Application of special coating for EPC.

Yellow area paint is the intermediate link between white area and black area, which plays a connecting role. As long as we pay enough attention to and improve this link, we can even make up for some shortcomings of white area and black area.

First, the three elements of EPC coating

1. Strength:

(1) Normal temperature strength, if the normal temperature strength is not enough, the coating will crack due to slight expansion of the white mold during drying, and most of the cracks are located at the inner right-angle joint and the coating accumulation.

(2) High-temperature strength. If the high-temperature strength is insufficient, sand will be stuck during casting, and even the box will collapse.

2. Fire resistance:

It can prevent molten iron from ablating and wetting the coating and avoid coating residue on the surface of the casting.

The higher the refractoriness, the better. The refractoriness of aggregate must be higher than the casting temperatures, and the sinterability should also be ensured. When the aggregate has high refractoriness and poor sinterability, molten iron and coating can't form liquid phase, and molten iron will infiltrate the coating, resulting in the formation of powder on the casting surface.

Both fire resistance and sinterability should be taken into account. Good sinterability can strengthen the high-temperature strength of the coating. The molten iron with good sinterability can produce controllable liquid phase during the mold-filling process, which will bond the aggregate particles together, and make the coating dense and strong at high temperatures, but the permeability of the coating will decrease accordingly.

The key to good sinterability is the reasonable proportion of Al_2O_3 content, SiO_2 content and CaO content in aggregate. Proper SiO_2 content can form a glassy sintered surface of the coating at high-temperature, which makes up for the decrease of coating strength caused by the loss of binder at high temperatures. CaO is decomposed into Ca and O_2 at high-temperature. The existence of Ca increases the sinterability of the coating, and also improves the desulfurization effect, thus achieving the purpose of preventing carburization and sulphurization.

It is suggested that the content of Al_2O_3 in gray iron coating is between 40% and 50%, and the content of CaO is between 1% and 1.5% (the content of CaO in kyanite is 0.5%, and the content of alumina in bauxite is between 0.2% and 2%, so kyanite and bauxite can be used as aggregate of gray iron coating). The content of Al_2O_3 in the coating for ductile iron castings is between 60% and 70%, and the content of CaO is between 0.5% and 1% (the content of CaO in mullite is between 0.04% and 0.14%, and kyanite mixed with mullite can completely meet all the indexes of the coating for ductile iron). It is suggested that the content of Al_2O_3 in the coating for cast steel is above 70%, and the content of CaO is between 0.1% and 0.5%.

3. Breathability:

High permeability coating combined with high negative pressure is helpful to the flow and wall attachment of molten iron during casting. It is helpful to discharge carbon slag and waste gas, and also helps to reduce back injection and pressure in the cavity.

Second, the performance index of EPC coating

1. Tuhangability:

Refers to the performance of coating adsorbed on the surface of white mold.

The factors that affect the coating properties are:

(1) The aggregate is overweight and coarse. Corundum and zircon sand aggregates have high density, so they should not be too thick if used. Aggregate and white mold surface are attached and wrapped with colloid. Overweight aggregate will break the supporting force of colloid, and make aggregate leave the interlayer of colloid and approach the surface of white mold infinitely. At this time, the thinner the colloid layer between aggregate and white mold surface, the weaker the ability of aggregate to adsorb on the surface of white mold.

The proportion of this kind of aggregate can be appropriately reduced and the mesh number of this kind of aggregate can be improved.

(2) The adhesive has insufficient bonding ability. Xanthan gum can be used as an auxiliary adhesive and thickener.

(3) The surface of the white mold is too hydrophobic. It can be caused by the high wax content in the antistatic coating of white mold beads. The solution is to use lipid antistatic coating as much as possible.

2. Leveling:

It refers to the performance of coating self-leveling on the surface of white mold.

Factors affecting leveling are:

(1) The proportion of thickener is not appropriate. If the proportion of thickener is too high, the coating will not flow, and if it is too low, the coating will be left blank without thickness.

(2) The paint is not evenly mixed. Too short mixing time will make the overall viscosity and consistency of the coating uneven, and too large local viscosity and consistency of the

coating will affect leveling.

(3) The paint just dipped should be turned upside down every half hour until the paint stops flowing. This can prevent local accumulation, too thick coating and cracking.

3. Thixotropic:

Refers to the ability to maintain the shear consistency of paint when it is stirred after it stops stirring.

Factors affecting thixotropy are:

(1) The dehydration and solidification speed of colloid is too fast.

(2) The aggregate lacks flaky minerals, such as mica powder.

(3) Thixotropic agents: bentonite, CMC, montmorillonite, attapulgite, etc. are lacking in coatings.

4. Air permeability at room temperature:

Refers to the reading on the air permeability tester after the paint is dried.

The factors affecting air permeability are:

(1) The aggregate thickness is uneven, and the aggregate in the range of 80 mesh to 120 mesh accounts for too little.

(2) Silicone-containing glue, such as silica sol, is used.

(3) There is too much dust in the aggregate.

(4) No mica is added to the aggregate (mica powder has low water absorption, scales are elastic and have good thermochemical stability, and the addition of 80-mesh mica and 120-mesh mica in a ratio of 1:1 can increase the air permeability of the coating).

5. Suspendability:

Refers to the aggregate can be fully suspended in the coating solution for a long time.

The factors that affect the suspension are:

(1) The aggregate density is too heavy.

(2) The effect of thickening gel by suspending agent is poor.

(3) The viscosity of colloid is too small.

(4) The Baume of the coating solution is too low.

6. High-temperature air permeability:

Refers to the permeability of the coating when casting.

The factors that affect high-temperature air permeability are:

(1) The aggregate mesh number in a single interval with a ratio of more than 50% determines the overall air permeability of the coating. For example, aggregate with 100-120 mesh should be selected, accounting for more than 50% of all aggregates, and fine aggregate with a size of less than 180 mesh should be added as little as possible, and dust aggregate with

a size of less than 300 mesh should be eliminated.

(2) The greater the proportion of colloid in coating, the greater the loss on ignition during casting, and the more pores formed, the better the high-temperature air permeability. If a casting coating uses a large amount of colloid, and the air permeability at room temperature can still reach the standard, then the air permeability at high-temperature when it is cast will be better than that of a coating with a small proportion of colloid.

Some coating companies use very little glue. On the one hand, they are afraid that too much glue will lead to a large amount of casting gas. On the other hand, they are afraid that too much glue will lead to more organic matter and a corresponding increase in impurities during combustion. There is no need to be afraid of the second point. After the colloid is burned, it becomes inorganic, which is extracted or adsorbed on the coating with negative pressure. Under the premise of large negative pressure, the burning impurities will not enter the cavity.

III. Formulation Analysis of EPC Coatings

1. Aggregate:

There are many kinds of aggregates. Cast aluminum aggregates include graphite powder, low aluminum powder (bauxite with 50% alumina content), cast iron aggregates include kyanite, mullite and high aluminum powder (bauxite with 70% alumina content), and cast steel aggregates mainly include zircon powder, corundum powder (first brown corundum, with good high-temperature toughness) and andalusite.

For high air permeability, it is suggested that the aggregate mesh number should be between 120~180 mesh, and the proportion should exceed 60%, and the powder below 300 mesh should be eliminated.

Kyanite and mullite mixed aggregates are the first choice for cast iron aggregates. Kyanite has a very high expansion rate, while mullite has a low expansion rate (less than 1% at 1500℃), which is just complementary to prevent sand sticking and penetration caused by cracking during casting. Actually, kyanite will be transformed into mullite and silica at 1300℃, but this is theoretical data. The casting is over before kyanite is completely transformed into mullite, so we need to add mullite aggregates in advance.

Take domestic kyanite with 60% alumina content as an example (see Table 3.1). The coarser the mesh number, the greater the high-temperature expansion rate. The higher the alumina content, the greater the high-temperature expansion rate. Therefore, coating for iron castings with kyanite as aggregates must be matched with other aggregates with low high-temperature expansion rate.

Brown corundum is the first choice for cast steel aggregates, followed by zircon sand.

There are three reasons:

(1) The density of brown corundum is 3.9～4g/cm3, and the density of zircon sand is 4.6～4.7g/cm3. Brown corundum is lighter than zircon sand, and aggregates with too high density often need more suspending agents, which will increase the unnecessary organic gas generation of coatings.

(2) The linear thermal expansion coefficient of brown corundum is 7~9/℃(0~1600℃), and that of zircon sand is 5.01~6/℃(200~1000℃). There is little difference between them, but brown corundum is much cheaper than zircon sand, so it is cost-effective to use brown corundum.

Table 3.1

Temperature (℃)	**Linear expansion rate (%)**		
	0.18～0.125mm	0.088～0.074mm	＜0.074mm
100	0.02	0.00	0.04
300	0.12	0.14	0.24
500	0.35	0.40	0.42
700	0.75	0.67	0.63
900	1.36	0.93	0.78
1100	1.55	1.12	1.43
1300	1.65	2.18	1.73
1500	11.90	10.66	3.35

(3) Zircon ore needs to be imported, and the local production capacity in China is seriously insufficient, while corundum is exported in China, and brown corundum is relatively stable in raw material guarantee.

2. Binder (colloid):

General binders include latex powder, water glass, silica sol, dextrin, polyvinyl alcohol and VAE emulsion.

Latex powder commonly used in water-based coatings can be divided into flexible latex powder and rigid latex powder.

Rigid latex powder has strong bonding strength, but its ductility is slightly weak. The flexible latex powder has excellent ductility, low compression-folding ratio, good toughness and good crack resistance, but the bonding strength is not as high as the former.

(1) How to choose latex powder?

Flexible latex powder is selected as the coating with large aggregate particles. The larger the aggregate, the easier it is for the coating to crack when drying (In fact, any coating will crack at the right angle inside the white mold. Because the inner right angle is easy to accumulate paint, the coating thickness increases, but the finer the aggregate, the smaller the crack, which is difficult to observe with the naked eye). Flexible latex powder has strong ductility and can resist cracking caused by partial white mold expansion, so flexible latex powder is preferred.

(2) Why does the coating crack?

Coating cracking is common in the first coating drying. Because the white mold will expand when the paint is dried. Generally speaking, the expansion ratio is EPS > stmma > epmma. See Figure 4.1 and Figure 4.2 for paint cracking detection.

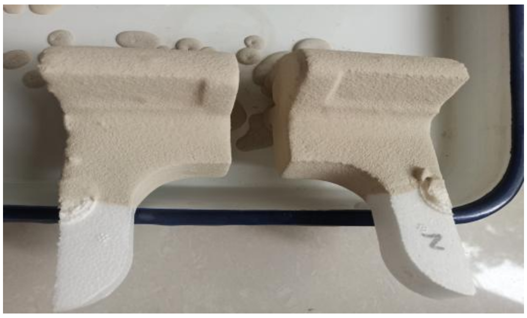
 

Figure 3.1 Cracking in the first pass Figure 3.2 No cracking in the second pass

Table 3.2 shows the expansion data of STMMA white mold in the oven.

Table 3.2 White Die Expansion Data

Batch number: STMMA-20230504-06 3# Pre-development specific gravity: 50 seconds, 20.1g.

Detection date	**testing time**	**ambient temperature (℃)**	**Measuring point**			**remarks**
			1# （mm）	**2# （mm）**	**3# （mm）**	
May 6(th)	five past ten	normal atmospheric temperature	313.3	266.1	175.0	
May 6(th)	five past eleven	**55℃ oven**	314.0	266.4	175.3	
May 6(th)	nine past twelve	**55℃ oven**	315.0	267.0	175.8	
May 6(th)	ten past one p.m.	**55℃ oven**	315.2	267.2	175.9	
May 6(th)	twelve past two p.m.	**55℃ oven**	315.1	267.1	175.6	
May 6(th)	ten past three p.m.	**55℃ oven**	315.0	267.0	175.5	

From the data, it can be seen that the size of the white mold expands slightly in the oven, so the coating loses its extensibility and forms cracks after drying on the surface of the white mold. The finer the aggregate, the smaller the cracks, even invisible to the naked eye. But this does not mean that cracks do not exist, so it is necessary to brush the paint twice.

Dextrin has strong adsorption to white mold, high wet strength and dry strength, strong adhesion after drying, good shell forming and shelling. Because of the strong adhesion of dextrin, it is difficult to clean the floor with the paint prepared with dextrin, so enterprises that require the beauty and cleanliness of the workshop should choose carefully. The solubility and dry tensile strength of yellow dextrin are better than those of white dextrin, so yellow dextrin is the first choice for water-based coatings. The technical indexes of dextrin are shown in Table 3.3.

Table 3.3 Technical Indicators of Dextrin

kind	**exterior**	**Water content%**	**Solubility (20°C)**	**Dry tensile strength (Mpa)**
White dextrin	White powder	＜2	＞60	＞0.30
Yellow dextrin	Yellow powder	＜2	＞90	＞0.35

3. Thickener and suspending agent:

Thickening agent and suspending agent can be said together, because their effects are similar, and many suspending agents are thickening agents themselves.

Commonly used are xanthan gum (good coating), guar gum (easy demoulding), bentonite, montmorillonite, attapulgite and sodium carboxymethyl cellulose.

Xanthan gum is extracted from corn kernels. Starch in a single corn kernel is processed to form sugar. Sugar is mixed with Xanthomonas campestris, a bacterial microorganism, and then fermented. The fermented mixture is dried and ground into light yellow powder.

Guar gum is the seed of Cycas quadrangularis Leguminosae. In order to form gum, the seed is taken out of the plant and cracked. The inside of the seed is scraped off and then ground into cream powder.

(1) The viscosity of guar gum is higher than that of xanthan gum. Guar gum has a viscosity of 5000-6000, and xanthan gum has a viscosity of about 2000. However, measured results show that xanthan gum has better film-forming properties and better demoulding properties.

(2) When the PH of xanthan gum is between 4 and 10, its viscosity is not affected, and its original viscosity and performance can be maintained below 120℃. Guar gum is relatively weak.

(3) The 1: 1 mixture of guar gum and xanthan gum can enhance the viscosity. At that time, we did this experiment to solve the problem of coating cracking, and found that it was

not helpful to improve the cracking, but found that the strength of the coating at room temperature was improved.

(4) Guar gum and xanthan gum belong to naturally occurring high molecular water-soluble plant gum, which are easily degraded by microorganisms. If they are kept for a long time (not tightly sealed), the temperature is too high (above 40℃) and the humidity is too high (above 70℃) for about one month, hairs will grow on the surface of the whole system. Therefore, a sufficient proportion of preservatives should be added to the paint.

The main mineral of bentonite is montmorillonite, and some coatings use bentonite as suspending agent. Bentonite can be divided into calcium-based bentonite, lithium-based bentonite and sodium-based bentonite according to the different adsorption cations. Water-based coatings mainly use sodium bentonite and lithium bentonite.

The difference between lithium-based bentonite and sodium-based bentonite mainly lies in cation, active strength, value and use, yield and doping factors. Specifically, the cation of lithium-based bentonite is lithium ion, and its activity strength and dispersibility are better than those of sodium-based bentonite, and its price is relatively high. However, the cation of sodium bentonite is sodium ion, and its activity strength and dispersibility are worse than that of lithium bentonite. Lithium bentonite is mainly used in high-end industries, while sodium bentonite is widely used in metallurgy, casting, petrochemical industry, medicine, cosmetics and other industries.

High-end coatings generally choose lithium-based bentonite. Castchem chooses lithium-based montmorillonite with higher purity, so the cost of high-end coatings is often higher, but the effect may not necessarily be qualitative, because when a product reaches the limit, an increase of 1% in performance may increase the cost by 100%. Many customers think that buying expensive coatings will cure all diseases. The success of coating application is closely related to customer's product characteristics, production conditions and operator's experience level. After a period of testing, a skilled paint factory can prepare coatings suitable for customers.

Low-cost coatings can be used for castings with low surface quality requirements, and they can barely be used by experienced masters, but good coatings must be used for casting complex parts. Cost determines quality, and good and cheap goods do not exist.

See Table 3.4 for the chemical composition of sodium bentonite and lithium bentonite.

Table 3.4 Chemical Composition of Sodium Bentonite and Lithium Bentonite (%)

bentonite	SiO_2	Al_2O_3	MgO	Na_2O	CaO	K_2O	Fe_2O_3	OOa	LOIb	total
Sodium base	65.70	13.05	3.56	1.95	2.46	0.43	1.21	0.24	11.40	100
Lithium base	65.89	13.60	3.79	0.31	1.94	0.58	1.80	1.30	10.79	100

Attapulgite, as suspending agent and adsorbent, absorbs water quickly, but it can't absorb water and swell like montmorillonite in water, so it must be stirred at high speed to disperse soil particles. It has good adsorbability, can adsorb carbon slag and coke mud in the casting process, and can increase the thixotropy of the coating.

4. Defoamer:

With the mixing of paint, bubbles with different numbers and sizes will be formed. If bubbles cannot be eliminated in time, the bubbles in the coating will be broken and pits will be formed on the surface of the coating, which will affect the uniformity and consistency of coating strength. The coating at the pit is particularly thin, and molten iron will flow out from the weak point during casting.

The common defoamers for water-based coatings are divided into silicone defoamer, polyether defoamer and calcium carbonate defoamer. In order to ensure the permeability of the coating, calcium carbonate defoamer is preferred, which does not contain silicon and will not block the pores of the coating. Calcium carbonate micropores can absorb bubbles in liquid, but the coating is easy to become alkaline, so calcium carbonate is not suitable as defoamer if there is an assistant that is similar to alkaline.

Polyether defoamers are nonionic surfactants, which are usually composed of chain polymers such as polyoxyethylene and polyoxypropylene. Silicone defoamers are siloxane-based compounds, which are usually composed of long-chain macromolecules composed of several organic groups, silicon atoms and oxygen atoms.

Polyether defoamers are usually suitable for water-based systems, such as water-based coatings and water-based acrylic emulsion. Silicone defoamers are widely used in various liquid systems, including aqueous and oily liquids.

Silicone defoamers have good defoaming and defoaming performance, but the main substance in them, dimethyl silicone oil, is waterproof to some extent, which will affect the air permeability of coatings. Weighing the advantages and disadvantages, we choose polyether defoamer with moderate air permeability and foam inhibition ability.

5. Mildew-proof bactericide:

For water-based coatings with many organic substances in the formula, after forming water solution (tap water itself contains a small amount of microorganisms), the microorganisms in it grow rapidly, especially under the high-temperature conditions in summer, it is necessary to add mildew-proof fungicides to the coatings.

Fungicides include substituted aromatic hydrocarbons (pentachlorophenol, benzyl bromoacetate), heterocyclic compounds (benzimidazoles, isothiazoles), amine compounds (dithiocarbamates, phthalimides), formaldehyde releasers and other mildew-proof fungicides (tetrachlorobenzoquinone, barium metaborate, zinc oxide).

Castchem coating selects the mixture of nano-zinc oxide (which can be directly embedded in the nucleus of microorganisms and destroy the replication structure of microorganisms from the inside), benzisothiazolone and calcium propionate, and adopts multiple and multi-effect means to sterilize. But it is also the most expensive fungicide on the market, and customers who have extreme requirements for product quality can try it.

Four, common problems of EPC coating

1. Pore:

Features: air holes in the casting, a air holes on the surface of castings.

Reason: the foam pattern was rolled into the molten metal, the decomposed gas is swept into the molten metal.

Preventive measures:

(1) Top injection system is not adopted, the multi-layer gating system is not used.

(2) Improve the air permeability of the coating.

For example, if 8% mica is added to EPC coating (the more mica is added, the better, and the thicker it is, the better), the thickness needs to be matched. Too coarse mica is easy to stick to the metal surface after sintering to form white powder, while too fine mica will reduce the permeability of the coating. In the early Casthcem coating for iron castings, the addition amount of 120-mesh mica was 12%. After repeated experiments, it was found that such a high addition amount would affect the air permeability of the coating, so the addition amount of mica was reduced to 8%, and the air permeability of the coating was obviously improved. Subsequently, 80-mesh coarse mica and 120-mesh fine mica were mixed 1: 1, and the air permeability was improved by another step.

On the premise of not affecting the fire resistance and sinterability, round refractory aggregate should be used as far as possible, and the reasonable particle size (< 80 mesh: 3%～5%, 80~120 mesh: 20%～30%, 120~180 mesh: 40%～45%, > 180 mesh: 20 ~ 25%) should be adopted.

2. Sticking sand:

Features: Sticking sand can be divided into mechanical sticking sand and chemical sticking sand. Mechanical sticking sand is characterized by the presence of sand particles and metal mixture on the surface of castings, such as coating left between the sand-sticking part of EPC castings and castings. Chemical sand sticking is a low melting point substance formed on the casting surface by the chemical reaction between molten metal and coating. For example, silicon powder coating and MnO in high manganese steel form a series of low melting point compounds to produce new sand sticking.

Measures to prevent mechanical sand sticking: appropriately reduce the permeability of coatings, such as increasing the content of fine aggregate, reducing the vacuum.

Measures to prevent chemical sand sticking:

（1）Choose refractory aggregate according to the type of casting alloy.

For example, zircon powder aggregate or corundum aggregate should be selected for alloy steel castings, and alkaline refractory aggregate such as magnesia powder or forsterite should be selected for high manganese steel castings.

(2) avoid gas being involved in the coating when stirring, completely eliminate the gas involved in the paint.

(3) Improve the coating drawability and ensure the coating has sufficient strength.

(4) One-time thick coating is easy to cause Chen Sheng shrinkage crack, so if necessary, it can be changed to secondary coating with thinner coating or partial coating again.

(5) increasing the filling density of sand, check whether the vibration parameters of the molding machine are within the specified range.

(6) prevent coating leakage, the material layer in the sharp corner of the pattern is easy to crack, so try to change it to fillet.

3. Surface residue of EPC casting:

Features: Residual residue on casting surface.

Cause: The decomposed gas was not discharged in time, low pouring temperature, low negative pressure, pattern decomposition is slow.

Preventive measures:

(1) improve the pouring temperature.

(2) improving the air permeability of the coating, increase the negative pressure.

(3) increasing the cross-sectional area of the gating system,the pouring system was changed from bottom pouring to side pouring.

(4) instead of EPS, STMMA foam pattern material is used, use easy-to-decompose adhesive to bond patterns.

(5) Add a dark riser where the molten iron finally flows.

4. Inclusion of foreign bodies:

Features: There is slag inclusion on the casting surface.

Reasons: the strength of coating is not enough, and the butt joint of gating system is unreasonable, the paint is not completely dried and falls off when it meets molten iron flash explosion, the molten metal is impure.

Preventive measures:

(1) improve the coating strength.

(2) Accurately calculate the size of the butting part of the gating system.

(3) Paint the butt joint.

(4) Prevent incomplete combustion of EPC.

(5) refining molten meta, use filter screen and slag baffle.

5. Nodulation and acupuncture:

Features: There are dense small pores or large bubbles on the inner surface of the coating of EPC pattern. After negative pressure casting, protrusions with different shapes and sizes are formed on the surface of the casting.

Preventive measures: Ensure the quality of the coating, and do not use the coating with deteriorated and moldy bubbles. The viscosity of the coating should be appropriate and the coating adhesion should be good. Improve the coating and hanging process to prevent corners from bulging.

6. Paint breaks water:

Features: The coating solution is separated from the carrier, resulting in water returning to water and powder returning to powder.

Cause: The paint suspension system is unstable, resulting in paint separation.

Preventive measures: By forced mixing, timely correcting and improving the powder-liquid ratio and improving the dispersion of coatings.

7. Casting bulge:

Features: Smooth or unsmooth lumps are formed on the casting surface.

Reason: The coating has insufficient adhesion to the white mold, and the next coating is easy to wet the last coating. The drying speed is fast, the humidity is high, and the wet yellow mold is dried at high temperature and high humidity.

V. About the Lost Foam coating for iron castings of Castchem Company.

The lost foam coating made by Castchem Company can be traced back to 2002. We only made water-based coatings with high permeability. At that time, the original intention of making coatings was to provide better services for foundry enterprises in the white area and yellow area. Since then, Castchem Company has started to research and develop coatings, various aggregates, various rubber powders, various suspending agents, defoamers, mildewproof agents and adsorbents, trying them one by one, and doing experiments over and over again on the premise that only one variable is allowed to be changed, so that the experimental results are scientific.

As we also do coatings ourselves, we know that the EPC coating industry is very difficult, and it is very difficult to stabilize a special coating. First of all, it is difficult to control the veins, associated minerals, mesh number, alumina content and impurities of domestic aggregates. Secondly, the quality of various binders is also very unstable, and suspending agents, defoamers and mildew inhibitors have great influence on coatings, so there are too many uncertain factors for domestic coating manufacturers to make a stable coating. Foundries often change the paint when it is unstable, and change it after it has been stable for a while. However, as long as the analysis and testing of each kind of aggregate and auxiliary materials are done well, the stability problem of different batches of the same coating can be avoided to the maximum extent.

Table 3.5 is the data we measured for some batches of aggregate mesh intervals.

Table 3.5 Detection data of kyanite mesh number

Detection date	< 80 mesh (%)	80~120 mesh (%)	120~180 mesh (%)	> 180 mesh (%)
2021-09-03	5.29	27.98	42.44	24.29
2021-09-04	1.28	26.63	48.47	23.62
2021-10-21	3.90	28.09	52.67	15.34
2022-01-11	5.20	25.56	42.72	26.52

Refer to Figure 3.3~ Figure 3.10 for related instruments and reference data of paint detection.

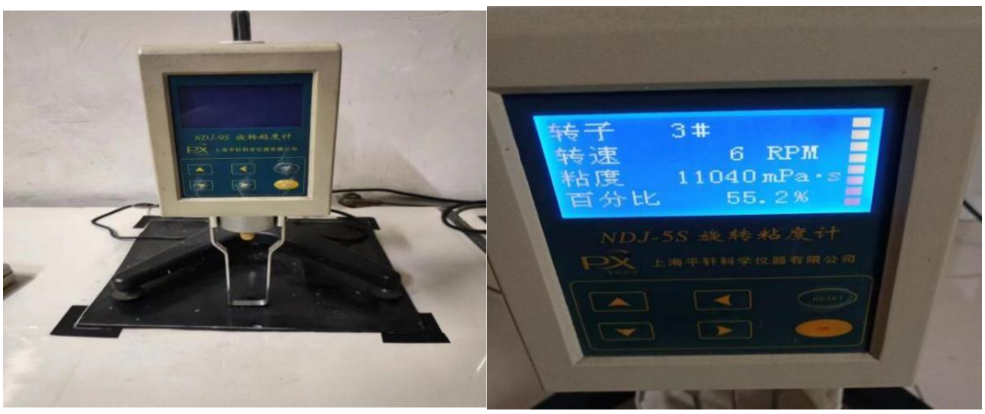
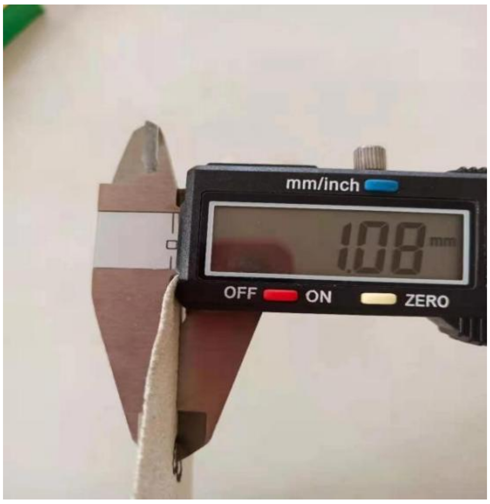


Fig. 3.3 Rotating viscometer for testing paint viscosity between Baume degree 60~65.



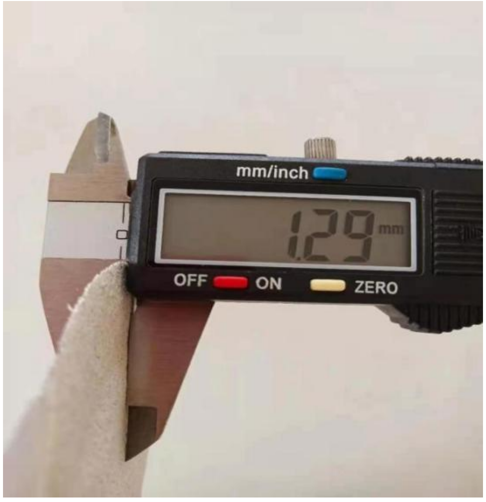


Figure 3.4 60 Baume First Pass Coating Thickness Figure 3.5 65 Baume First Pass Coating Thickness

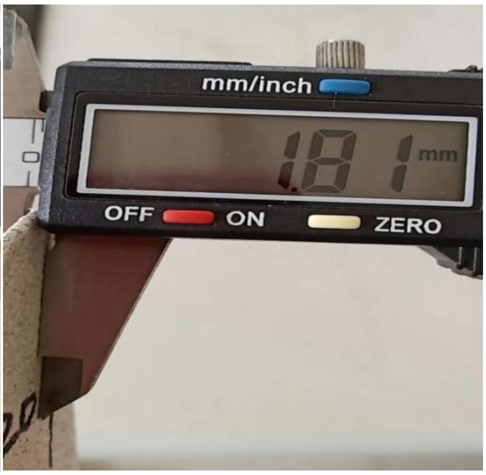


Fig. 3.6 Paint thickness of 60 Baume Second Pass Fig. 3.7 Material thickness of 65 Baume Second Pass

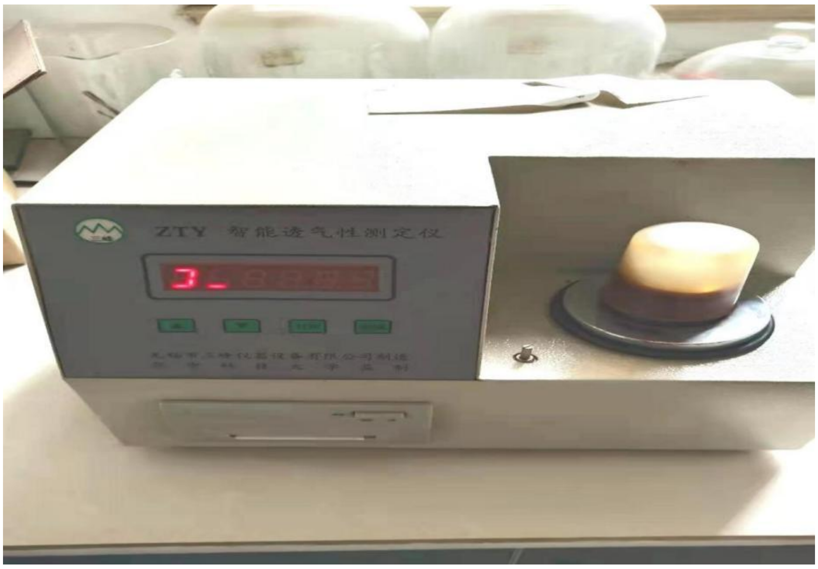


Figure 3.8 Intelligent Permeability Tester

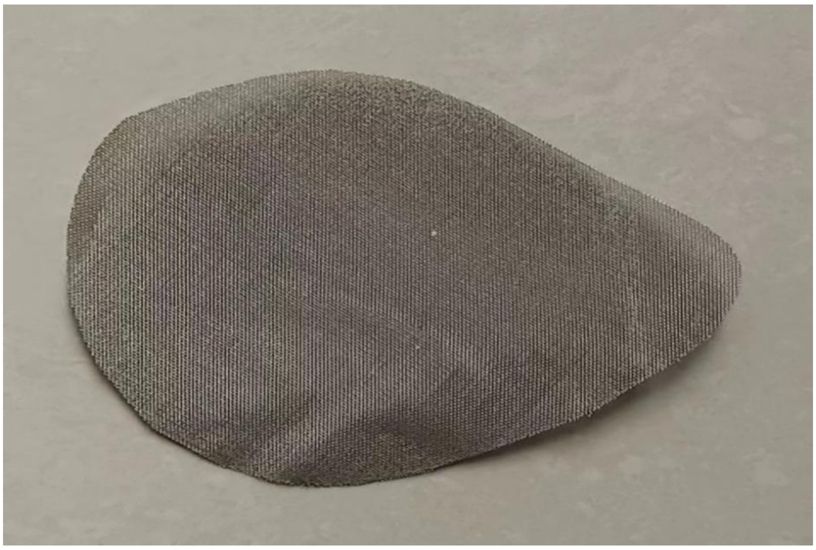


Figure 3.9 Steel wire mesh for measuring air permeability of paint once and twice.

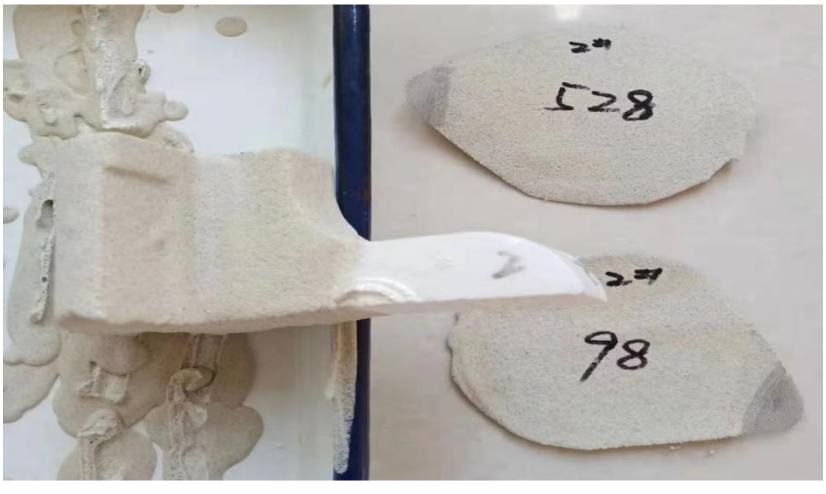


Fig. 3.10 Permeability of the coating over and over again and cracking of white mold coating.