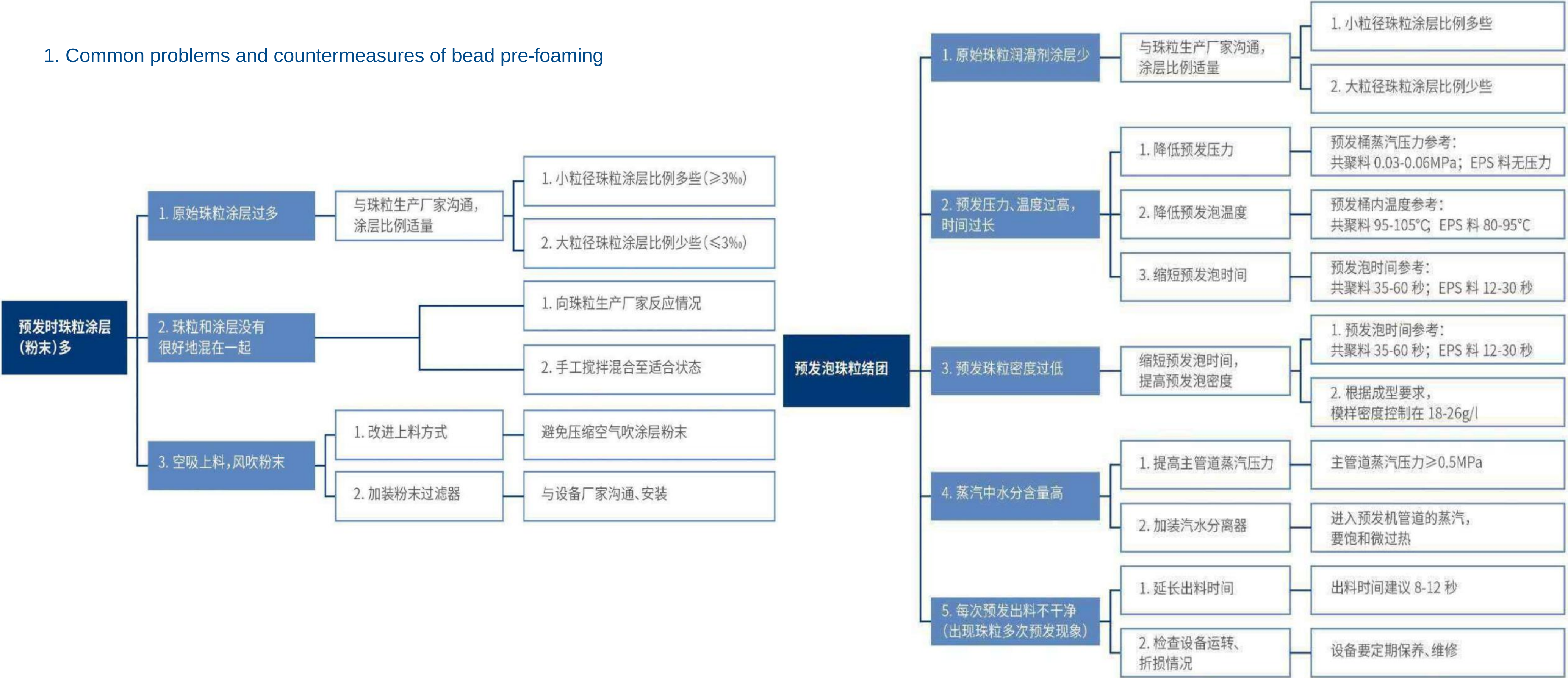




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1. Analysis and countermeasures of common defects in foaming and molding

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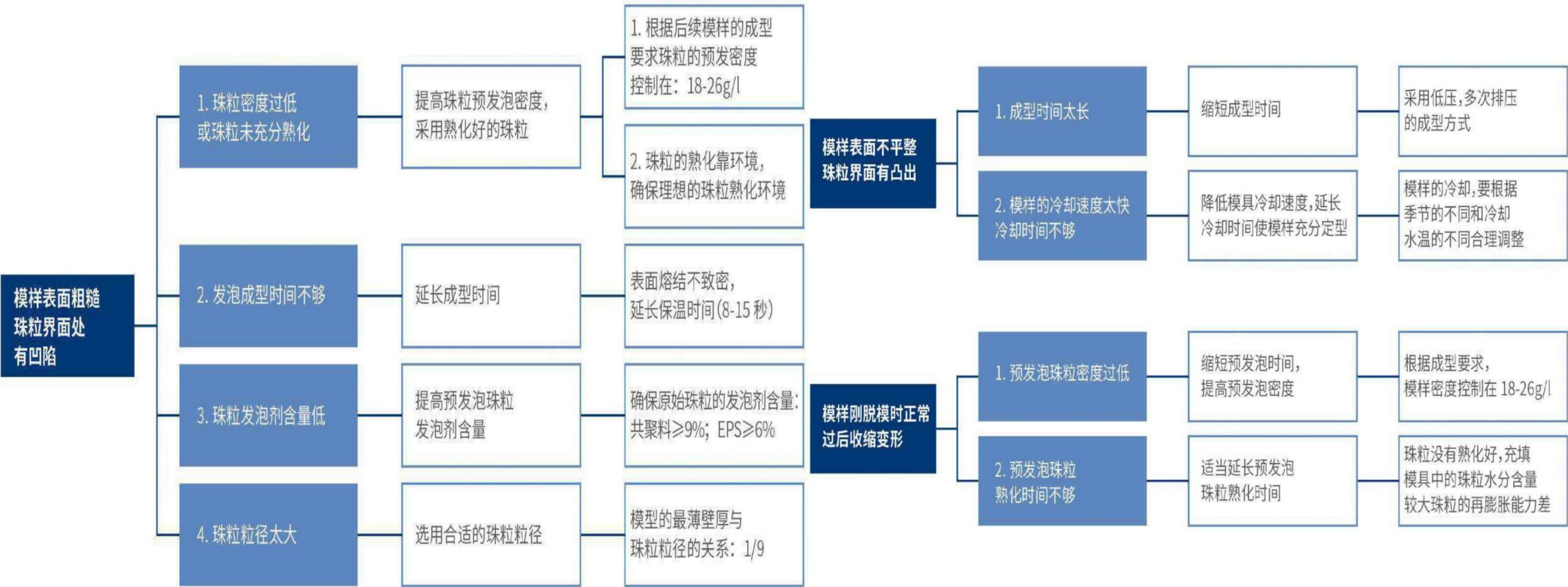




Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.1 Analysis and Countermeasures of Common Defects in Foaming and Forming

6.1.2 Common defects and countermeasures of foam molding





Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.1 Analysis and Countermeasures of Common Defects in Foaming and Forming

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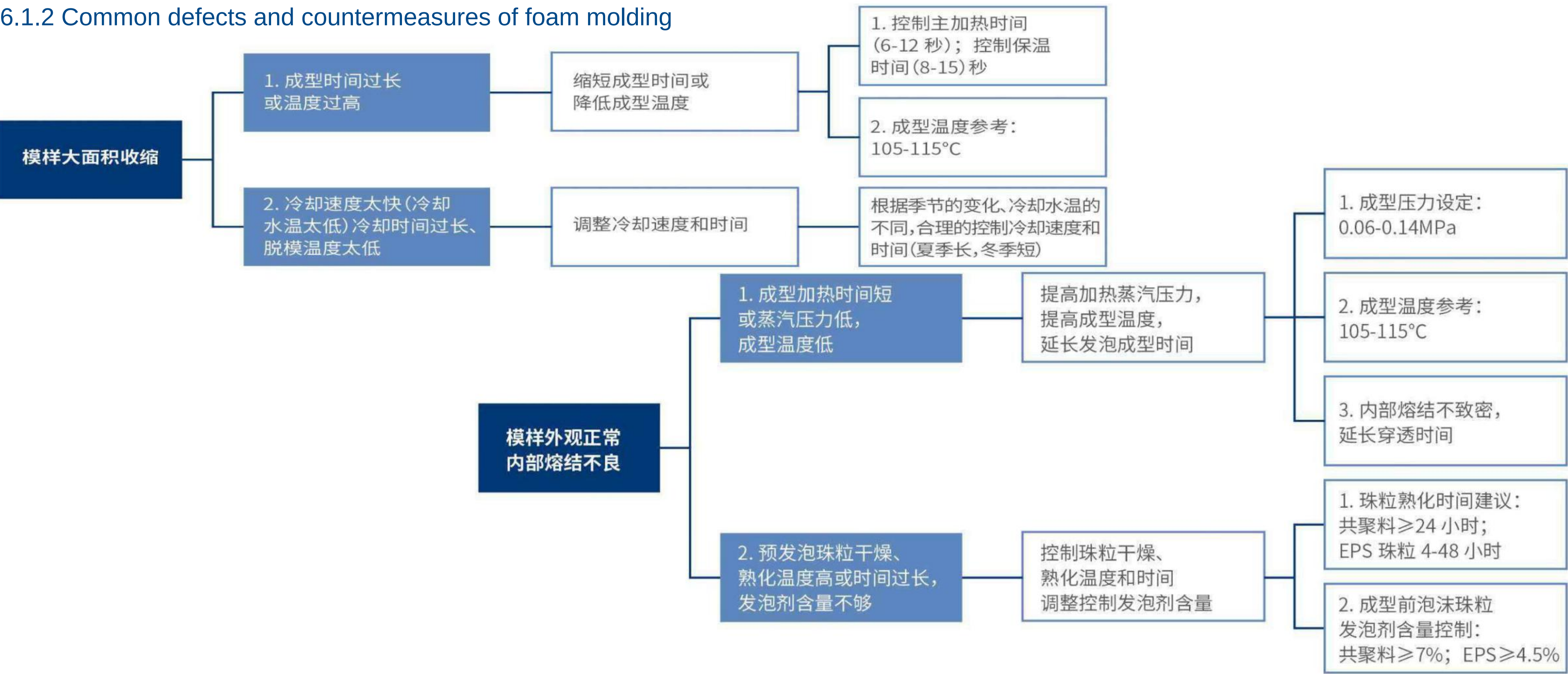




Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.1 Analysis and Countermeasures of Common Defects in Foaming and Forming

6.1.2 Common defects and countermeasures of foam molding

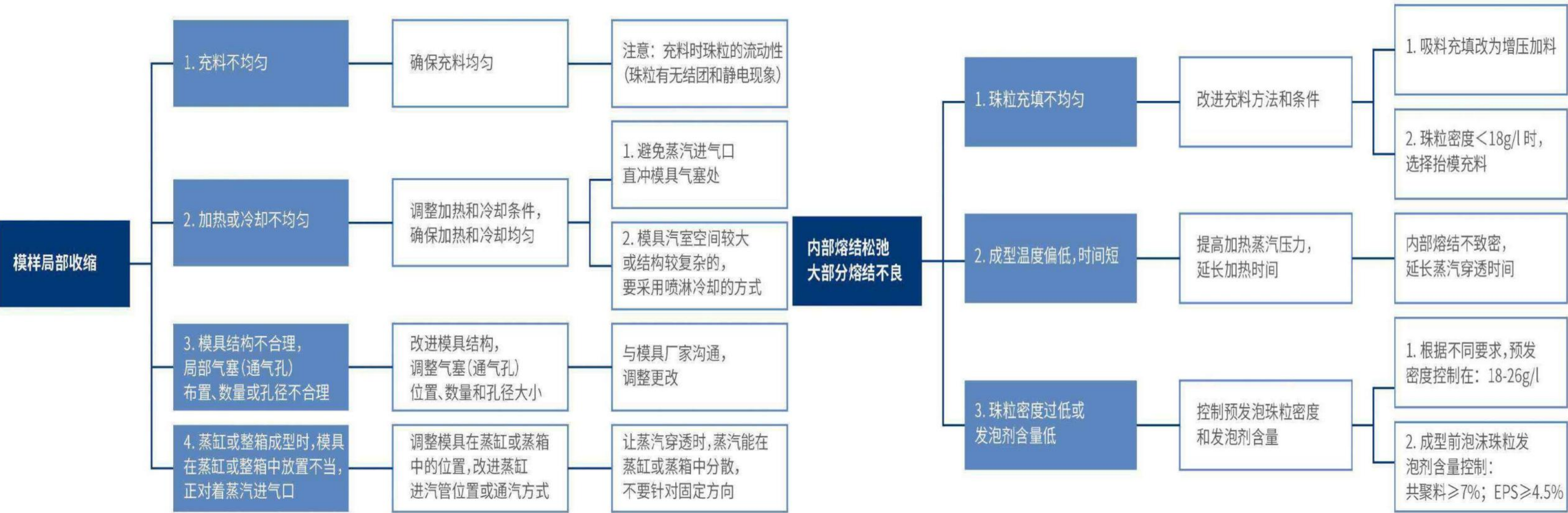




Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.1 Analysis and Countermeasures of Common Defects in Foaming and Forming

6.1.2 Common defects and countermeasures of foam molding





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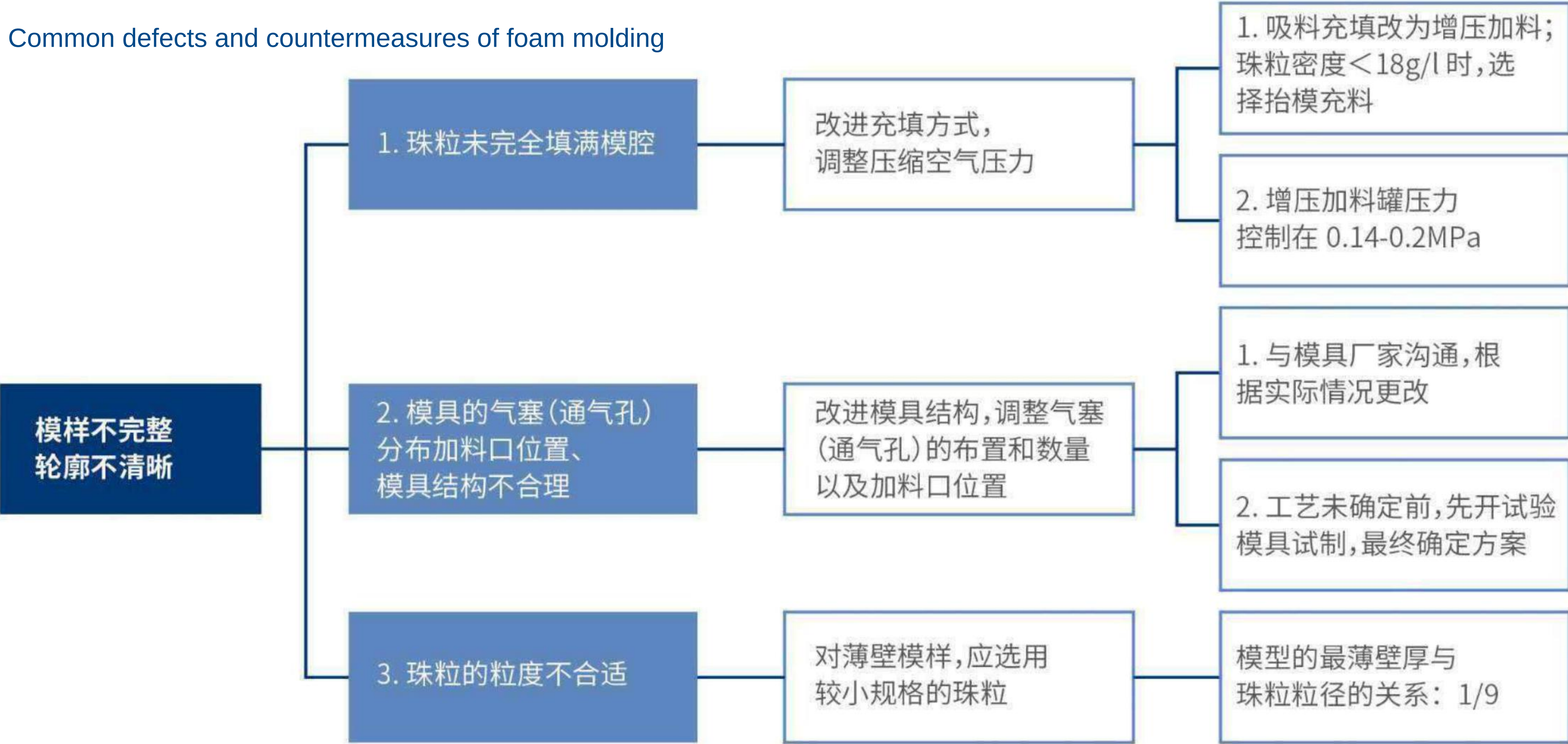




Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.1 Analysis and Countermeasures of Common Defects in Foaming and Forming

6.1.2 Common defects and countermeasures of foam molding





Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

2. Coating defects and countermeasures

1. Coating properties

Defects in the main performance of lost foam casting coatings and

	countermeasures Causes of defects		Handling advice
Question (1)	Low coating strength and poor wear resistance	• Poor binder effect or usage • Appropriately increase the amount of organic or inorganic binder, or use a better size Aggregate particle size, or • The coating is too thin or that is too dry • Differently coatings used different particle sizes	• Appropriately increase the thickness of the coating, increase the temperature of the drying room, and prolong the drying time
Question (2)	Poor air permeability of the coating	• Grain size grading of refractory materials, grain shape is not good, increase the particle size and use refractory polygons • The coating is too thick • Appropriately reduce the thickness of the coating to make the coating good, and the permeability is reduced .	• Appropriately increase the thickness of the coating, increase the temperature of the drying room, and prolong the drying time

2. Coating defects and countermeasures

1. Coating properties

	problem defect	casting coatings	Handling advice
Question (3)	Poor adsorption and thermal insulation	- Improper selection of refractory materials - Too much raw material in the refractory material - Too thin coating	- Choose diatomite with finer particle size, muscovite as filler, and mix with attapulgite suspending agent with strong adsorption - Use calcined aggregate as much as possible - Appropriately increase the thickness of the coating , the refractoriness is not enough - Alloy types do not match - According to the casting material requirements,
Question (4)	wall thickness and pouring temperature	select the appropriate refractory material and particle size gradation suspending agent is incorrect or the amount added The total time soft water is used	Choose the appropriate refractory aggregate and coarse sand Choose the appropriate refractory suspending agent Inappropriate refractory material quality particle size gradation Too long drying time, the water quality is poor The 2 hours, at least
Question (5)			



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

2. Coating defects and countermeasures

1. Coating properties

Defects in the main performance of lost foam casting coatings and

	countermeasures Causes of defects		Handling advice
Question (6)	Poor paintability	•The control of Baume degree of the coating is not suitable •The internal structure of the coating is weak, the shear thinning ability is poor, and the wettability to the substrate is poor •There is static electricity or oil stains on the foam pattern, too much parting agent and mold release agent •The Baume degree of the coating	•Select the appropriate degree of Baume according to the operating requirements •Add additives to make the coating have good leveling and permeability •Ensure the purity of the white mold
Question (7)	Poor flowability	Inappropriate • The amount of surfactant is too large • The paint suspension is poor	•Choose the appropriate degree of Baume according to the operation requirements •Choose the appropriate additives •Improve the suspension and thixotropy of the coating

Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.2 Defects and countermeasures of coatings

6.2.2 Coating preparation

process ỹ Lubai (picture: rewritten)



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.2 Defects and countermeasures of coatings

6.2.2 Coating preparation process

• Coating accumulation (picture: newly written)





Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

3. Typical problems in the pouring process

1. Pouring back spray

In the enterprises we visited, there was a slight or serious situation of pouring and reverse spraying.

There are three main cases:

• The first case: the pouring starts to spray back. The reasons for this back spray are as follows:

• The pouring speed is too fast at the beginning, including the unreasonable design of the spout, and the cross-section of the metal liquid flow is waterfall-like, which quickly seals the pouring cup

, the gas produced at the beginning could not escape and the fireworks were scattered.

• The paint in the sprue cup is not dry, or there is moisture.

• Too much hot glue is used in the connection between the sprue cup and the sprue, and the amount of gas is too large.



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

3. Typical problems in the pouring process

1. Pouring reverse spray

• The second case: splashing during the normal pouring process, mainly due to the following reasons: • The water content in the foam is large or the paint is not dry. • The pre-foam density is seriously exceeding the standard. • The coating gas generation is too large, the high temperature air permeability is poor, the dry sand air permeability is poor, or the sand box screen is seriously blocked. • The third situation: fireworks suddenly splashed in the later stage of pouring. There are several reasons for this situation: • The sprue is too short and the metal hydraulic head is not enough. • The late pouring speed is too fast, and the vaporized volatiles have no time to remove and accumulate to the top. • Paint, dry sand air permeability is too poor. There are still many cases of back spraying in field production. Occasional pouring back spraying generally occurs in pouring, and multiple pouring back spraying should be paid attention to, because as long as it is back spraying, there will definitely be pouring interruptions. , There are more or less problems with castings, or even direct waste, so it is particularly important to train workers and carefully complete the lost foam process control.



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

4. External defects of castings

1. Casting deformation

The casting deformation is caused by the deformation of the pattern due to the external force during the coating and box embedding operation, or the cooling shrinkage of the casting is blocked. Thin-walled large plane

Castings or "semi-enclosed" castings, frame structure castings, and other castings that are not compact in structure are prone to oversize and lead to scrap

•

• Reasons for deformation • The pre-

foam density is low. When the structure of the casting is not compact and the rigidity is poor, it is deformed during the drying process, and the corrective measures in the later stage are improper. • The setting of

the anti-deformation process during bonding is unreasonable, the operation method during hanging coating is wrong, the placement method during drying is wrong, the sand releasing method during burying box

modeling is wrong, or the parameter setting of the shaking table is unreasonable.

(2) Technological measures to prevent deformation

• Reasonably consider the applicability of the product. Lost foam casting should pour some castings with compact structure and good rigidity, and its yield is relatively high. In the selection of pre-release

density, try to make the white mold as rigid as possible, and take appropriate anti-deformation process measures during the drying process. 1 5 2 6 7 1 8 8 5 6 8

Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

4. External defects of castings

1. Casting deformation

(2) Process measures to prevent

deformation (2) For castings with
uncompact structure and low rigidity,

temporary process measures can be added

, such as process support,

process rib, etc., to improve the

rigidity of the pattern, now

generally use wood strips, fiber

strips, foam strips, and some also set up inversion





Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

4. Foaming, casting external defects

1. Casting deformation

• Process measures to prevent deformation •

Generally, dip coating, flow coating, spray coating or a combination of multiple processes are used for hanging coating.

Placement, if necessary, make some molds.

• When burying the box, the bottom sand must be compacted (standardized operation of the bottom sand height is required), and the complexity of the casting structure should be taken into account when the sand is placed.

Special treatment is required locally (partial quantitative sand release with cloth bags), the sand is required to be leveled and then the vibrating table is opened to start vibrating, and

Set the vibration parameters logically. (For details, please refer to <Operation Instructions for Sand and Vibration When Embedding the Box> on the next page)

• For the thin-walled castings or castings with uneven thickness after turning the box, they should not be piled up randomly to avoid being induced by external forces during the cooling process.

deformed.



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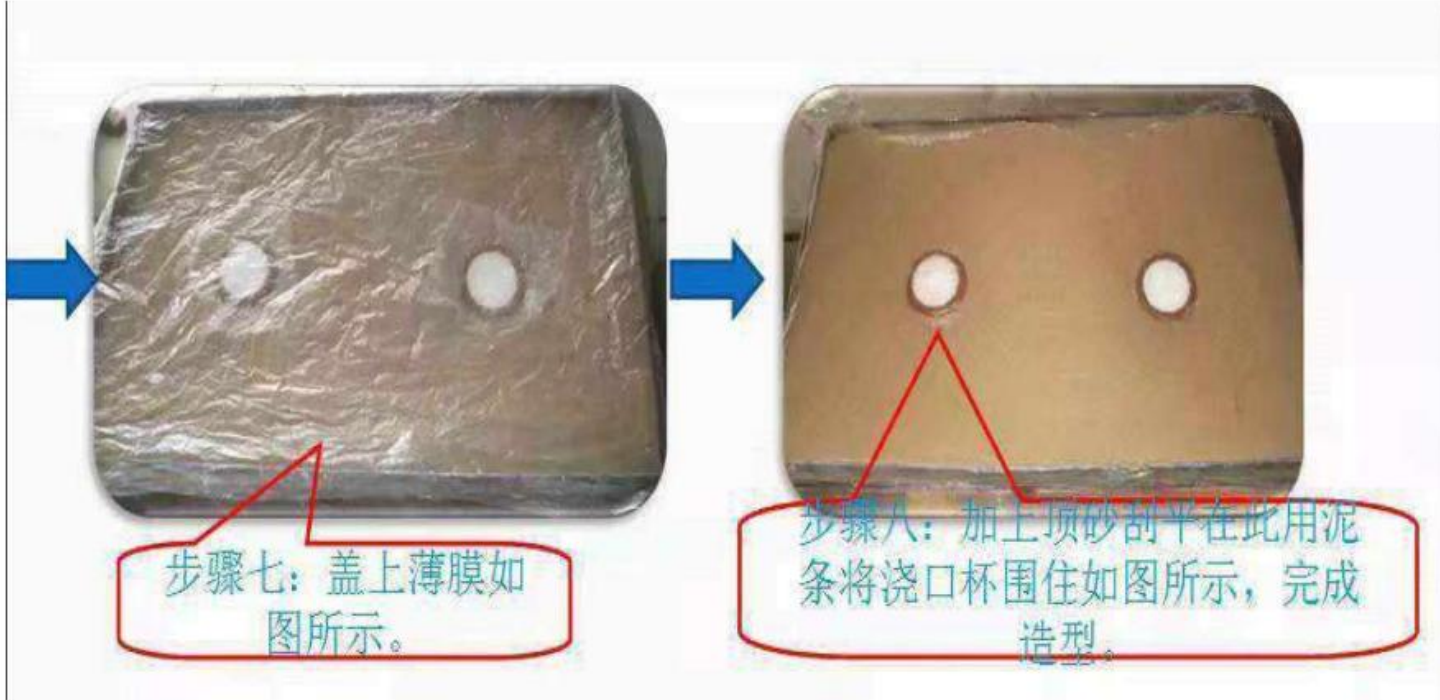
6.4 External defects of castings



6.4.1 Casting deformation (2)

Process measures to prevent deformation Operation

instructions for adding sand and vibrating when burying the box:





Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.4 External defects of castings

6.4.2 Sticky sand

Sticky sand refers to the casting defects that are not easy to clean due to the bonding of modeling materials on the surface of the casting. It is one of the common surface defects of lost foam casting. It often occurs on the bottom or underside of castings, as well as hot spots and loose parts of the mold. In lost foam casting, due to the effect of vacuum suction and high temperature pouring, the penetration force of molten metal is much stronger than that in sand casting, and it is easy to penetrate into the mold material through the coating layer and cause sticky sand. ̈ Reasons for sticky sand ̈ The coating layer is too thin, or the composition of the coating layer is not ideal, and the refractoriness and erosion resistance are poor, and the casting is prone to sticky sand. Several factories in the companies we visited have such a problem. The yellow mold drying room and the modeling area are too far apart. Workers place a large number of models in the modeling area. Due to the high humidity of the air, the paint is seriously damp, and there is reverse spraying during the pouring process. After turning the box, the sand sticking is more serious.

Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.4 External defects of castings

6.4.2 Sticky sand

(1) Causes of sticky sand

• The pouring temperature is too high,

The vacuum degree is too high,

The particle size of the type material is too

Coarse high temperature molten metal from

Exudation of paint pores

Sticky sand.



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.4 External defects of castings

6.4.2 Sticky sand

(1) Causes of sticky sand (3) No

self-hardening sand treatment is applied to the blind holes and pits of the pattern, the molding sand is not compact or uneven, and the high-temperature molten metal is due to the action of gravity, and the coating layer is cracked and iron nodules appear. In this case, the castings with iron nodules are basically scraps.

The places where the paint and sand were originally are now iron-clad sand, and the paint and sand must have entered the casting.





Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.4 External defects of castings

6.4.2 Sand sticking

(2) Technological measures to prevent

sand sticking

- Increase the thickness of the coating appropriately, and apply the coating three or four times when necessary (such as pouring steel castings, large iron castings, and the inner holes of castings) ; The best coating formulation to improve the refractoriness, erosion resistance and moisture resistance of the coating. The coating should be brushed evenly and of suitable thickness.
- Reasonable control of vacuum degree and pouring temperature. In the case of ensuring the smooth progress of the pouring, the vacuum degree and pouring temperature should be kept as low as possible to suppress the penetration of the high-temperature molten metal.
- For inner holes or other places that are difficult to clean, use resin sand, water glass sand buried type or cold iron with slightly higher refractoriness (some corners can also be hand-delivered in real time to ensure the compactness of the molding sand) .
- Use fine-grained sand or adjust the particle size. Sand requires good roundness and is not easy to wear. At present, many factories use pearl sand, and the effect is ideal.



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.4 External defects of castings

6.4.3 Insufficient pouring (partial crumbling of the

box) The top or thin wall of the pattern is not replaced by the metal liquid, resulting in the partial failure of the casting to form and the appearance of depressions or holes. (1)

Reasons for insufficient pouring: During the pouring process, the front resistance of the metal liquid is too large or the temperature of the metal liquid is too low, which makes it difficult to fill the mold, and the foam model cannot disappear during the pattern replacement process, resulting in insufficient pouring defects. (2) Process measures to prevent insufficient pouring
• Reduce the amount of gas generated by the foam pattern (change the type of beads, reduce the pre-expanded density and make the pattern completely dry), and appropriately increase the pouring temperature of the molten metal and pour the static pressure head. • Appropriately increase the degree of negative pressure and increase the exhaust speed.

Adjust the pouring operation. The faster the pouring speed, the better without back spraying.



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.4 External defects of castings

6.4.4 Where the slag-inclusion-like

cold insulation casting is finally filled, there are often slag-like defects on the outer surface, which are called slag-inclusion-like cold insulation defects. Cold compartments are often covered with carbon films, or residues of polystyrene decomposition products (bright carbon). (1) The reason for the slag inclusion-like cold partition is that the decomposition and gasification of polystyrene foam absorb heat and reduce the temperature of the molten metal. Therefore, as the pouring process progresses, the temperature of the molten metal that initially enters the mold becomes lower and lower. The lower the temperature of the molten metal, in addition to the greater its own viscosity, the gasification of the foam is not rapid and incomplete. Then the gas, residue and molten metal from the gasification and decomposition of the foam are wrapped together, forming a slag-like cold insulation defect at the place where the casting is finally filled. It can be seen that such defects are prone to occur when the following conditions occur: ̈ The pouring temperature and speed are low. In some of the companies I went to, due to the poor air permeability of the paint, the pouring and reverse spraying were serious, so the workers poured very slowly when pouring. ̈ The density of foam plastic is too high. In order to improve the stiffness and surface quality of the foam model in some factories, the density of the foam reaches the upper limit, which leads to an increase in the amount of foam vaporization during the pouring process. ̈ The design of the pouring system is unreasonable, so that the pouring temperature of the molten metal in the filling height direction and the cross-sectional direction is getting lower and lower, and this slag inclusion-like cold insulation defect is easy to appear on the surface of the casting. ̈ There is a pause in the pouring process. Generally, the pouring is cut off due to the reverse spraying of the paint or a problem with the driving.



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.4 External defects of castings

6.4.4 Slag inclusion-like cold

partition (2) Process measures to eliminate the slag inclusion-like cold

partition defect
• Improve the pouring system, and adopt the stepped gate to increase the filling temperature of the molten metal in the height direction (appropriately supplement the molten iron filling temperature); to ensure The molten metal fills the mold smoothly and quickly.
• Set up a slag collecting riser at the place where the casting is last filled, so that the molten metal that enters the mold first is discharged into the riser. In this way, the slag can be discharged and the temperature of the molten metal can be increased.

• Increase the pouring temperature and speed. The foam model is made of foam plastic that meets the casting requirements and has a relatively low density

•

• Choose better paints. A paint factory in Suizhou, Hubei developed "adsorbent ductile iron special paints" that have high air tightness requirements (need to suppress anti-leakage castings) or use on thick and large parts.



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.4 External defects of castings

6.4.5 Wrinkled and heavy

skin Lost foam casting During the production of iron castings, wrinkled or orange peel-shaped depressions appear on the surface (side or top surface) of the casting, which is called wrinkled skin. During the pouring process, the foam pattern is rapidly vaporized in a high-temperature and oxygen-free environment, and at the same time absorbs a large amount of heat in the molten metal, which causes the temperature of the molten metal to drop a lot, and some colloidal substances are too late to vaporize or incompletely vaporized. The tumor-like substances are adsorbed on the coating layer. During the solidification of the molten metal, these nodules continue to decompose at high temperatures, and the parts in contact with the molten metal continue to absorb heat, resulting in orange peel-like solidification of the molten metal, sometimes inside the casting. Black carbon inclusion defects also appear on the section. Furthermore, when the filling speed of the molten metal exceeds the vaporization and removal speed of the pyrolysis product, a layer of unpyrolyzed or insufficiently pyrolyzed asphalt-like viscous liquid will accumulate on the surface of the molten metal. Due to its cooling effect, the flow front of the molten metal forms a crust, and when this thin crust is broken by the subsequent flow of molten metal, it is pushed towards the The side of the casting causes corrugated or drip-shaped wrinkle defects on the side of the casting. When unpacking, carefully peel off the paint layer, you will find that a large number of fine flakes and flakes of bright carbon have accumulated on the surface of the casting, which is caused by the secondary decomposition of the liquid product by the high temperature of the casting. . After removing these carbon powders , corrugated and drip-like wrinkle defects can be clearly seen on the surface of the corresponding castings.



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.4 External defects of castings

6.4.5 Wrinkled skin and heavy

skin Causes of wrinkled skin defects The density

of the foam model is too high, and the heat absorption of foam gasification is large

The temperature of molten iron is low and the pouring speed is slow The geometry of

the casting is not conducive to the gas generated by the gasification of the foam Drain quickly. The air permeability

of paint and molding sand is too poor

 Process measures to eliminate wrinkle defects When

selecting the pre-release density of the foam model, the lower the pre-release density, the better (some manufacturers have white molds that are qualified due to unsatisfactory

molding fillers) under the condition that the rigidity and surface quality of the foam pattern are guaranteed to be qualified . If the rate is low, blindly increasing the pre-release density is

a major reason for the formation of wrinkle defects, so the pressurized feeding tank is very practical)



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.4 External defects of castings

6.4.5 Wrinkled skin and

heavy skin (2) Process measures to eliminate

wrinkled skin defects (2) The ultimate goal of process design is to ensure smooth filling of molten iron. When the bottom pouring system is used, wrinkled skin defects are often formed on the upper surface of the casting. When the top-cast gating system is used, the flow direction of the molten metal is opposite to the escape direction of the pyrolysis products, resulting in turbulent flow, which is easy to surround some polystyrene or its pyrolysis products inside the casting, thus forming carbon inclusion defects. Therefore, it is very important to choose the appropriate casting process and molten metal temperature. If the temperature is too high, the foam will vaporize too quickly, which will cause reverse spraying, crumpling of the box, and inclusion of pores. Appears, the general pouring temperature can be about 50 degrees higher than traditional casting. Compared with other casting processes, the step casting system is more stable for molten metal filling. ÿ The air permeability of paint and molding sand directly affects the difficulty of discharging the pyrolysis products of the pattern, so it must have an impact on the wrinkle skin defect. The air permeability of the coating layer depends on its composition and thickness. For example, when the particle size of the refractory filler in the coating is greater than 325 mesh, the air permeability of the coating is very low, which is easy to cause wrinkle defects; When it is larger than 1.5mm), it is easy to cause wrinkles and skin defects. Generally, the coating thickness of small iron castings is controlled at 0.6-1.2mm, and satisfactory results can be obtained. Modeling sand with a more rounded particle size has a better effect. Applying negative pressure during pouring can help the pyrolysis products to be discharged out of the mold, which is beneficial to reduce wrinkles and skin defects, but it should be noted that the degree of negative pressure should not be too high, otherwise it is easy to cause infiltration and sticky sand defects, and the "coanda effect (heavy skin phenomenon)")" will also be more pronounced as the negative pressure increases.



6.4 External defects of castings

6.4.6 Cracks



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

5. Common Intrinsic Defects

1. Pores, slag inclusions

Pores and slag inclusions exist under the skin in the upper or dead corners of the casting, and such defects can only be seen after machining. stomata

and slag inclusions sometimes exist separately, but in most cases they coexist at the same time. Porosity and slag inclusion are in lost foam casting, especially

It is a common casting defect when casting aluminum alloy castings. When the defect appears on the non-important machined surface, it can be repaired by welding

; If it appears on the important processing surface, it will cause the casting to be scrapped.

From the reasons for the formation of stomata, the formation process, that is, according to its formation mechanism, stomata can be divided into the following types, namely:

Inlet stomata, entrained stomata, precipitation stomata, endogenous reaction stomata, and exogenous reaction stomata.



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

5. Common Intrinsic Defects

1. Pores and slag inclusions (1)

Causes of pores and slag inclusions ÿ Gasification

of the foam model in a high temperature and oxygen-free environment will generate a large amount of gas and a certain amount of liquid residues, which are the main sources of pores and slag inclusions when defects occur. ÿ When the pouring system is unreasonable (such as top pouring) or the structure of the inner gate is unreasonable, the sprue cannot be filled, which will easily cause gas and residue to be trapped in the molten metal, forming pores and slag inclusions. ÿ The pouring temperature is too low, the permeability and adsorption of the coating are too poor, and the gas and residue cannot be fully discharged and floated to the top of the casting, and pores and slag inclusions are also easily generated. ÿ When the coating is too thick in the dead corner of the casting, or the gas permeability of the coating is very low, due to the pressure of the gas, it is easy to wrap the gasification gas under the skin to form a "vapor". ÿ The thick and large-section castings are cast under the negative pressure of lost foam. If the molten metal advances too fast under the action of negative pressure, a part of the foam plastic mold will be surrounded in the middle of the molten metal, the molten metal around the pores will solidify, and the gas will be discharged through the channel. clogged, forming pores. ÿ The density of the foam model is too high and the pouring temperature is too high.



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

5. Common Intrinsic Defects

1. Pores and slag inclusions (2)

Process measures to eliminate pores and slag inclusions

Choose a coating with superior performance. The coating with good air permeability, strength and adsorption of the coating layer is a good way to solve the pores and inclusions. Improve the pumping capacity of the vacuum system, so that the vaporized gas can be pumped out of the sand box in time (the key is to make the vaporized product of the foam model quickly discharge within the effective time). The bottom pouring system is adopted. In this way, the filling direction of the molten metal is consistent with the upward floating direction of the vaporized gas and the residue, which reduces the chance of the molten metal entraining the gas and the residue. If the height of the castings in the placement direction exceeds 350mm, it is recommended to use the step casting process. Increase the pouring temperature, choose the best pouring temperature, and slow down the pouring speed when the pouring is about to end, so that the gasification gas and residue have sufficient time to be discharged out of the sand box and rise to the top of the casting. And set a slag collecting riser at the highest point or dead corner of the casting. For the following castings with higher requirements, when making the pattern, increase the machining allowance of the top of the model and important surfaces, and use metal cutting to eliminate pores and slag inclusions. Select foam materials with low carbon content, appropriately reduce the pre-foam density, and correctly select the pouring temperature and negative pressure. The negative pressure should make the molten metal filling and advancing speed moderate.



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.5 Common Intrinsic Defects

6.5.2 Shrinkage porosity

The setting of the feeding riser of the lost foam casting is much more convenient than that of the ordinary sand casting, but the feeding capacity of the same size riser is not as good as that of the ordinary sand casting. This is due to the riser of the lost foam casting. Liquid temperatures tend to be lower. Therefore, when using lost foam casting to produce alloys with large shrinkage such as steel castings, it is necessary to prevent shrinkage cavities and shrinkage porosity defects. Process measures to eliminate shrinkage cavities and shrinkage porosity: ỹ Increase the volume of the feeding riser, and select a reasonable shape. ỹ Increase the temperature of the molten metal in the riser, adopt the heating riser or let the liquid metal enter the cavity through the riser, and the method of "replacing the riser with the gate" is widely used for ductile iron and steel castings. ỹ Use cold iron together. In lost foam casting, the inner chiller is generally directly embedded in the foam pattern, and the outer chiller is directly attached to the hot joint, which is easy to operate. ỹ When pouring ductile iron, increase the negative pressure immediately after pouring to improve the rigidity of the mold to strengthen (graphitization expansion and liquid shrinkage will offset part of it).



6.5 Common Intrinsic Defects

6.5.3 Trachoma

Trachoma defects are also called white defects in lost foam casting. During the casting process, the coating is cracked for some reason.

(The sprue cup and runner are more likely to break), the molding sand follows the molten metal into the cavity, and is scattered like elegant snowflakes or

Intensive distribution, because the sand section is generally white (the pearl sand section is brownish gray), the processing surface will be damaged during cutting.

It turns out that some anti-leakage castings (box body, valve body parts) have a low one-time pressing rate, which is also the reason.

Sand hole defects are mainly caused by damage to the coating layer, so the preventive measures are simple.

Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.5 Common Intrinsic Defects

6.5.3 Trachoma ỹ

The key to the gating system

parts such as cups on a box

(foam tumbler and

ceramic pouring cup) with

sprue catcher

Repair the joint with paint or

Use a sealant strip to prevent

Prevent molten metal from seeping out



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.5 Common Intrinsic Defects

6.5.3 Trachoma ȳ

The lower part of the intersection of the sprue and the runner is due to

The drop of metal liquid is large, the impact force is concentrated, and the coating is easy

Easy to damage, we generally recommend setting sprue nests.



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.5 Common Intrinsic Defects

6.5.3 Sand

holes in runner and inner

runner and inner runner and casting

The paint on the contact parts of the parts is not

There can be ruptures, generally

In this case, we recommend using

an integral runner (the white mold

outside the box is bonded well),

Combination in the box is not recommended.



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.5 Common Intrinsic Defects

6.5.3 Sand holes

The dead corners (blind holes, corners) of the casting shall be pre-plugged with self-hardening sand, otherwise the coating will be crushed by the gravity of the molten metal, which will also cause the casting to enter the sand.





Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.5 Common Intrinsic Defects

6.5.4 Carburizing defects of steel castings

When EPS is used as the pattern material, due to the high pouring temperature of cast steel, the polystyrene foam will undergo deep cracking, the hydrogen content on the surface of the molten metal can increase sharply, and the hydrogen content increases, indicating that there is a large amount of high-temperature free carbon, which is the root cause of carbon increase on the surface of steel castings. Carburizing defects mainly occur in low carbon steels with a carbon content of less than 0.25%. When the original carbon content in the steel is greater than 0.45%, the carburization is very small. The depth of the carbonization layer is generally between 0.2-2mm, and the amount of carbonization is generally 0.01-0.1%. As a result of surface carburization, not only the machinability and weldability of the castings are deteriorated, but for stainless steels, the corrosion resistance properties are deteriorated. Especially for some low carbon steel and low carbon alloy steel castings with higher requirements, its performance is particularly obvious. Therefore, it will be necessary to control and prevent the surface carburization of castings. To do this, it is necessary to understand the casting

Reasons and influencing factors of carbon increase on steel surface.



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.5 Common Intrinsic Defects

6.5.4 Carburizing defects of steel castings

Carburizing mechanism

The carburizing process of steel castings is a complex physical and chemical process, which involves the high-temperature thermal decomposition of foam patterns, as well as the high-temperature decomposition products of foam patterns and molds Interaction with molten metal. The thermal decomposition of the foam pattern becomes more and more intense with the increase of temperature, and at the same time, there are more solid pyrolysis products composed of free carbon. Due to the characteristics of the chemical composition of steel castings, these carbon-containing solid phases interact with molten steel, so that the castings are always covered by the misty free carbon or hydrocarbon residues in the plastic mold decomposition products during the pouring, cooling and solidification processes. Coated and diffused into the surface of the casting at the same time, it is easy to cause surface or local carburization defects of the steel casting. During the condensation process of pouring and casting, the free carbon and gaseous hydrocarbons in the high temperature decomposition products of polystyrene, except for part of the discharge type and the other part, directly interact with the molten metal and infiltrate into the molten metal at the beginning, and the rest Part of the decomposition products penetrate into the mould and accumulate in it (especially at the mould-metal interface); these products are then gasified again when the mould is heated by the molten steel. The carbon-containing gas (such as CH₄, etc.) generated by this secondary gasification is the main cause of carbon increase on the surface of steel castings. There are two factors that affect the degree of carbonization on the surface of the casting, one is the decomposition product of the foamed plastic and the concentration gradient of carbon in the molten steel, and the other is the content and characteristics of alloying elements in the steel. When the poured molten steel contains very low carbon content (such as stainless steel), there is a large concentration gradient between the large amount of free carbon produced in the gas phase on the molten metal surface and the carbon in the molten steel. Therefore, the free carbon in the gas phase must migrate and diffuse into the molten steel. However, the degree of surface carburization of steel castings depends on the thermal state of the casting mold; the thermal state is determined by the heating rate of the casting mold , the secondary gasification rate of the accumulated phase, the composition and concentration of the decomposition products, and the diffusion flow The development of the casting and the solidification rate of the casting are determined.



Chapter 6 Defect Analysis and Countermeasures of Lost Foam Casting

6.5 Common Intrinsic Defects

6.5.4 Carburizing Defects of Steel Castings

• Carburizing Mechanism The process of

massive migration and diffusion of carbon into molten steel includes three stages: a. Free

carbon is sent to the boundary of the phase (surface of molten metal). b. Free carbon passes

through the boundary. c. Finally, the free carbon diffuses into the molten metal body. If the

carbon content in the molten steel increases, the concentration difference of carbon in the gas phase and the molten steel will decrease significantly, and it will be difficult for carbon to migrate and

diffuse into the molten metal. • • Methods to prevent carburization To control the surface carburization of steel castings, the effective methods are: • Prevent the formation of solid carbon (ie free

carbon), which is the key to solving surface carburization defects. • Make the depth of gasification and cracking of foam plastics shallower and reduce the activity of carbon. • The generated gas

phase is quickly discharged out of the mold, and the time of contact with the molten steel is reduced, so that the degree of "contamination" of the high-temperature molten steel is greatly reduced .



Chapter 7 Analysis of Typical Cases of Lost Foam Casting



1. Requirements for coating properties of common types of castings
2. Relationship between defects in lost foam casting and sand and coating
3. Application of lost foam casting technology in the production of electric power fittings



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.1 Requirements for coating properties of common types of castings

We have always said that paint is not a "currency". In the actual production process, the paint should be selected according to the product structure and process requirements. Without a good understanding of the composition of coatings, the performance of raw materials and related production equipment, it is impossible to make coatings well; so coatings are not random, and good coatings cannot be made by anyone. The above has made some targeted elaborations. I personally think that a good coating can stand the test. It must be determined by combining the structural characteristics of the casting and the on-site production environment through continuous experiments and improvements. "Stability" is the first element pursued by lost foam coatings. "The lost foam casting process is the biggest, the process determines the coating, the coating serves the process, the product quality requirements, and the coating performance determines." Only the superior performance of the coating can achieve excellent products. From a broad perspective, different materials have completely different requirements for coating properties. From a small level, the differences in coating properties required for different wall thicknesses of products are also relatively large. Let's talk about the performance requirements of several types of castings for coatings according to the situation of visiting some enterprises.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

1. Requirements for coating properties of common types of castings

1. Ductile iron pipe fittings, tee, water pump castings,

and various valve castings of pipe, pump and valve casting products have a common feature, and it is required to do air tightness experiments. The pass rate of one-time pressing of such castings directly affects the production cost of enterprises control. There are three main factors that affect the qualification rate of one-time pressing: First, the design of the pouring system: in order to ensure the stable filling of the molten metal, the bottom pouring and stepped pouring systems are more effective, and some manufacturers use the rain-type top pouring system. The effect is also good. Second, the performance of the coating should be combined with the pouring method; third, the control of the pouring temperature and the pouring speed: the root cause of the "sweating" of this type of casting is that the thickness direction of the casting is not dense, and there are some traces left by the decomposition and gasification of the foam. (wrinkled skin, heavy skin, cold insulation, etc.), or there are three-hole defects on the surface of the casting

(stomata, slag holes, shrinkage holes).



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

1. Requirements for coating properties of common types of castings

1. Pipe, pump and valve casting products In addition,

for these rotary body castings, the problem of deformation and out-of-roundness should also be paid attention to. These causes are explained in detail in the defect analysis section, and the following requirements are put forward for the performance of coatings: ̈ Different pouring processes have different requirements for the permeability of coatings. Here we are talking about high temperature permeability (about 1100 °C). For example , pure bottom casting is used, and the metal liquid rises steadily in the cavity. The high temperature permeability is too good. The direction and speed of the molten metal flow, the "Coanda effect " is more obvious, and the castings are more likely to have heavy skin, wrinkled skin, and gas coating. For example, top injection, since the advancing direction of the molten metal and the discharge direction of the foam gasification decomposition products are opposite, if the high temperature gas permeability of the coating is poor, the gasification decomposition products are too late to be discharged, and the gas coating phenomenon is very serious, 1/3 or lower 1 in the height direction of the casting The probability of "sweating" in the /3 position is very high, so the choice of high temperature air permeability of the coating should be combined with the pouring process design. ̈ Different wall thicknesses require different coating strengths. Out-of-roundness at the interface of such large-diameter castings is very common, and some customers use internal supports to achieve good results, but overall the requirements for the coatings used are also very strict. It is necessary to ensure sufficient strength and certain toughness to ensure the deformation of the foam model during the operation of dipping, handling and embedding. The linear stickiness of the castings of some customers means that the coating lacks toughness, and the castings are deflated or bulged.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.1 Requirements for coating properties of common types of castings

7.1.2 Case and shell casting products For the

gearbox body and flywheel housing produced by some customers, the opening position is often deformed and the problem of oil leakage occurs.

In terms of anti-deformation measures, wood strips and fiber strips have played a great role.

As mentioned above, the performance requirements of such products on coatings are as

follows: First, the coatings require good dry strength and certain toughness; Wet leveling,

adhesion, wet strength and recoatability are required to be high, which is also the most important prerequisite for ensuring good surface finish of

castings; thirdly, the high temperature air permeability of the coating is the same as that described above, and the air permeability is reasonable ,

the probability of oil leakage of the box and shell parts will be controlled very low (defects caused by foam gasification and decomposition products

such as cold insulation and wrinkled skin will be effectively controlled).



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.1 Requirements for coating properties of common types of castings

7.1.3 Machine tools, automobile covering mold casting products For

large castings such as machine tools and automobile covering molds, the defects of bad box and poor surface finish are common. Because this type of casting generally uses EPS as the raw material for the foam pattern, the production of foam gasification decomposition products is relatively large during the pouring process, and the pressure imbalance in the cavity is the direct cause of the collapse of the casting. In the final analysis, it is the foam gasification decomposition product. The removal speed should be better controlled. The performance requirements of such products are as follows: First, the air pressure balance in the cavity should be controlled by combining the pouring process and the air permeability of the coating. Second, the dry strength and high temperature strength of the coating are also very important. Although the sand mold strength is provided by negative pressure, the coating layer is the premise to ensure that the negative pressure forms a safety barrier. This is the reason why some machine parts crumble during the pouring process. Third, the coating should have high erosion resistance and refractoriness, because the casting time of machine tool and automobile covering mold castings is generally long, and the molten iron will wash the runner and cavity greatly. After pouring, overheating will lead to thick parts. Sticky sand, so pay attention to it together .



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.1 Requirements for coating properties of common types of castings

7.1.4 The material of ductile iron castings such as differential

reduction shells and brackets is generally QT450-10, 500-7 or 600-3; in order to reduce a series of defects caused by the poor discharge of foam gasification residues, usually choose Copolymer (STMMA) was used as the raw material for the foam model. The performance requirements of such products for coatings are as follows: First, by comparing with ordinary EPS, it is found that the instantaneous gas generation of the copolymer material in a high temperature and oxygen-free environment is much larger than that of the EPS material of the same amount, so the high temperature air permeability of the coating is very high. high. Second, the fluidity of molten iron made of ductile iron is worse than that of gray iron, the wetting of the coating by molten iron is better, and the surface finish of the casting can be guaranteed. Third, the fission of the copolymer in a high temperature and oxygen-free environment not only produces gaseous products, but also a large number of liquid products. These liquid products are easily attached to the surface of the casting under the action of negative pressure to form carbon deposits, which will seriously lead to the surface of the casting. Potholes are bumpy, which affects the surface finish of the casting. Therefore, the lost foam ductile iron coating should have a very important feature: the adsorption of the liquid products of high temperature decomposition of foam, which is a problem ignored by many domestic manufacturers, but when this problem occurs in castings, it is always in the foam pre-expansion density. , Negative pressure, pouring temperature to find the reason, the effect is not very obvious, and even bring new problems, so many manufacturers are intimidated by the lost foam high-end ductile iron parts. There is a company in Suizhou, Hubei that has been producing ductile iron parts with reduced shells and brackets since 2011. The overall yield is quite good. They have done a lot of work on the adsorption of coatings to the liquid products of high temperature decomposition of foam .



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.1 Requirements for coating properties of common types of castings

7.1.5 Thin-walled castings for motor shells Compared

with other castings, there is an obvious difference between the castings and the thin wall thickness of the castings and high pouring temperature (some manufacturers control the pouring temperature of molten iron at 1600°C). The requirements for coating performance of such products are as follows: First, the coating of the motor casing is required to have good high temperature resistance and erosion resistance ; Insufficient pouring defects, such defects have a great relationship with low pouring temperature, pouring interruption, and poor air permeability, but on-site production often ignores the thermal insulation performance of coatings (emphasis on the heat storage capacity of refractory materials) and the moisturizing effect of molten iron on the coating layer. Therefore, the lost foam motor shell coating should have good thermal insulation performance and small surface wettability. Third, many of the companies we visited mentioned that the paint has poor coating properties, the surface of the blade is "pox", and it is difficult to clean up by shot blasting in the later stage. Some companies use a polisher to polish the blade as a whole. In fact, the effect of this problem is obvious when the coating performance is adjusted slightly, that is, to find a balance between the wettability and penetration performance of the coating to the foam substrate. When the coating has good leveling, film-forming and low-temperature air permeability (the air in the grain boundary of the foam particles can be quickly discharged with the evaporation of moisture during drying in the drying room, and the coating will not enter the grain boundary), and the inner layer The coating aggregate should use as little as possible aggregates such as quartz powder, and it is best to use refractory materials (such as mullite, bauxite) with a small reduction in burning.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.1 Requirements for coating properties of common types of castings

7.1.6 Low carbon alloy steel casting products cast by the empty shell method

The purpose of this type of casting emptying is mainly to solve the porosity and carbonization defects of steel castings.

The carbon increase is described in detail. Here, only two requirements for the paint are put forward for the empty shell process operation:

First, it has good dry strength and high temperature strength; second, it

has good heat resistance, shrinkage resistance and crack resistance. Some manufacturers use the method of pumping negative pressure and passing oxygen in the sand box to burn

The foam is removed, and some adopt the lost foam precision casting composite process, which is roasted in a roaster. These two processes mold after the foam burns off.

The strength of the type depends entirely on the coating, and the temperature difference before and after the coating is large, so it is necessary to do some research on the formulation and material selection of the coating.

chapter.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

2. The relationship between defects in lost foam casting and sand and paint

1. The point of view of thin coating fine sand for lost foam casting Looking

at the casting defects at home and abroad, it is nothing more than pores, slag inclusions and shrinkage cavities. Among them, the biggest key lies in air involvement and sand core formation, so vacuum casting and sand core-free casting method have become the solution, thus creating vacuum lost foam casting. I especially emphasize the word vacuum here, the purpose is that the characteristics of vacuum must be really used to improve the problems that are currently occurring in casting. The advantages of casting in a vacuum or negative pressure environment are as follows: 1) Reduce porosity defects in castings 2) Suction out slag inclusions in castings 3) Strengthen casting filling capacity 4) Reduce temperature loss during casting The above is the vacuum lost foam casting method that makes The benefits obtained in vacuum, but the key lies in the air permeability and slag permeability of the coating. Over the years, the domestic vacuum lost foam casting industry has never put forward the point of slag permeability, so I put forward the technical point of using fine sand and thin coatings to improve the current domestic problems.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

2. The relationship between defects in lost foam casting and sand and paint

1. Perspective of thin coating fine sand for lost foam casting

The point of sand vs. thin paint is not theory, but an example that has been used for many years. The size of fine sand is between 80 and 100 mesh

, The thickness of the thin coating is between 0.3~0.6mm, using fine sand as the molding sand and thin coating in the aluminum alloy vacuum lost foam casting

In the technology, when the box is turned over after casting, it can be found that the surface of the molding sand is stained with a tar-like substance, which is a white meme aluminum alloy cast.

The casting temperature failed to vaporize the jelly produced by the white mold, and vacuum suction and slag-permeable paint were used to draw the jelly out of the mold cavity for suction.

Into the molding sand to improve the porosity and slag inclusion of aluminum alloy castings.

experience gained.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.2 The relationship between defects in lost foam casting and sand and paint

7.2.2 The advantages of thin coating fine sand for lost foam casting The application

of fine sand in vacuum lost foam casting has the same characteristics. Therefore, I propose the use of fine sand and thin coating for vacuum lost foam casting. The advantages are as follows: 1) High Breathable, effectively improve the porosity problem. 2) High slag permeability, effectively sucking out carbon slag and reducing defects. 3) The fine sand has high fluidity, improves the precision of castings, and reduces the problem of sand deposition. 4) The amount of paint is small, which reduces the cost of paint. 5) The paint dries quickly and reduces the drying cost. 6) Improve the phenomenon of back spraying during casting, and avoid the back spray caused by the wet phenomenon of the white mold when dipping the paste. 7) The gravitational acceleration of the falling sand of the fine sand is small, which reduces the destructive force of the white mold during molding and avoids the deformation of the white mold. 8) When dipping, the paint is light and thin to avoid deformation or damage of the white mold due to the thick paint.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.2 The relationship between defects in lost foam casting and sand and paint

7.2.2 Advantages of thin coating and fine sand for lost foam casting In contrast, many

lost foam foundries in China use thick coating, coarse sand and even bead-sized sand.

In vacuum lost foam casting, because the coarser the molding sand, the stronger the coating strength needs to be to avoid the problem of sticking sand.

The stronger the strength, the thicker the thickness, the thicker the coating, the worse the air permeability, and the worse the air permeability, the larger the sand particles, and the worse it is.

Sexual circulation, which leads to the easy rupture of the white mold when dipping, and the increase in the number of dipping.

Drying leads to reverse spraying of casting, large coating thickness, poor ventilation and poor fluidity, resulting in stomata and slag hole defects in castings. In order to improve fluidity ,

increase the pouring temperature and increase the size of the pouring port, which leads to increased costs, and the consequence is all lost foam casting. [factory](#)

Ben is too high and poorly managed. Even the paint is made of the same ceramic shell as lost wax casting, and then the white mold is first burned and then cast.

It completely violates the true meaning of vacuum lost foam casting.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

3. Characteristic analysis of coatings used in lost foam casting ductile iron parts

1. Analysis of coating process in lost foam casting

Coating is one of the most important raw and auxiliary materials for lost foam casting. It has a great influence on the internal and external quality of the product, especially in the production of ductile iron products. In terms of slag inclusion defects, coatings are one of the most important factors. At present, the coatings used by most lost foam casting manufacturers in China are not problematic in the production of gray iron products, but because the performance of the coatings does not meet the requirements in the production of ductile iron products, they cannot effectively solve the problems of carbon deposition and slag inclusion. Due to the defects, many manufacturers cannot produce ductile iron products with processing requirements; this is also a common problem for domestic manufacturers. The lost foam coating is composed of refractory aggregates, fillers, organic binders, inorganic binders, suspending agents, surfactants, defoaming agents, etc. Liquid adsorption (adsorption of liquid residues of foam models at high temperatures), exhaust, etc. The lost foam coating for cast iron and cast steel needs to have good liquid adsorption, good air permeability, good refractoriness, good suspension, good thixotropy, good wettability and good leveling; In addition to the above properties, die-cast aluminum coatings also need to have good thermal insulation. Among all the characteristics of lost foam coatings, liquid adsorption is the unique and most important characteristic of lost foam coatings.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

3. Characteristic analysis of coatings used in lost foam casting ductile iron parts

1. Analysis of coating process in lost foam casting When formulating

the process of ductile iron products with processing requirements, we all hope that the lower the negative pressure, the better; because under the action of high negative pressure, molten iron will produce jets and turbulence during pouring flow, the foam model will be wrapped in the molten iron and cannot be discharged, and eventually internal slag inclusion and carbon deposition defects will occur; at the same time, high negative pressure will increase the tendency of the molten iron to climb the wall, and the molten iron will not be able to supply enough gasification area in an instant. As a result, the molten iron will fluctuate up and down, resulting in slag inclusions, heavy skins, and carbon deposition defects on the surface. In order to avoid such defects, we hope that the negative pressure should be as small as possible while satisfying the needs of exhaust gas. According to years of experience in producing lost foam casting ductile iron: when making processed ductile iron products, the negative pressure should preferably not exceed 0.3bar, and this value is the value set at the beginning of pouring; the minimum vacuum degree during the pouring process is as long as Not less than 0.1bar is enough; do not artificially change the negative pressure value during the pouring process . However, even if many manufacturers know this truth, they cannot achieve low negative pressure pouring. The most fundamental reason is that the comprehensive performance of the coating cannot meet the requirements; this leads to many lost foam casting manufacturers pouring under low negative pressure. The phenomenon of cold insulation and reverse injection of molten iron.

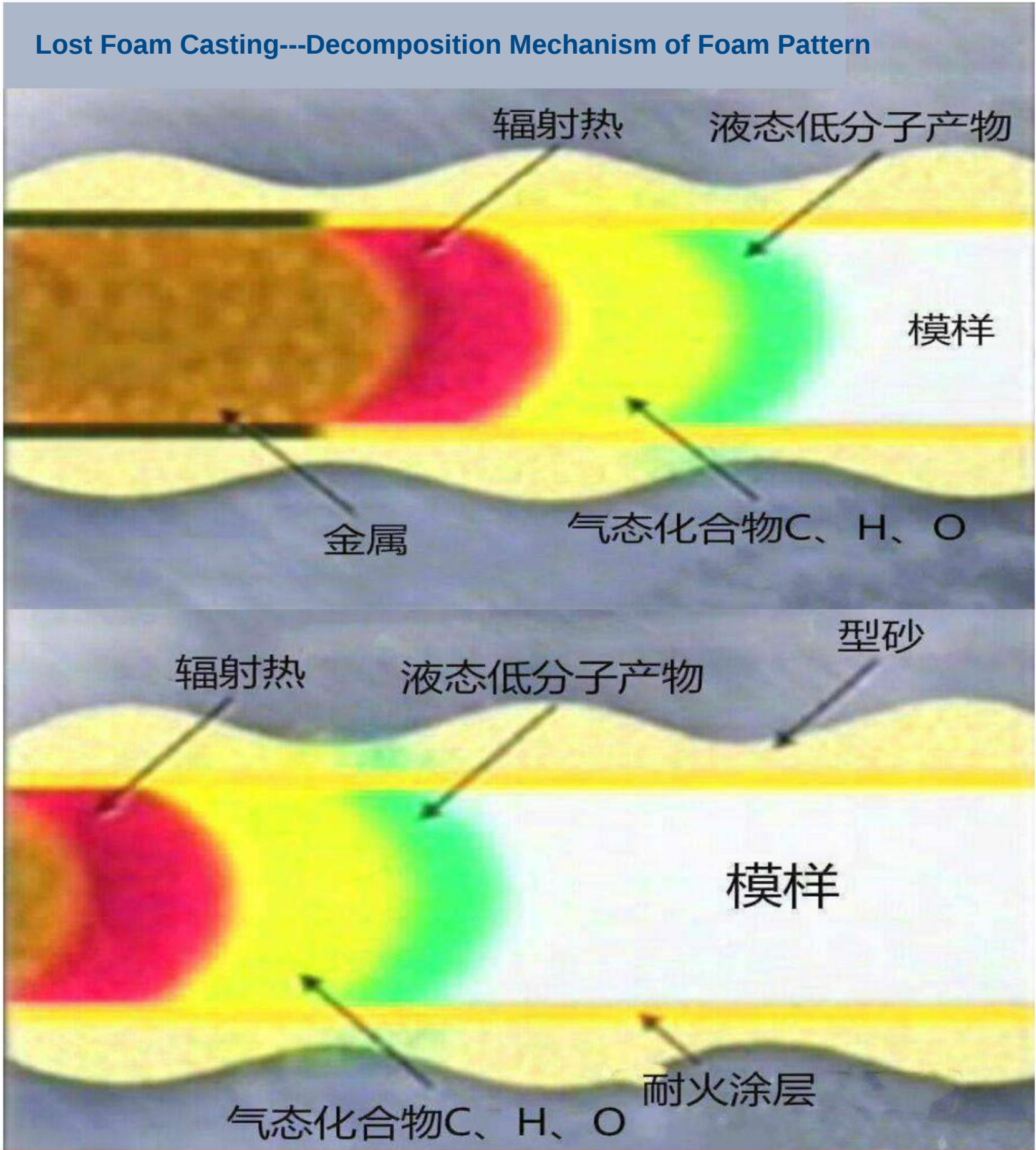


Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.3 Characteristic Analysis of Coatings Used in Lost Foam Casting Ductile Iron Parts

7.3.2 Analysis of the molten iron filling

process What kind of properties does the coating need to achieve to meet the application requirements? Let's analyze it in combination with the process of molten iron filling. First of all, in the process of contact between the high-temperature molten iron and the foam pattern, the foam pattern will have a short liquefaction process and then gasify; and the coating needs to adsorb the liquid products produced by the short-term liquefaction process into the coating , and wait for the subsequent high-temperature molten iron flow. Part of it will be vaporized when it is outdated, which is the most important performance of the coating---liquid adsorption! The vaporized gas is discharged through the gaps of the paint under the action of negative pressure, which is another performance of the paint - air permeability!



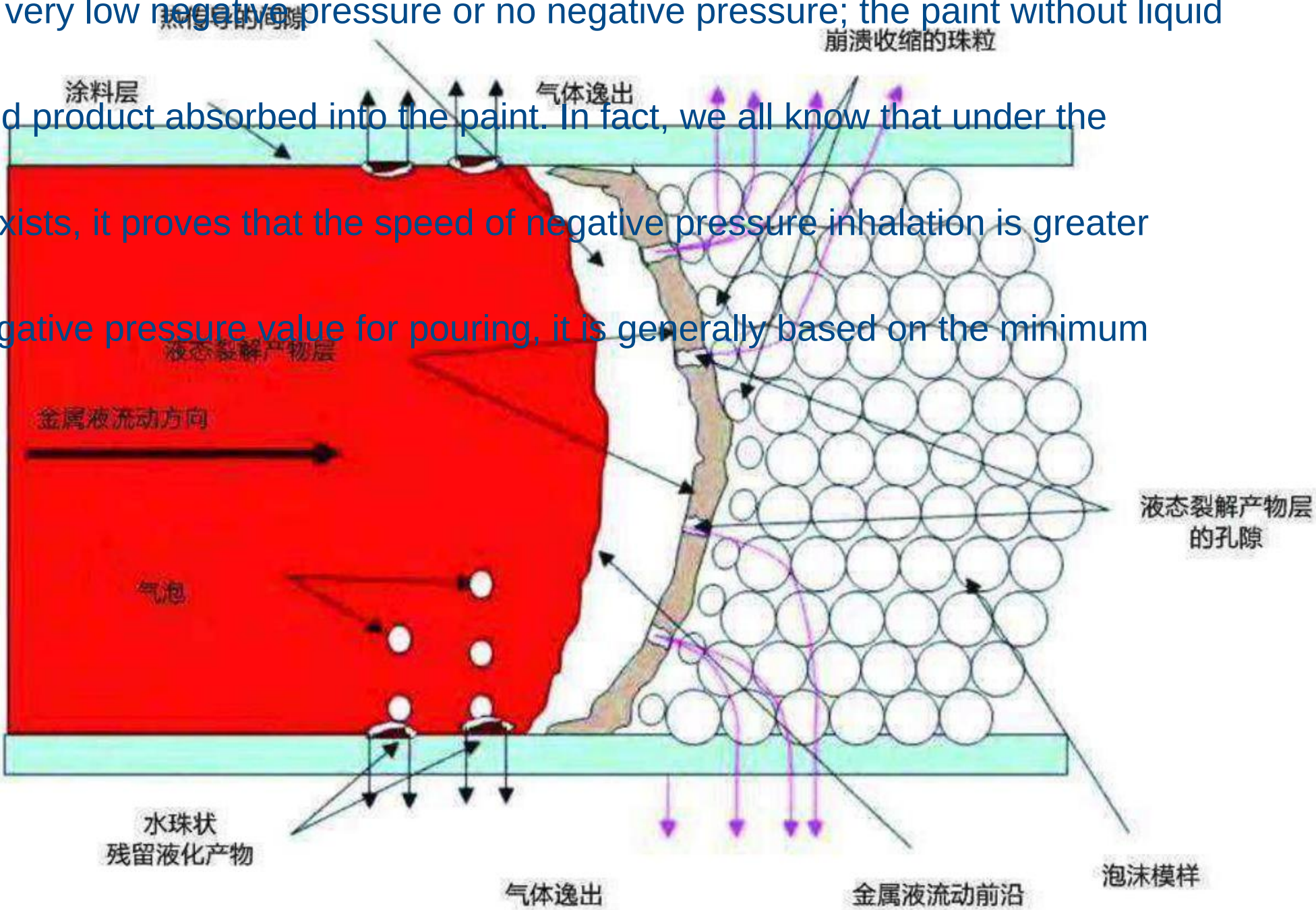


Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.3 Characteristic Analysis of Coatings Used in Lost Foam Casting Ductile Iron Parts

7.3.2 Analysis of molten iron filling process

Coatings with liquid adsorption must have good air permeability; but coatings with good air permeability do not necessarily have liquid adsorption! The paint with liquid adsorption can adsorb liquid products into the paint under the condition of very low negative pressure or no negative pressure; the paint without liquid adsorption can only rely on large negative pressure to absorb a small part of the liquid product absorbed into the paint. In fact, we all know that under the premise that the sand box is ventilated smoothly, as long as the negative pressure exists, it proves that the speed of negative pressure inhalation is greater than the speed of the vaporization of the foam . Therefore, when we set the initial negative pressure value for pouring, it is generally based on the minimum negative pressure value during the pouring process that is not less than 0.1bar.





Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.3 Characteristic Analysis of Coatings Used in Lost Foam Casting Ductile Iron Parts

Summarize:

Through the above analysis, it is not difficult to see that in order to completely solve the carbon deposition and slag inclusion defects of ductile iron products produced by the lost foam process

, the paint used must have good liquid adsorption. Only if the coating has this property can the residual foam be guaranteed.

The slag will not remain on the inside and outside of the casting, thus ensuring the quality of the casting; and this performance is not simply through the aggregate

and the performance of the filler, it is achieved by the gradual gasification of several organic binders at different temperatures to form fine

The siphon phenomenon formed by the channel is realized, and the formation of these fine channels is also related to the composition and proportion of the refractory aggregate and filler.

have a lot to do with it.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

4. Solutions for Carbon Defects in Lost Foam Casting Ductile Iron Parts

1. Causes and solutions of carbon defects in ductile iron Since the development of lost foam casting, it has been vigorously promoted and applied in many fields; especially in the production of gray iron boxes, pump bodies, motor shells, and ductile iron pipe fittings In terms of other products, the lost foam process has been widely used in mass production. However, in the production of ductile iron products with processing requirements, the application of the lost foam process has encountered many problems, mainly carbon defects, which are expressed in the form of surface carbon and internal carbon slag; many factories cannot completely solve the problem of carbon defects. Forced to change the process, or even abandon the market. Below, we will analyze the causes and solutions of ductile iron carbon defects from several aspects: ÿ First, we all know the causes of carbon defects . Whether it is EPS or copolymer materials, the models will be generated after gasification and decomposition. Elemental carbon and its compounds are collectively referred to as gasification residues; these gasification residues and impurities in molten iron combine to form carbon defects on the surface or inside of the casting.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

4. Solutions for Carbon Defects in Lost Foam Casting Ductile Iron Parts

1. Causes and solutions of ductile iron carbon defects
Second, the idea

of solving carbon defects
Model gasification residues and impurities in

molten iron are unavoidable in lost foam casting. What we want to solve these problems is to find a way to discharge these impurities out of the casting during

the molten iron filling process, or to accumulate them within the processing capacity of the casting, and in this process to avoid gasification residues and

Impurities in the molten iron aggregate into clusters that would otherwise be difficult to drain out of the casting through the paint. Third, the selection of

materials
First of all, when choosing the model material, we should choose a copolymer material with relatively few gasification residues, and at the same time

try to make the molten iron as pure as possible. The most important thing is that the coating we choose should have excellent liquid adsorption; In the early

stage of formation, the chemical residues are adsorbed and discharged as much as possible by the coating, so that they do not have the opportunity to

aggregate with impurities in the molten iron to form a large volume of carbon slag that cannot be discharged. What needs to be reminded here is that the

vaporization residue is not discharged by vacuum adsorption, but by the liquid adsorption of paint; we will give an in-depth explanation when setting the process

parameters later.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

4. Solutions for Carbon Defects in Lost Foam Casting Ductile Iron Parts

1. Causes and solutions of ductile iron carbon defects

γ Fourth, the setting of lost foam process parameters:

(1) Control of the quality of the white mold

The first choice is the copolymer material; under the premise of ensuring the strength and surface quality of the model, the density should be as low as possible, and the general wall thickness should be less than

For products with a thickness of 20mm, the pre-expansion density is controlled at 20~23g/l; for products with a wall thickness greater than 20mm, the pre-expansion density is generally controlled at

19~21g/l. Of course, this is a conventional setting. For some thin-walled products, the specific gravity of the pre-release can be appropriately increased. and

For some products with very different wall thicknesses, separate molding should also be considered. At the same time, different wall thicknesses should be selected according to different

Particle size; different products should be determined comprehensively after specific process analysis.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

4. Solutions for Carbon Defects in Lost Foam Casting Ductile Iron Parts

1. Causes and solutions of ductile iron carbon defects
Fourth, the setting

of lost foam process parameters: (2) The paint should choose paint with

excellent liquid adsorption. Many manufacturers believe that high vacuum is

beneficial to carbon slag adsorption and discharge, this understanding is very one-sided. Because we all know that the greater the vacuum degree, the more obvious the

Coanda effect of the molten iron, that is to say, the greater the downward curvature of the U-shaped area formed between the molten iron and the model, the molten iron has

risen along the coating shell at this time. If the distance is high, the coating shell attached to the molten iron has completely lost the effect of exhaust gas adsorption. The residue

after gasification at the bottom of the U-shaped must rise along the U-shaped wall to reach the position that is not closed. The distance is long and there are many It hangs on

the inner wall of the molten iron cladding without waiting for it to rise to the position. At the same time, the turbulent flow of the molten iron filling the mold with the high vacuum

degree will cause the molten iron to roll up in the cavity, so that the model is divided and wrapped in the molten iron. Although the vaporized residue of the model will float in the

direction of the paint exhaust, but because it combines with the impurities in the molten iron to form carbon slag, even if it drifts to the position of the paint, it cannot be

discharged by the paint due to the volume, but is wrapped inside the molten iron The residues form internal carbon residue defects.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

4. Solutions for Carbon Defects in Lost Foam Casting Ductile Iron Parts

1. Causes and solutions of ductile iron carbon defects ỹ Fourth, the setting of

lost foam process parameters: (2) The paint should be selected with excellent

liquid adsorption properties, and most of the carbon residue defects caused by high

vacuum degree Internal defects will be formed, because the appearance is covered by the molten iron of the Coanda, and this carbon defect will form a diffuse and

irregular distribution, which is difficult to remove by processing. When using a paint with excellent liquid adsorption, the vacuum degree can be set very low, the U-

shaped area formed is very shallow, and the distance for the vaporization residue to escape is very short. At the same time, several compounds in the paint are at

different temperatures. The instantaneous strong siphon phenomenon formed by the gradual gasification under the coating can make the gasification residue fully

adsorbed and discharged by the coating. On the other hand, because the vacuum degree is low, the turbulent flow of the molten iron filling mold will not be formed,

thus avoiding the split and wrapping of the mold. Regarding the setting of vacuum degree, many people also realize that for products with processing requirements,

the lower the vacuum degree, the better, but because the quality of the coating is not good enough, the low vacuum degree brings about other problems such as cold

insulation and fire convection. Therefore, the coating with excellent liquid adsorption is one of the key conditions for the lost foam to solve the problem of processing

defects.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

4. Solutions for Carbon Defects in Lost Foam Casting Ductile Iron Parts

1. Causes and solutions of ductile iron carbon defects

lost foam process parameters:

(3) The design of the pouring system

The lost foam process has strict requirements on the filling of molten iron. First of all, it must be stable. Only a stable model can be gasified layer by layer, and can

It is beneficial to the adsorption and discharge of gasification residues. The next step is fast, which requires the filling speed of molten iron to keep up with the gasification of the model.

speed. According to such filling requirements, when we consider the design of the gating system, we should first use the bottom injection as much as

possible for the casting, or the bottom injection plus the side injection, and try not to use the top injection. In order to solve the temperature

compensation and improve the process yield, many manufacturers often like to use the top casting method. This casting method has a good surface, but the i

Defects are everywhere.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

4. Solutions for Carbon Defects in Lost Foam Casting Ductile Iron Parts

1. Causes and solutions of ductile iron carbon defects

Fourth, the

setting of lost foam process parameters: 4 Pouring temperature

Generally speaking, the casting temperature of lost foam is 30~50

higher than that of cavity casting, but from the practical application point of view, the pouring temperature of lost foam is generally more than 50 higher than that of cavity casting. For ductile iron, this means that the temperature of the spheroidizing treatment is more than 50°C higher than the traditional one, which also involves the process of high-temperature spheroidizing treatment. Pouring temperature, which is also one of the reasons why carbon defects cannot be completely solved. 5 Vacuum pouring under low vacuum is the key to solving processing defects. Under normal circumstances, the initial setting of vacuum degree does not exceed 0.03MPa. Through the above analysis, it is not difficult to see that the two most critical elements to solve the problem of ductile iron processing defects are the design of coatings and gating systems, and many manufacturers are used to gray iron and ductile iron products without processing requirements, so they often ignore it. the crucial role of these two conditions.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.4 Solutions for Carbon Defects in Lost Foam Casting Ductile Iron Parts

7.4.2 The two most critical elements to solve the problem of ductile iron processing

defects Through the above analysis, it is not difficult to see that the two most critical elements to solve the problem of ductile iron processing defects are the design of coating and gating system. Gray iron and ductile iron products without processing requirements are often ignored, so the key role of these two conditions is often ignored.

Why gray iron is not very sensitive to these two key conditions, there are material reasons and product acceptance requirements. ÿ a. First of all, from the analysis of the material, the slag generated by the gray iron material itself is very small when it is smelted, and it is generated when it comes into contact with the air.

There is also very little oxide slag, so in terms of the purity of molten iron, gray iron is much better than ductile iron.

ÿ b. Solidification method of gray iron and ductile iron: The most critical point is that the solidification method of gray iron is layered solidification, which is conducive to the floating of impurities, so many gray iron products have a slag collecting riser on the top or increase processing. The remaining amount can solve a part of the carbon residue problem. The solidification method of ductile iron is paste-like solidification. Many carbon slag wrapped in the product has no time to surface, and the channel has been closed by the precipitated dendrites. Therefore, adding a slag riser and increasing the processing allowance have little effect.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.4 Solutions for Carbon Defects in Lost Foam Casting Ductile Iron Parts

7.4.2 The two most critical elements to solve the problem of ductile iron processing

defects ȳ c. The acceptance standard of some domestic gray iron casting products is low: another aspect is also a very critical reason is the product

The acceptance requirements are low. Many of our gray iron products are now concentrated in some domestic accessories markets such as cabinets and motor shells. Many domestic manufacturers have much lower quality requirements for products than exports, especially many products are for self-use, internal enterprises. Many problems are coordinated with each other, even if it is an outsourced product, it will pass if it can basically pass the relationship.

ȳ

ȳ d. Analysis of the current situation of the domestic foundry and casting market: Under such quality requirements, enterprises often try to reduce costs in order to meet the demand.

Malicious competition for low prices. The boss of a company in Shaanxi has seen the quality of our exported ductile iron products and recognized our process concept very much, but he said a very thought-provoking sentence "According to your concept, the defects of the product can indeed be solved, but I will No matter how good the quality is, the manufacturer will not raise the price for me, and I have to pay for the increased cost ." This may represent the common aspiration of some suppliers, and it also reflects the quality of some product accessories market in China.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.4 Solutions for Carbon Defects in Lost Foam Casting Ductile Iron Parts

Conclusion: However, under the current economic situation, the original quality concept has been greatly impacted, and the weakness of the domestic market has made t

Many manufacturers operate bleakly, and the quality requirements of the export market cannot be met. In fact, these are directly related to the level of technical

craftsmanship and quality awareness . We are paying for our skill level and quality awareness. Quality determines the market. Faced with the ever-increasing

quality requirements, we should seriously reflect on it. The original market share that can be solved by relationship will become smaller and smaller, and products

that rely on polishing and repairing will be less and less recognized; labor, environmental protection The increase in cost offsets the price advantage of lower-end

products. In this case, high-quality products are the foundation of the market competition . How to really solve the defects and improve the quality of the products

is the main problem faced by our majority of foundry enterprises, and it is also a problem that needs to be taken seriously and needs to be solved urgently.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

5. The application of lost foam casting technology in the production of electric power fittings

1. Abstract

With the increase of investment in infrastructure construction in my country, the demand for power fittings has also expanded, and the construction of power facilities is

A long-term infrastructure project, so the power fittings market has been steadily rising. Of course, this market includes domestic

outside market. The domestic market is mainly concentrated in several state-owned power companies, and the foreign market is mainly Europe and the United States, India and the United States.

Iran.

At present, there are several lost foam foundries in China that are developing products for power fittings, some for domestic and some for export. Among them, Jiangsu

All the power fittings made by a company in Nanjing and a machinery factory in Gaoyou, Jiangsu are exported. The following is a company in Nanjing, Jiangsu.

Taking the electric power fittings produced as an example, the application of the lost foam technology in electric power fittings is introduced.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.5 Application of Lost Foam Casting Technology in the Production of Electric Power Fittings

7.5.2 Pattern analysis of steel cap casting products There are many

product series of electric power fittings, among which the most representative products are steel caps and wire

rods. The picture below shows the white mold and casting product picture of the steel cap. According to the working conditions of the steel cap and

the technical requirements of the product itself, we can see that the most critical dimension of the product is the internal dimension of the socket head,

because this part also needs mate with another part . The product is produced by the lost foam process . There are two options for white mold molding,

segment molding and integral molding.





Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.5 Application of Lost Foam Casting Technology in the Production of Electric Power Fittings

7.5.2 Analysis of the pattern parting scheme of steel cap casting products 1.

The scheme of sheet forming is to form parts from the middle symmetrical part of the product; the mold can be a Haval mold, and the diaphragm is formed and then bonded into a whole. The advantages of this scheme are: the product is simple to form, the production efficiency is high, and the white mold can be formed by a fully automatic forming machine, so the labor is less; Disadvantages: the stability of the overall size of the product is poor, because the overall size of the final product is obtained after bonding, so the precision of the bonding mold, the operation of the workers, the quality of the glue and many other factors will affect the overall size of the product. There are two kinds of glue for the lost foam and white mold bonding, one is cold glue (AB glue; one-component glue) and the other is hot glue (hot melt glue), but whether cold glue or hot glue is used, in order to ensure the bonding Qualified, the glue needs to be extruded when bonding, that is to say, after the white mold is bonded, a glue tumor needs to be extruded from the glue at the bonding place, so as to ensure that the entire bonding surface is completely bonded; once the bonding surface is not completely glued External glue treatment is required. Because once there is a gap on the bonding surface, the paint will invade, and the poured product is waste. For steel cap products, it is very troublesome to deal with the protruding glioblastoma after the product is bonded, whether it is in the white mold or in the casting, it is difficult to ensure the appearance quality and size of the product, especially the key socket part is difficult to clean. .



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.5 Application of Lost Foam Casting Technology in the Production of Electric Power Fittings

7.5.2 Analysis of the pattern parting scheme of steel cap casting

products 2. Integral molding; Integral molding means that the white

mold is integrally formed through the mold. Advantages: the white mold does not need to be bonded, the overall dimensional stability of the product is

good, and the subsequent processes are reduced; Disadvantages: The molding is more complicated, and the mold can only be loaded and unloaded

manually, so the molding efficiency is low and the labor is large. Through the analysis of the above two schemes, Nanjing Company finally adopted the

integral molding process; because when we produce a product, we first need to consider the quality of the product, and then the cost of the product;

therefore, the first consideration is the process analysis of the product It is the quality of the product, but also the overall cost. The steel cap is integrally

formed, and the increase in the amount of workers is only in one process of forming, but it will save a lot of labor in terms of product bonding and final

grinding and cleaning, which is basically the same as the split forming in terms of labor , even if it is more, it is limited, and this solution is much better than

chip forming in terms of dimensional accuracy and surface quality. At the same time, because the process of bonding the product as a whole is omitted, it

also reduces a hidden quality risk; therefore, the final yield of the overall molding is higher than that of the segmented molding, and the cost is correspondingly

reduced. In terms of overall efficiency, there are two methods. Basically the same.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.5 Application of Lost Foam Casting Technology in the Production of Electric Power Fittings

7.5.3 Several issues that should be paid attention to when designing the steel cap

product. The material of the steel cap product is ductile iron ASTM65-45-12 and needs hot-dip galvanizing on the surface. Although this product is not processed, it is

It has very high requirements on the internal quality, because the steel cap needs to be tested by tensile test. Once the inside of the steel cap is cast

Defects will break, and the steel cap needs to be hot-dip galvanized. If the product has shrinkage or surface defects, acid reflux will occur.

phenomenon; therefore, the actual requirements of this product and the requirements of the processed product are the same. According to the use requirements of the product,

When considering the casting process of steel cap products, we need to pay attention to several

aspects: ÿ 1) Selection of beads: In order to reduce carbon deposition defects; use copolymer beads; Kester Chemical's standard 3# or small 3#

fee.

ÿ 2) Properly adjust the carbon equivalent of ductile iron ingredients.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.5 Application of Lost Foam Casting Technology in the Production of Electric Power Fittings

7.5.3 Several issues to be paid attention to in the design process of steel cap products According to

the use requirements of the product, several aspects need to be paid attention to when considering the casting process of steel cap products: ý 3) Increase the

pouring temperature: because the maximum temperature of the steel cap is The thin wall thickness is only 4mm, which is prone to casting defects such as cold insulation and fire flow; therefore, the

furnace temperature is required to be 1600 °C, and the pouring temperature is not lower than 1480 °C. Under such process requirements, it is necessary to ensure that the furnace is released and

poured. In addition to the temperature, the quality of spheroidization must be guaranteed; because the general foundry of high-temperature spheroidization technology is not very good, the pouring

time should be as short as possible to prevent the molten iron from cooling down.

ý 4) The slag removal system should be fully considered in the design of the gating system, and the stable filling of molten iron should be ensured. Otherwise, the defects of carbon-inclusion slag will easily

occur for thin-walled products; the defects of carbon-inclusion slag are similar to the defects of fire flow. But it is not exactly the same. When there are many such defects, the surface cannot be seen,

especially when the vacuum degree is relatively large. It appears in the thin-walled position, and it is easy to break during the tensile test. ý 5) Vacuum degree: In order to ensure the stability of filling;

the vacuum degree should not be higher than 0.04MPa; generally set at 0.03MPa; this is also the vacuum degree requirement for processing products.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.5 Application of Lost Foam Casting Technology in the Production of Electric Power Fittings

7.5.4 Sanding and vibrating and process analysis of steel cap

products For steel cap products, in addition to meeting the above process conditions that need attention, it is also necessary to pay attention to the filling and deformation of the product; although the product can be shaped, but , if the deformation rate of the casting is small, the subsequent workload will be greatly reduced, so in terms of equipment, a vibrating table with efficient filling and compaction and a small amount of deformation is necessary. In order to solve the problem of filling compaction and deformation, some factories have adopted the method of increasing the thickness of the coating and using pearl sand for modeling. It seems that some problems have been solved on the surface, but in fact, it has brought great hidden dangers to the quality. • First, increasing the thickness of the coating will inevitably reduce the air permeability and liquid adsorption of the coating. At this time, it can only be compensated by increasing the vacuum degree, and the high vacuum degree will have a great impact on the filling of molten iron, and it is easy to produce internal defects. At present, many domestic manufacturers choose this method to make up for the lack of vibration table performance. Therefore, many manufacturers have low yields when producing ductile iron products with processing requirements. The main problem is that there are many defects in the processed products.



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7.5.4 Sanding and vibrating and process analysis of steel cap products

Second, the use of gemstone sand will reduce the rigidity of the mold wall, especially in the production of thick and large ductile iron products, the rigidity of the mold wall directly affects the organization of the product; Many people think that high vacuum will increase the rigidity of the mold wall, but this is a misunderstanding. After the sand box is covered with plastic film, the effect of vacuum degree on the molding sand is only about 200mm below the plastic film. No matter how much the vacuum degree is below 300mm, it has no effect on the rigidity of the molding sand. The rigidity of this part of the molding sand depends entirely on the vibrating table. compact performance.

It is not difficult to see from a comprehensive analysis that although the steel cap product is not processed, because the product needs hot-dip galvanizing and the particularity of its use, it is actually difficult to produce it by the lost foam process. In particular, it is necessary to ensure that the interior of the steel cap is not Any quality defects are allowed. Because the tensile test is only a random inspection, if the process measures are unreasonable and cannot guarantee the inherent quality of the product, the product will have a major quality risk. Especially as an export product, it will face a major risk of quality claims. From the perspective of the degree of internal quality requirements, the requirements of steel cap products are actually stricter than many machined products, because many machined products are not complete. Processing; Besides, as long as the inherent defects are not on the processing surface, products without special requirements are acceptable. Although the steel cap is not processed, the use state will strictly inspect the internal quality of the product.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.5 Application of Lost Foam Casting Technology in the Production of Electric Power Fittings

7.5.5A16SJ socket head wire rod (ASTM 60-40-18) process analysis Next, we will introduce the production of

socket head wire rod: The key dimension of the wire rod product is also the inner size of the socket head, and

like the steel cap, it must be carried out with other products. Cooperate. The comprehensive analysis and parting method is the same as that of the steel cap, which is also

integrally formed. In addition, the rod part of the steel cap product needs to be fully processed , the outer circle processing amount is 2mm on one side, and the center of the rod

is machined with a blind hole of 20 mm. the difference

y
Common point: The requirements for the appearance and internal quality of the products are consistent, so there are common process parameters. Difference:

The wire rod is thicker than the steel cap, so the temperature requirements are not as sensitive as the steel cap; in addition, when considering the matching





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7.5 Application of Lost Foam Casting Technology in the Production of Electric Power Fittings

7.5.5A16SJ Wire-pulling Rod (ASTM 60-40-18) Process Analysis The following points need to be paid

attention to regarding the technical considerations of the wire-pulling rod: 1) Beads: In order to reduce

carbon deposition defects, use copolymer beads, 3A of Kester Chemical # or 2# material, while controlling the specific gravity of the beads to be below 23 grams. 2)

Appropriately adjust the carbon equivalent of ductile iron ingredients; 3) Pouring temperature: It is required that the discharge temperature is 1560 °C, the pouring

temperature is not lower than 1460 °C, and the pouring time should be as short as possible to prevent the molten iron from cooling down. 4) The slag removal system

should be fully considered in the design of the pouring system, and the stable filling of the molten iron should be ensured. 5) Vacuum degree: In order to ensure the stability

of filling, the vacuum degree should not be higher than 0.04MPa, generally set at 0.03MPa, which is also the vacuum degree requirement for processing products. 6)

Coatings: Coatings with high liquid adsorption properties are required.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.5 Application of Lost Foam Casting Technology in the Production of Electric Power Fittings

7.5.5A16SJ socket-headed wire rod (ASTM 60-40-18) process analysis In addition to the general technical

requirements, the requirements for the coating are relatively strict in the process of the wire rod, which is related to the thickness of the wire rod. Because the thick and large products produce more residual carbon, it is required that the paint should absorb the liquid material in the vaporization process of the white mold into the paint at the first time, and then vaporize the second time when the subsequent high-temperature molten iron passes through. The liquid adsorption of coatings is an important indicator of lost foam casting coatings. At present, many domestic manufacturers put the air permeability of the coatings in the first place when they produce or formulate their own coatings. They think that as long as the coatings have good air permeability and high fire resistance, they can meet the requirements. In fact, this is a misunderstanding. ; Because the air permeability of the coating mainly depends on the particle size of the refractory aggregate and filler, that is to say, the smaller the mesh number, the larger the particle size, the better the air permeability. However, no matter how the aggregate reduces the mesh, it cannot be lower than 120 mesh, otherwise it will affect the surface quality of the casting, and the molding sand used for molding, whether it is quartz sand or pearl sand, usually has a mesh between 30 and 70 mesh; Although the particle size is large, the vaporized gas travels through the molding sand for a long distance, that is to say, under the action of vacuum, no matter how good the permeability of the coating is, the permeability of the molding sand is the most critical. Therefore, when the lost foam process is producing ductile iron products, it is necessary to have a coating with efficient liquid adsorption; at the same time, the specific gravity of the white mold must also be reasonably controlled.



Chapter 7 Analysis of Typical Cases of Lost Foam Casting

7.5 Application of Lost Foam Casting Technology in the Production of Electric Power Fittings

7.5.6 Summary In

general, the production of power fittings by the lost foam process is feasible in terms of technology, and the cost is also lower than that of sand casting. In particular, the subsequent grinding workload is reduced, and both labor and environment have been significantly improved. . However, using the lost foam process to produce power fittings has high requirements on process technology, key equipment and coatings. Many domestic factories that use high vacuum technology are difficult to adapt, because the lost foam process produces ductile iron, especially those with inherent quality requirements. For ductile iron products, there are high requirements for the filling of molten iron, the design of the slag removal system and the liquid adsorption of the coating . I visited a lost foam factory that produces steel caps, and I saw that the product yield was less than 70% due to process design, paint and other issues, and there were also major quality risks for products that had passed the appearance inspection. Because for the so-called qualified products, the internal quality defects cannot be excluded from the analysis from the process point of view. With the improvement of quality awareness in the casting market at home and abroad, the requirements for casting products are becoming more and more strict, which also promotes the lost foam casting process ; we are required to continuously improve and even innovate the lost foam casting process, not only It stays on making some wear-resistant parts and gray iron products that are not processed or have very low processing requirements; such a process can be adopted not because the process is mature, but is selected by the product market with simple requirements. Therefore, the lost foam casting process that can completely solve the surface and internal quality defects is a mature process! It is also a living craft!



Chapter 8 Lost Foam Casting Detail Management and Vision

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1. The details of the lost foam casting white area pattern production
2. The lost foam casting production management
3. The lost foam casting safety production control
4. The principles and visions of the lost foam casting process



Chapter 8 Lost Foam Casting Detail Management and Vision

1. The details of the lost foam casting white area pattern production

1. The relationship between the quality of the lost foam casting foam pattern and the particle

size of the beads: The particle size range of the original beads is large, which leads to the

following problems--- Due to the different particle sizes of the beads, the foaming agent

contained The content is also different; in general, the larger particle size of the beads has more foaming agent content, and it is not easy to volatilize when the

beads are placed, and it is easy to foam during pre-expansion. The content of foaming agent for beads with small particle size is relatively less, and it is more volatile

than beads with large particle size in the same environment when the beads are placed. Heavy. Due to the different particle size of the beads, the expansion ratio

of the beads is also different; in general, the expansion ratio of the beads with larger particle size is larger, and the expansion ratio of beads with small particle size

is smaller, which is As a result, the pre-issued beads are not uniform, and the density measurement actually measures a pseudo-density. For example: the density

of the pre-released beads is required to be 22g/l, and the specific gravity is also measured during the pre-release process; the actual: the density of the pre-released

beads with a large particle size is 19g/l; the pre-release of the small-diameter beads Then it reached 25g/l.



Chapter 8 Lost Foam Casting Detail Management and Vision

1. The details of the lost foam casting white area pattern production

1. The relationship between the quality of the lost foam casting foam pattern and the particle size of the

beads. Due to the different requirements for the molding parameters of the beads of different densities, the subsequent molding cannot be adjusted, resulting in a large gap between the beads on the surface of the pattern and uneven surface. Less than the subsequent process requirements.

During subsequent molding, due to the fixation of the existing charging method (beads charged into the mold cavity, generally lighter beads are far from the charging port), resulting in an increase in the density step of the pattern, and local charging. The occurrence of insufficient material defects. Due to the larger density steps of the pattern, on the same pattern, the strength of the pattern with higher density is better; where the density is lower, the strength of the pattern itself is poor, which leads to the deformation of the pattern. According to our long-term research on the white area of lost foam casting and a large number of customer follow-up and service, we have come to the conclusion:

The diameter range should be controlled within 0.15mm; this is the most suitable foam bead size for lost foam casting!



Chapter 8 Lost Foam Casting Detail Management and Vision

8.1 Details of the white area pattern production of lost foam casting

8.1.2 The relationship between the quality of the lost foam casting foam pattern and the curing of the beads

Reasons: the foam beads before molding are not well cured, which will lead to the following problems---

foam beads before molding are not well cured, which will cause the molding to fill up. When feeding, it is easy to cause the defect of insufficient filling; the moisture content in the poorly aged beads is large, and the resilience of the beads is poor. In the pressurized feeding tank, several foam beads are easy to stick together and form. Poor flow of foam beads when filling

, it is prone to the defect of insufficient filling.

• The foam beads before molding are not well-cured, which will lead to poor re-expansion ability of foam beads during foam molding; poorly-cured beads have a large moisture content. Water must be evaporated and converted into water vapor, and a large amount of heat must be absorbed in the process, resulting in poor re-expansion ability of foam beads during secondary foaming. It can be done by increasing the bead density during pre-shot. It is well known that the density of the pattern is too high, which will lead to other defects in the future. • The foam beads before molding are not well-cured, which will cause the size of the molded pattern to shrink greatly during foam molding; the poorly-cured beads have poor re-expansion ability due to their poor resilience and poor re-expansion ability. The phenomenon of boiled foam is easy to occur during foam molding, and the water content inside the formed foam beads is relatively large, which leads to the poor strength of the formed pattern itself. When it is dried in a drying room, the water inside the pattern evaporates. After that, the pattern is prone to the phenomenon of large size shrinkage, especially the large-sized pattern, this phenomenon is more obvious.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.1 Details of the white area pattern production of lost foam casting

8.1.2 The relationship between the quality of the lost foam casting foam pattern and the

curing of the beads And the molding filling of foam board, do not use pressurized feeding, basically fill with suction, the beads are naturally accumulated in the mold cavity, if the beads are in the secondary foaming molding, their own re-expansion ability is poor. This will lead to the occurrence of this defect. The poorly cured beads have a large water content. During foam molding, the re-expansion ability is poor and the water absorption is strong. Naturally , a thick and large foam will appear . The phenomenon of face depression. ÿ The foam beads before molding are not well-cured, which will lead to the appearance after molding. When placed in the drying room, there will be three times of foaming. During foam molding, due to the large water content of the beads themselves, the re-expansion ability of the beads is very poor. During the foam molding and steam penetration process, the foaming agent escapes relatively little, and the residual foam in the foam pattern. If the content of foaming agent is too much, it will be dried in the drying room later. When the water inside the pattern evaporates, the foaming agent will escape at a certain temperature, causing the pattern to foam three times, thus affecting the surface quality of the pattern. According to our long-term research on the white area of lost foam casting and a large number of customer follow-up and services, we have concluded that the moisture content of the foam beads before molding should be controlled within 1%; this is the only way to determine whether the foam beads are well-cured or not. , the most fundamental indicator!



Chapter 8 Lost Foam Casting Detail Management and Vision

8.1 Details of the white area pattern production of lost foam casting

8.1.3 Drying of lost foam pattern and paint coating It is suggested that casting

is playing with "two waters": one is: molten iron of different materials, and the other is: water for making coffee; many casting defects in lost foam casting are after The person is at fault (foam, paint not fully dry - "watery"). Let's talk about the moisture drying of each link in detail: Current domestic equipment: under normal circumstances 1. The moisture content of the beads just pre-released is about 5% (this moisture is controlled by the drying and curing process of the beads, high-quality beads Bead ripening depends on a good environment! The surrounding environment for bead ripening should have low humidity and good ventilation conditions. It is also necessary to reasonably use the bead drying and curing function of the fluidized bed of the pre-conditioner); 2. The shape of the formed foam (The moisture content of the foam pattern just made by traditional water cooling is 5-10% (the moisture drying in this link is as follows): 3. The moisture content of the paint mixed with the pattern dip coating is about 45% (the moisture drying in this link is as follows) one page)



Chapter 8 Lost Foam Casting Detail Management and Vision

8.1 Details of the white area pattern production of lost foam casting

8.1.3 Suggestions for drying foam patterns and paint coatings of lost foam patterns

Suggestions for pattern and paint drying: a. Pattern drying process: The newly formed foam

patterns should not be forced to dry in the drying room immediately, the reason: the newly formed foam patterns The capillary pores of the foam-like beads are in an open state. If

they are forced to dry in the drying room immediately, the capillary pores of the beads will be quickly closed, and the surface beads will continue to expand slightly at a certain

temperature, locking the surface of the pattern (we often say The surface of the pattern is closed), and it is difficult for the moisture remaining in the pattern to escape during the

molding process . The correct method is suggested: the formed foam pattern should first let the moisture in the foam pattern escape 60-70% at room temperature or in a low-

temperature drying room with hot air flow, and then enter the drying room, using the low humidity of the drying room to force it. Drying (pattern drying: the temperature of the drying

room is controlled at 35-40°C, and the humidity is controlled below 10%) Note: After the foam pattern is dried, the interior of the pattern will not absorb water, and the surface will form

when it is hot and cold. Water film (dry as soon as it enters the drying room) b. Paint drying process: The paint layer is different. If the dried model cluster is placed in a place with high

room temperature and humidity, the coating will absorb moisture quickly . (So: the model cluster is taken out of the drying room and packed, you must pay attention to this link)



Chapter 8 Lost Foam Casting Detail Management and Vision

8.1 Details of the white area pattern production of lost foam casting

8.1.4 Relationship between shrinkage rate of lost foam foam pattern and bead size and drying temperature

For details, please refer to:

Chapter 2 Fabrication of Foam Models and Combination of Mold Clusters

6. Model sheet drying and anti-deformation treatment

1. Drying and stabilization of foam patterns

The size shrinkage experiments of some foam patterns are as follows:

Experiment 1: Relationship between foam pattern shrinkage and bead size

Experiment 2: Relationship between foam pattern shrinkage and drying temperature



Chapter 8 Lost Foam Casting Detail Management and Vision

2. Lost foam casting production management

1. The basic requirements of lost foam for production managers

(1) Strengthen study and master certain theoretical knowledge of lost foam casting.

• Familiar with the casting process card requirements and strictly implement them.

(3) Strengthen the quality inspection of each process and control the problem at the source.

• Strengthen the management and control of on-site operation data, and make on-site operation records (to be well documented, to understand how it happened, and to waste it.

how was it rubbish)



Chapter 8 Lost Foam Casting Detail Management and Vision

8.2 Lost Foam Casting Production Management

8.2.2 Significance of Management in Lost Foam Casting

Production Statistics In 2017, there were more than 1,500 lost foam casting enterprises in China, and the number of such lost foam enterprises is undoubtedly the first in the world; in terms of output, China lost foam casting in 2017. The output of casting is as much as 2.8 million tons, which is undoubtedly the first in the world. Although the number of enterprises and production capacity ranks first in the world, there is still a considerable gap between China's lost foam casting enterprises and developed countries in terms of the production scale, product quality and product value of a single factory, especially the lack of high-quality castings. The author believes that this gap should be in 5-10 years. There are many reasons for this gap, including process technology, equipment, and raw materials. We believe that management is also a very important factor. There is a considerable gap between Chinese enterprises and developed countries in the management level of lost foam casting production. China's lost foam casting industry has not developed for a long time. In the past, everyone mainly focused on equipment, technology, etc., and little discussion on management. In the long-term promotion and practical application of lost foam casting technology, we have come into contact with different types of enterprises, including state-owned enterprises, private enterprises, joint-stock enterprises, individual enterprises, partnership enterprises, etc., with different scales and different management models. Varies. Different management produces different results, and we have a deep understanding of this. Here, we put forward our ideas based on our own practice of casting production and the observation of the production practice of hundreds of lost foam casting factories. At the same time, we will do our best to promote the healthy development of China's lost foam casting industry.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.2 Lost Foam Casting Production Management

8.2.2 The significance of management in lost foam casting production

Management is of great significance in lost foam casting production! Lost foam casting involves many disciplines such as plastics, chemical industry, refractory materials, electromechanical, casting, etc. It has a long process flow and many influencing factors. According to the usual habit, lost foam casting includes two parts: white area and black area. •White area: refers to the process of pattern preparation and coating completion. Including the rational selection of foam model raw materials, pre-foaming, molding, model drying, bonding combination, coating preparation, dip coating (or brushing, or spraying), coating drying and other processes, the white area is carried out as a system unit Management, set up three processes of foam molding, coating, and combination. •Black area: refers to the process of molding and pouring to complete the workpiece. Including smelting, vibration molding, pouring under negative pressure, sand treatment and other processes. Generally, the black area is managed as a system unit, and two processes of smelting and molding and pouring are set up. Inspection, cleaning and other post-processing are the same as other casting processes and can be used together. It will not be described separately here.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.2 Lost Foam Casting Production Management

8.2.2 The significance of management in the production of lost

foam casting Lost foam casting includes so many technological processes, which is a systematic project. At the same time, it determines the long cycle period of lost foam casting production, so there are many links and factors that need to be managed. In the production process, problems in each link will directly affect the quality of the final product, resulting in the disconnection or loss of control of the entire production, resulting in the loss of manpower and material resources, and affecting the delivery cycle and reputation. The degree of influence of management on production can be analyzed through a specific case: a lost foam casting enterprise, which has declined rapidly in recent years, has now ceased production. I once discussed with the original supervisor that in addition to the directional difficulties caused by macro management factors (such as strategic adjustment, brain drain, etc.), the management fluctuations in the specific production process directly caused the decline in quality and economic benefits . He said: "In the best period of management, the qualified rate of castings can reach more than 90% in one press, and the final pass rate can reach more than 95%; using the same equipment, the same process, and the same material, when the management is chaotic, one-time The suppression pass rate quickly dropped to below 60%, and the final pass rate dropped to below 75%. "According to the selling price of their products, the pass rate of about 80% can achieve break-even, so when the management is chaotic, it will naturally lose money.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.2 Lost Foam Casting Production Management

8.2.2 The significance of management in the production of lost

foam casting For a company we serve, for a long period of time after the trial production, due to the strong randomness of management, the product quality is unstable, and it is good and bad. After analysis with the leaders of the enterprise, it is recommended to stop production for training and rectification. Suspension of production for rectification requires great determination, because after all, it will affect the output, or even affect the fluctuations of management cadres and employees. The company finally made up its mind to carry out this work, stopped production for a week, fixed positions and staff for each link, found gaps, set standards, formulated rectification measures, and implemented them to each specific person and each step of operation, after re-production, process, etc. Nothing has changed, but it has a new look, and the pass rate has gone up immediately. The leaders of the company said with deep feeling that management is too important for lost foam production. Strengthening detailed management and establishing a sound management system is the only way to achieve effective management of lost foam casting production. Compared with the traditional casting process, lost foam casting has higher requirements for technicians and lower requirements for operators. Due to the factors of physical strength and skills, the traditional modeling process is facing the embarrassment of a shortage of operating human resources, and it is even gradually decreasing.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.2 Lost Foam Casting Production Management

8.2.2 The significance of management in the production of lost foam

casting The low requirement for operators is also one of the important factors that attract everyone to lost

foam casting. We believe that according to the production characteristics of lost foam casting, although the skills of the operators are low, the overall quality

requirements are not low, and even the requirements are improved, that is, the requirements for the operator's sense of responsibility and serious work are

high. . The production process of lost foam casting requires every worker to have a very strong sense of responsibility, and every step of the operation must be

very serious. Once, the representatives of some member units of the China Foundry Association Real Casting Committee organized a visit to Japan. Japanese

companies attach great importance to certain details in the production process, and do it very well. Some products are very delicate, which is very inspiring to

everyone. Lost Foam Casting is a system with many production links and interconnected. Therefore, the control and management of details has become a

concrete manifestation of lost foam casting production management, including personnel management, process management, quality management, equipment

management, etc. Most of the lost foam foundries in China have simple equipment, low degree of mechanization and automation, and most of them are purely

manual operations. Therefore, the human factor is very important to the production of lost foam casting, and the emotions of employees directly affect the quality

of products.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.2 Lost Foam Casting Production Management

8.2.2 The significance of management in lost foam casting

production So how to achieve effective control of personnel factors?

There are two basic elements in the production process of lost foam

casting: First, human factors--effective control of human factors is an effective guarantee for smooth production! 1. Set

the number of posts and staff to ensure the stability of the staff. The personnel are unstable, which is very taboo in the production of lost foam casting. Many factories, especially newly built factories, have very unstable personnel due to various factors such as wages and skills. They will be replaced every few days. The training has not been completed yet, and tomorrow will be new. People are unstable, and quality and production cannot be stabilized. 2. Establish a post responsibility system and make the responsibilities clear. Unclear job responsibilities lead to no one being responsible in the end, blaming each other. 3. Supervision and examination. Personnel management without supervision and assessment will not be effective and long-term. Human inertia is inherent, and only by strengthening supervision and assessment can we ensure the continuous and stable standard operation of employees. 4. Strengthen pre-job training. Conduct systematic training before starting the job. Pre-job training should be a very important part. Through training, every employee knows what to do, how to do it, and to what extent, so that everyone can form good work habits from the beginning. Otherwise, some bad work habits will be difficult to change once established. There are some factories where workers operate very extensively. It's just that there was no good training in the beginning. Good work habits are not formed. strict requirements. Every step of the operation of every employee must be strictly required. 5. Rewards and punishments are clearly defined to protect the enthusiasm and enthusiasm of employees for serious work. (Those who want to be rewarded are elated; those who want to be punished are terrified)



Chapter 8 Lost Foam Casting Detail Management and Vision

8.2 Lost Foam Casting Production Management

8.2.2 The significance of management in the production of lost

foam casting Second, process control---effective process control is the guarantee to achieve product

stability! Process plays a key role in lost foam casting production. Many factories are unable to produce good products because the overall process quality and level of technology are not high,

and at the same time, there is a lack of effective process management. 1. Develop a reasonable process. The process is for the specific products and specific conditions of each factory. The same

product can have different process plans because of different raw and auxiliary materials and different habits. As long as it does not violate the basic principles of lost foam casting, there is no unified

process. Standards and Modes. As long as it is reasonable, it is good to be able to produce good products, and there is no need to compare which process plan is better than which process plan. 2.

The necessity of process test. No one has "alchemy", and it is definitely the best to formulate a process. In the process of formulating the lost foam casting product process, experiments and failures

should be allowed. 3. The process specification is simple and clear. After the process is determined, a process card is formulated. The content of the craft card should be simple, clear and easy to

understand, so that employees can see it clearly. The content of craft cards in many factories is cumbersome, and workers do not see them as decorations at all. 4. Although the pouring and riser

system is molded; once the process plan is determined, if conditions permit, try to mold the pouring and riser system to reduce the impact of differences in manual operations on the implementation

of the process plan. 5. Strictly implement the process plan. Once the process personnel and the technical department have determined the process plan, and there is no problem after the test, the

production workshop must strictly implement it, and cannot change it casually.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.3 Lost Foam Casting Safety Production Control

Safety first, prevention first, comprehensive management

Production must be safe, and safety can produce production. All personnel must establish the concept of "safety first", understand and strictly implement relevant safety technical rules and regulations. Every enterprise should put safety production first, and employees and leaders must pay attention to it, so that the enterprise can develop better and faster. How to do a good job in safety production should start from the following aspects: a. Firmly establish The idea of "safety first, people-oriented". To achieve this, we must proceed from the overall situation of maintaining social development and stability, and firmly establish the concept of caring, caring, and respecting people. This is the foundation of doing a good job in safety production. Treat employees as their own brothers and sisters, Caring for them from work and life, let employees feel the care of the company, and voluntarily do their own work. b. To improve the safety production rules and regulations and various operating procedures, the most important thing is to implement them. To do a good job in safety production, it is the key to establish and improve various safety production rules and regulations. With the system, employees can only follow the rules and evidence when they are on the job. All kinds of systems are the accumulation of past experience and lessons, and compliance with rules and regulations can lead to safe production.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.3 Lost Foam Casting Safety Production Control

How to do a good job in production safety should start from the following aspects: c. The

production workers should do the "four diligences", and the safety work will be guaranteed. "Four diligence" refers to "eye diligence, hand diligence, brain diligence and mouth diligence". Lost foam casting has many production links

, The process is complex, and there are many potential safety hazards. All staff must: observe carefully, study hard, use their brains, and operate in strict accordance with the operating procedures

, it will avoid all potential safety hazards, prevent accidents before they occur, and effectively ensure safe production. d. Strengthen employee

safety education, increase safety training, and improve the overall quality of employees. It is necessary to use the time of the pre-class meeting to carry out safety education for employees, and insist on

With one question a day and one case a week, combined with accident cases, we will publicize the hazards of safety to employees, so that employees can firmly establish the safety concept of "safety is the sky, life is

supreme", and let employees understand that safety is benefit and safety is happiness. Change the concept of employee safety, change "I want to be safe" to "I want to be safe", give up the job

Workers voluntarily abide by the laws and regulations, so that safe production can be lasting and safe production can be guaranteed. The unit should also regularly conduct safety training for employees, and

Great staff skills training, so that employees can memorize the various procedures of the post and operate them proficiently.

Only by doing a good job in the training and education of employees and improving the safety awareness and safety skills of employees can it be possible to avoid the occurrence of various safety accidents.

Safety production work is a systematic work, and it is not good to rely on the management of the safety department and related personnel. Only through the joint efforts of all employees, from

Start by yourself, do your best, and work safely.



Chapter 8 Lost Foam Casting Detail Management and Vision

4. The principles and vision of the lost foam casting process

1. The lost foam casting process principle is

made ; do it well; do it finely; do it skillfully! As

the so-called "every beginning is difficult", the reasons for lost foam casting in each lost foam casting company are different, but the original intention and vision are

basically similar. Before 2006, mainly due to the influence of the raw and auxiliary materials of lost foam casting and the lack of awareness of the lost foam

technology, there appeared "the phenomenon that the last batch of enterprises fell into one batch of enterprises", and even "talk about lost foam discoloration" ,

More than ten years have passed, lost foam casting in the vast number of scientific research institutions, the company's technical personnel continue to explore, the

technology is becoming more and more mature, the output of lost foam casting castings has increased. The outstanding contributions in the production of some

special-shaped parts and complex structural parts have been favored by many enterprises. The majority of casting colleagues take lost foam casting as the

advantage of green casting to the fullest. In actual production, everyone gradually understands lost foam technology, controls lost foam production, and summarizes

a lot of experience. Here we will talk about the basic principles of lost foam casting process practice: make, do well, do fine, do skillful.



Chapter 8 Lost Foam Casting Detail Management and Vision

4. The principles and vision of the lost foam casting process

1. The principle of lost foam casting process

• The first step is to make it. In line with the original intention of the lost foam production line, making samples of the products selected in the early stage is the first step to be completed. After we select a product as the production line design. After the basis of the rhythm, it is necessary to consider the influence of factors such as mold, casting process, raw and auxiliary materials, etc., total design, after many tests, inspection (appearance, size, internal defects) to obtain castings that can be trial processed and assembled.

• The second is to do a good job, that is, to achieve small batch production (50-200 pieces), verify equipment, verify process, and at the same time for workers theory and combined on-site operation. Training, formulating operating procedures, and building hope for leaders and employees.

• The third is to be fine, each process has a certain scope of adaptation. As mentioned above, the large process and small links of lost foam casting, the degree of automatic operation will not be too high, so some unstable factors will affect the lost foam. The stability of the casting quality, such as the fluctuation of raw materials and the difference in the operation level of workers, so in this step, we need to further improve the casting process, that is, to expand the scope of application of the casting process. The channel is tapered to seal the molten iron at the end of the sprue, so that the lower half of the sprue cup is always full, and the slight interruption of the flow during the pouring process will not affect the filling of the casting, and there will be no cold insulation.

In the companies we visited, many technicians seemed to be lazy. The process card was determined after a small batch of 200 pieces, so the sudden batch scrapping in the later period caught me off guard, or the overall yield was always hovering at 90%, so please be sure to Do a good job of this step, otherwise it will be very passive.



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4. The principles and vision of the lost foam casting process

1. The principle of lost foam casting process

The fourth is to be skillful. The first thing that everyone thinks is that practice makes perfect. Yes, this is only a requirement for operation. We can use tooling to further improve production efficiency. The cleverness mentioned here also has the meaning of ingenious craftsmanship and ingenious ingenuity, which means that this production line can be profitable. Improving the yield of the casting process, the comprehensive yield, and reducing the cost of castings are all tasks to be completed in this step. Here we emphasize the cost of castings, which includes equipment depreciation, financial costs, material costs, management costs, etc.

We can also call it's comprehensive cost.

We encountered such a problem in the process of helping a Guangxi company to carry out lean production. There were differences in the choice of foam beads and coatings. There was a thick ductile iron part. The company insisted on using ordinary products due to the low added value of the product. EPS material, the surface finish of the castings in the later stage is very unstable, and there are many carbon inclusion defects on the machined surface. It is completely repaired in the later stage. Later, we suggested a small batch trial production of the copolymer material, the surface finish is greatly improved, and there are almost no processing defects.

The cost is 60 yuan/ton lower than ordinary EPS.



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1. The principle of lost foam casting

In addition, there is a ductile iron casting that needs to be pressed. The original cost of the factory's own paint is about 1650 yuan/ton.

It is recommended to use adsorbable coatings for ductile iron, thinking that the price gap is about 2000, the boss is reluctant, and after trial production

, Through coating weight reduction and some auxiliary measures, the qualified rate of one-time pressing has been increased from 85% to 97% (the castings that leaked air before)

Infiltration treatment after grinding), the surface finish is greatly improved, and the comprehensive cost is reduced by 120 yuan / ton compared with the original, so I

We suggest to find raw and auxiliary materials suitable for your own products not only by price, but also by telling the supplier the requirements of the product, and correspondingly.

requirements for raw and auxiliary materials, and testing methods, but it cannot be said that high prices are good, only those that are suitable for you are stable.

The best.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.4 Principles and Vision of Lost Foam Casting Process

8.4.2 How to conduct preliminary investigation when preparing the

lost foam casting project The superiority has also attracted widespread attention in the foundry community. In China, more and more foundry companies have begun to investigate and plan to adopt the lost foam casting process to reduce costs and improve the overall quality of castings to cope with the increasingly fierce competition in quality and price. However, for many manufacturers who are new to this process, how to choose a strong partner to cooperate with themselves through preliminary inspection is a process that needs to be taken seriously. Many manufacturers suffered huge economic losses because of errors in analysis and judgment during the early inspection process. The author has been engaged in the lost foam casting industry for more than ten years, and has come into contact with many domestic lost foam casting enterprises, and many enterprises have learned painful lessons in this regard. Regarding this issue, the author will talk about this issue based on my own experience and the lessons of some manufacturers. Talk about your opinion.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.4 Principles and Vision of Lost Foam Casting Process

8.4.2 How to conduct preliminary inspection when preparing for the lost foam

casting project For a foundry that is about to start the lost foam casting project, the preliminary inspection of the project should start from the following aspects. First of all, the inspector needs to have an overall understanding of the lost foam casting process. Information about this can be obtained from some

Professional books and the Internet, but when acquiring knowledge in this area, it is best to only understand the process and not pay too much attention to the details of the process, because some domestic books on lost foam casting have a detailed understanding of the process of lost foam casting. The introduction is more detailed, but the details of many of the process principles involved have yet to be tested in practice, so it is best not to form preconceived concepts, otherwise it will have some negative impact on your next inspection work.

After you have an overall understanding of the process, the next step is to enter the most important part, which is to inspect the comprehensive strength of the service provider you choose. Why is this part the most important part? Because many manufacturers are choosing There were mistakes in the cooperation of the partners, which eventually led to the delay in the smooth production of the project, and some companies even closed down because of this.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.4 Principles and Vision of Lost Foam Casting Process

8.4.2 How to conduct preliminary inspection when preparing for the lost

foam casting project At present, there are many domestic companies engaged in lost foam casting services, and the technical strength is also uneven. When inspecting the comprehensive strength of these service companies, the inspecting party must firmly grasp the focus of their inspection - craftsmanship; because craftsmanship is the soul, and equipment serves the craftsmanship, the production lines designed and manufactured by service companies with real technological strength In order to truly guarantee the smooth implementation of the process.

Therefore, the focus of the inspection should be based on the technical and technological strength as the core. Before the inspection, the inspector must first determine the products that will be produced with lost foam in the future, and then bring the products to consult the industry. The lost mold industry has a wide range of contacts, and they have a comprehensive understanding of the overall level of domestic lost foam casting service companies . Let them first recommend a powerful service unit for their choice. Of course, the inspector can also provide services in other ways. After the inspection party has made a preliminary understanding and selection, the inspection party must verify the technical level of the service provider. The key to whether it can choose a truly powerful partner lies in this. At this time, the inspector must grasp one thing, that is, seeing is believing.



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8.4 Principles and Vision of Lost Foam Casting Process

8.4.2 How to conduct preliminary investigation when preparing for the lost foam casting project

How to make seeing believing? First of all, it is necessary to visit the company that the service provider has served, and there must be a professional

Accompanied by casting technicians, from the time the castings are turned out of the box, they start to track and observe until the final finished products are put into storage.

The appearance quality and internal quality of the product should be fully understood, and the real yield should be obtained. At the same time, pay attention to the

It is especially critical to compare the quality requirements of a bit with your own quality requirements, especially when producing products with processing requirements.

. In this process, the ability to inspect the key equipment of the production line is also carried out at the same time.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.4 Principles and Vision of Lost Foam Casting Process

8.4.2 How to carry out the preliminary investigation when preparing the lost foam

casting project The focus is on the following three aspects: 1. The first is the vibrating

table, 1. The filling and compacting function, whether the products with complex

cavities can be filled and compacted, and whether Pay attention to this observation, because in many cases, if the performance of the vibrating table is not good,

when producing products with complex cavities, it is necessary to fill the concave corners of the cavity with resin sand before it can be vibrated. This will have a

great impact on the inherent quality of the product. 2. The degree of deformation of the product. Determine whether the deformation degree of the shaking table can

meet the requirements of your own products by tracking the quality inspection of the product. 3. The molding rate of the shaking table is the key to the ability of the

production line. Shakers with advanced performance can generally achieve a molding rate of 8 to 10 cases/hour. Advanced vibrating tables often have an automatic

frequency conversion system. During the vibration process, the principle of compound vibration is used to make the sand produce irregular movements in the sand

box to fill the cavity of the product tightly, thereby avoiding the directional flow of the sand . Product is deformed. It has the characteristics of fast filling and

compaction, small deformation and high modeling rate.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.4 Principles and Vision of Lost Foam Casting Process

8.4.2 How to carry out the preliminary investigation when preparing the lost foam

casting project The focus is on the following three aspects: 2. Sand treatment

system, two equipments in the sand treatment system are the most critical, 1. Sand cooler,

mainly inspect the sand cooler Whether it is water-cooled , air-cooled or water-cooled and air-cooled, the key is to see the heat exchange efficiency of the sand cooler. At the same time, the energy consumption of the equipment should also be considered . Energy saving and high efficiency are the criteria for selection; 2. Screening conveyor, the function of this equipment itself is very simple, conveying and screening molding sand, but this equipment is the most problematic equipment in the lost foam casting production line, one is the screen The points do not meet the requirements, and the other is that the bottom screen is easily damaged and needs to be repaired and replaced frequently. Therefore, when inspecting the equipment, we must pay attention to the structure of the screen. 3. Case turning machine: At present, many domestic production lines are not equipped with case turning machine, some rely on driving to lift the sand box to the turning frame for turning the box, and some simply adopt the bottom-draining sand box to leak sand, and then use driving Lift the casting out of the sandbox. Although the bottom discharge sand box is convenient, there is the problem of incomplete sand discharge, which requires manual sand cleaning. But in automatic production lines and closed loop lines, it is necessary to be equipped with a turner. A good turner should be simple in structure, flexible and practical.



8.4 Principles and Vision of Lost Foam Casting Process

8.4.2 How to conduct a preliminary inspection when

preparing an EPC project The product is used as a design reference, and the service provider can analyze the process of the product. The content of the analysis includes the following aspects: 1. The mold plan, many people think that the mold plan is determined by the mold manufacturer, and has nothing to do with the service provider. This concept is wrong. At present, many domestic manufacturers of lost foam molds design the mold according to the requirements of the foam packaging mold when determining the mold plan. In fact, this is a mistake in the design concept, and the packaging mold can be Two-part splitting, and many lost foam products cannot be completed by two-part splitting. When encountering such a product, their solution is to slice and bond, but whether a product is suitable for slice bonding It is not determined by the mold factory, but determined by the process.



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8.4 Principles and Vision of Lost Foam Casting Process

8.4.2 How to conduct preliminary inspection when preparing an lost foam casting

project. For some products that cannot be formed in two parts, the mold plan must first be determined according to the requirements of the product itself, because on the one hand, piece bonding will bring about dimensional differences. Deviation, on the other hand, one more bonding process will inevitably lead to one more hidden quality risk, especially for some products with strict pressure requirements and geometric tolerance requirements, the slicing bonding will directly cause the dimensional tolerance and internal defects of the product. When encountering such a product, the mold plan should be determined by the service provider.

Whether it needs to be integrally formed, whether it needs to be bonded, how to select the bonding parts for the products that must be bonded, etc. The determination of these plans has an inevitable connection with the quality of the next product, so the determination of these plans is not the mold factory can decide , but should be decided by the service party according to the requirements of the product. Mold is the basis of product quality control. It is also the starting point of process control. I once transformed a foundry in Nanjing, Jiangsu (a factory that produces fire pipes), the products are 90-degree elbows and tee, diameter DN165, wall thickness 6mm, water pressure test 100bar, material QT-450-10, the starting mold is Two-part split bonding, the pressure test is not up to standard, analyze the reasons, the mold design is unreasonable, the pouring system design is unreasonable, and the coating quality is not up to standard. When the paint is replaced, the hydraulic yield of the product is 95%, because the leakage of such high-pressure pipe fittings cannot be solved by infiltration and repair welding, so the final yield is the final pressing yield. Using the same pouring system and coating, the original piece-bonded white mold was trial-produced, and the yield in the hydraulic test was 85%. Through this product, it is not difficult to see whether the mold scheme is reasonable or not has a direct impact on the product quality.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.4 Principles and Vision of Lost Foam Casting Process

8.4.2 How to conduct preliminary inspection when preparing the lost foam

casting project 2. Prediction of product yield and yield rate The characteristics

and requirements of making a reasonable yield and yield forecast, and this forecast is also the basis for both parties to sign and simultaneously

accept standards in the future. 3. Design scheme of production line; The inspector will provide the specific requirements and output of its own

products to the service side, so that the service side can preliminarily establish the scheme of the production line. The design of the production line

is determined according to the products produced. When designing a production line, first determine the size of the sand box according to the

products produced, and then match the corresponding vibrating table and sand processing system according to the number of boxes per hour for

molding and the number of boxes for pouring. At the same time, it is necessary to determine what kind of circulation mode the sand box adopts

according to the type of products produced.



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8.4 Principles and Vision of Lost Foam Casting Process

8.4.2 How to conduct preliminary inspection when preparing an lost foam

casting project If the production line is multi-variety and multi-material products, the inspector has two options:

One is fully automatic, requiring the production line plan provided by the service party A flexible fully automatic production line can be realized, the production line can produce several different types of products at the same time, and the cycle program can be programmed and designed according to the cooling time of different products. The second is semi-automatic or manual; the so-called fully automatic and semi-automatic here actually refers to the operation mode of the sand box. The sand processing system and the vibrating table are independent circulation systems. The semi-automatic operation relies on the equipment other than the production line to operate the sand box (the common use in China is to lift and transport the sand box), and the manual mode refers to the operation mode of the sand box by manually pushing the sand box on the track for cyclic operation. If the products to be produced by the inspecting party in the future are single-variety and large-scale products, they can choose a fully automatic production line that relies on oil cylinder to promote transposition, which is currently popular in China. This automatic production line is similar to the flexible automatic production line we mentioned above. Compared with the production line, it has the advantages of simple control and low maintenance cost, but its shortcomings are also very obvious. 1 5 2 6 7 1 8 8 5 6 8



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8.4.2 How to conduct preliminary investigation when preparing an lost foam casting project,

but no matter what kind of production line design scheme, the basic element of the design is the size of the sand box, and the production capacity is measured according to the molding rate. Strictly speaking In other words, the indicator of production capacity should be the number of molding boxes per hour. When the same sand box produces different products, the number of molding boxes per hour may be the same, but the tonnage of the products produced may be very different. When choosing the design scheme of the production line, the inspector should choose according to the actual needs of their own production. For example, if they produce a variety of products but choose a fully automatic production line with cylinder-driven transposition, they will encounter many problems in actual production in the future. Trouble.

In addition to the cyclic operation of the sand box in the design of the production line, the inspector should also pay attention to whether the layout of the production line meets the conventional requirements of casting. There was once a company where the pouring station of the production line was far away from the electric furnace smelting area. It takes about five minutes for the water to be transported to the pouring station, and this production line is mainly for the production of ductile iron products. In order to ensure the pouring temperature, the furnace temperature has to be increased during the production process. On the one hand, it is a waste of energy. The spheroidization quality also had a big impact. When the inspection party and the service party reach an agreement on the plan of the production line, the inspection task is basically completed, and the rest is to finalize the contract details with the most suitable service party.



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8.4 Principles and Vision of Lost Foam Casting Process

8.4.2 How to conduct a preliminary inspection when preparing a lost foam casting

project Here, we also remind the inspector to pay attention to the fact that when contacting with the service provider, no matter how famous the service provider is, no matter how much the service provider lists himself A successful example. We must do what we see is believing. Even if it is a field visit, we must verify what we see in many aspects, because every industry has its own unspoken rules, and lost foam casting is no exception. Although many manufacturers It is deeply hurt, but because of all aspects of the relationship, it is always reluctant to admit it to the outside world, which is one of the important reasons why many manufacturers are repeatedly used as a service company. Especially now, many individuals and companies in China have only been exposed to the lost foam casting process, but they claim that they have experience in this aspect.

How to have rich experience, and even use the successful products others have done to promote yourself. For example: a so-called lost foam engineer from Hunan who was recruited by a company in Jiangxi, was originally a worker in the white area workshop of a lost foam casting factory of a company in Hunan, but when he applied for the job, he claimed to be the lost foam casting company. The project was built by myself, and I used the successful products of this factory to prove my ability. After being fired in Jiangxi, he used his work experience in Jiangxi to apply for a job at a lost foam foundry in Longyan, Fujian. At this time, the products of the Jiangxi factory became his own capital to show off his strength, but such a person, but It is an irony to be able to mix in the lost foam casting industry all the time.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.4 Principles and Vision of Lost Foam Casting Process

8.4.2 The fundamental reason for how to conduct preliminary inspections when preparing for

the lost foam casting project is that there are too few people in this industry who dare to tell the truth, and many people are concerned about their own interests and hinder their actions.

The unspoken rules of the industry do not want to say. It is precisely because these irresponsible individuals and companies have brought down many lost foam manufacturers, the result

It makes many manufacturers who want to get involved in this industry lose confidence in lost foam casting, hindering the development and promotion of lost foam casting.

wide.

Therefore, for a foundry that is about to set foot in the lost foam industry, it is very necessary and critical to conduct preliminary inspections before building a project . In many cases,

the loss of investors due to the overall level of partners is far more

Far more than the service fee paid on the surface! Therefore, choosing a powerful company for cooperation is the smooth operation of the lost foam project.

The basic condition is also the key condition!



Chapter 8 Lost Foam Casting Detail Management and Vision

8.4 Principles and Vision of Lost Foam Casting Process

8.4.3 Let the lost foam casting technology return to the

foundry 1. The current situation of lost foam casting in China

is not optimistic. There are essential differences between lost foam casting and traditional sand casting. The factors affecting the quality of lost foam castings are far more than those of traditional sand casting. The technological maturity of die casting is also far lower than that of traditional sand casting. At present, there are thousands of lost foam casting enterprises in my country. It can be said that the process methods used by different enterprises for the same casting are very different. Raw and auxiliary materials, and even business leaders have different understandings of lost foam casting.

In this context, various foundry companies can also produce castings that meet the quality requirements of users, but the stage of trial production is difficult, and the quality of castings is very unstable. But it was impossible to retreat, so I had to bite the bullet and try. In the end, I could only choose some simple and low-end castings to organize production, and the company had to survive.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.4 Principles and Vision of Lost Foam Casting Process

8.4.3 Let the lost foam casting technology return to the foundry. For this,

the price paid by each company varies widely, and some companies may pay a heavy price or even suffer heavy losses. There are also companies that seem to be very easy to produce qualified castings with ease. However, the hardships and troubles they have paid can only be understood in their own hearts. The repeated experiments, the exchange of raw and auxiliary materials, the equipment failure every three days, and the technical personnel who have come and gone today have caused headaches for business leaders. endlessly. However, people's habit of thinking is to report good news but not bad news. In the eyes of others, all they see is the bright side, while the bitter side is unwilling to show to others, and he is silently bearing it in his heart, hoping to have See the light one day. As we all know, the castings produced by thousands of lost foam casting enterprises are mostly castings with lower quality requirements, while those with higher requirements are

No end casting company dares to set foot in it.

However, in my country's lost foam casting technology market, there are many people who shout that lost foam casting is a universal process. As a basis and proof for mass production. Many entrepreneurs who are new to Lost Foam are talking about it with great admiration. They don't hesitate to invest in building factories, purchasing equipment, purchasing materials , and recruiting personnel.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.4 Principles and Vision of Lost Foam Casting Process

8.4.3 Let lost foam casting technology lead back to foundries

But I don't know that there are minefields and abyss hanging in front of the beautiful dream.

With the core technology of lost foam casting, the lost foam casting can be done with three or two hands. Over the months, over the years, he

Their dreams are shattered, looking at the piles of waste, listening to the calls from users urging supply, looking at the full orders but wanting to

I cried without tears. And then make do with continuing to produce simple and low-end castings, with strength and strength

Enterprises with limited conditions may directly abandon the use of traditional sand casting, and only conduct in-depth and detailed exploration of the basic laws of lost foam casting.

Only by determining the process route can we maintain the stability and continuity of production.

This is the current situation of lost foam casting in my country.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.4 Principles and Vision of Lost Foam Casting Process

8.4.3 Let the lost foam casting technology return to the foundry 2. What is

the true meaning of lost foam casting? In order to make the lost foam

casting technology truly show its original technical advantages, how to realize its advantages? How do the so-called series of advantages come to fruition? What is

the true meaning of lost foam casting? From the perspective of most small and medium-sized enterprises, at present, lost foam casting can maintain normal large-

scale production, almost all of them are summing up experience in continuous test failures, and the accumulation of experience has become the basic law of the

growth of lost foam casting in China. The route taken by lost foam casting in my country deviates from the natural laws that a technology should follow, and the

production practice surpasses the research and development of basic theory. direction, lack of motivation. The basic theory of lost foam casting is the cornerstone and

source of promoting the development of this technology in the right direction. Blind practice without a solid foundation and power source will definitely bring fetters and

evil consequences to the development of the technology. Occasionally a casting is done well within a period of time, it does not mean that other castings can also be

done well, and it does not mean that this casting will continue to be done well in the future. If the casting is done in this factory, it does not mean that it can be done

well in other factories. If you do it well, it does not mean that he can do it well.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.4 Principles and Vision of Lost Foam Casting Process

8.4.3 What is the true meaning of the lost foam casting technology leading back

to the foundry ? Understanding and mastering the basic principles and laws of lost foam casting is the basis and key to maintain stable and continuous production. What is the basic principle of lost foam casting? What are the basic rules? The following aspects should be studied: 1. The basic law of the physical and chemical changes of the foam model during pouring; 2. The interaction between the foam model and the molten metal under pouring conditions; 3. The flow law of the molten metal during pouring ; 4 Variation law of temperature field of molten metal during pouring and solidification; 5 Variation law of pressure field in sandbox during molten metal pouring and solidification; 6 Existing form, formation principle and change of inclusions in molten metal 7. What are the conditions for maintaining the stable temperature field and pressure field in the sandbox; 8. The law of the movement of single sand particles and the whole sand body and the law of the filling foam model during the vibration process of dry sand; 9. The effect of vibration parameters on the dry sand filling foam model The basic principle of concave and compaction; 10 The influence of negative pressure on the filling rule of molten metal during pouring of molten metal;



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8.4 Principles and Vision of Lost Foam Casting Process

8.4.3 Let the lost foam casting technology lead back to the foundry 11 Sources

of inclusions and their changes and movement patterns during liquid metal filling and solidification; 12 The influence of foam model and negative pressure on the movement law of inclusions; 13 Foam model molding Principle and forming law; 14 Influence of foam model forming process on model quality; 15 What is the role of paint in lost foam casting process; 16 Changes of paint in drying process and its influence on model quality; 17 Which important properties of the coating have a greater impact on the quality of the lost foam casting; 18 How to control the process performance and working performance of the coating; 19 What main properties should the model material have; 20 The effect of the performance of the model material on the lost foam casting process; 21 Vibration The principle of adaptive control of parameters; 22 The principle of adaptive control of negative pressure parameters; 23 The principle of adaptive control of paint coating process;



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8.4 Principles and Vision of Lost Foam Casting Process

8.4.3 Let the lost foam casting technology lead back to the foundry 24 The

influence of the negative pressure structure of the sand box on the uniformity of

the pressure field; 25 The influence of clean raw and auxiliary materials on the

quality of castings; 26 How to prevent the contamination of molten metal; 27 The

dry sand particle size and the Matching relationship of coating layer thickness; 28

Which types of castings are suitable for the lost foam casting process; 29 The

influence of wall thickness difference of castings on the quality of lost foam

castings; 30 The composition of lost foam exhaust gas and its variation in production; 31 Lost foam

exhaust gas The principle and device of degradation treatment; 32 The influence of casting equipment

and tooling on the production efficiency of lost foam casting;

(33)... The above

lists some of the basic principles and laws of lost foam casting that need to be studied in depth. What is

the true meaning? The basic principles and basic laws are the true meaning of lost foam casting.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.4 Principles and Vision of Lost Foam Casting Process

8.4.3 Let the lost foam casting technology return to the foundry 3. How to do

lost foam casting well under the current situation? Returning to the topic of

this article, let the lost foam casting technology lead back to the foundry. Lost foam casting is not good enough to draw a tiger or a gourd. The lost foam casting technology

is the dominant technology. Lost foam casting enterprises should focus on technology, especially the basic technology and technical foundation. Large-scale enterprises

have considerable advantages in this regard. The most important of these advantages is that the leaders of the enterprise attach importance to technology, and the

enterprise has strong technical personnel. These technical personnel are hard-working, pay attention to practical results, and combine the actual situation of the factory.

The combination of in-depth research and development and actual scale production has truly tasted the joy of fruitful results. For small and medium-sized enterprises, most

of them are engaged in lost foam casting production using experience-based casting technology. At present, it is recommended to make castings with relatively mature

technology, strengthen technical training, and deeply understand the basic principles. Be sure to learn from good companies, find technical experts with real talents and

good conduct for consultation and study, and participate in formal technical training and professional conferences. But don't copy, don't copy, don't copy flowers and

connect wood, you must absorb the essence, get rid of its dross, find the process technology suitable for your own enterprise, combine the structure and characteristics of

the casting products produced, learn from each other's strengths and avoid weaknesses.



Chapter 8 Lost Foam Casting Detail Management and Vision

8.4 Principles and Vision of Lost Foam Casting Process

8.4.3 Let the lost foam casting technology lead back to the foundry Generally

speaking, in the actual production, we should pay attention to the following points: a. Don't

be greedy for foreign countries, don't be too happy, and try to install as few foam models in the sandbox as

possible; b. Turn the parts into pieces, operate as a whole, and try not to make molds in the sand box; c. Shorter

or shorter, reduce heat loss, minimize pouring time, and minimize the filling stroke of molten metal in the cavity; d. Increase Breathable, reduce slag pores,

make the coating as thin as possible, and remove the gas emitted by the model at the moment of pouring in time; e. The lower the energy, the lower the wall

effect, and the negative pressure during pouring as much as possible, as long as the box is not collapsed ; f. Dry the model to reduce water content,

dehumidification is required for drying, the models are staggered, not overcrowded, to facilitate hot air circulation; g. Don't be greedy for cheap, blindly reduce costs,

low prices and low quality, don't believe in "high quality and low price". "; h. Pay attention to records, have evidence to rely on, try to make production records as

much as possible, so that cause and effect are clear; i. Pay attention to the foundation, pay attention to the principle, and try to understand and grasp the principle of

lost foam casting and its influence relationship; j. Don't listen to partiality Faith is easy to be fooled. You must see the rabbit and not the eagle. Seeing is believing.

Lost Foam Casting Classic

"Winter Night Reading Shows Ziyu"

[Author] Lu You [Dynasty] The ancient
people of the Song Dynasty spared no effort
in learning, and the young and the young were
old. On paper, I feel shallow at the end, and I
absolutely know that this matter has to be done.

Hainan Hundred

Grateful

Rivers

Dade



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