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LOST FOAM METAL CASTING TECHNOLOGY

jmt

Process Steps

1. Mould foam (Thermocole) patterns
2. Assemble foam pattern if it is a multiple piece pattern
3. Complete assembly by gluing moulded foam runners & risers to pattern
4. Coat pattern / tree of small patterns with ceramic coating multiple times
5. Dry coating in drying owen
6. Burn-off (Shelling / Shell sintering) in heat treatment furnace
7. Compact shell in flask (moulding box) filled with loose silica sand
8. Pour liquid metal in shell under vacuum
9. Extract casting from flask (moulding box)
10. Casting finishing & fettling

Foam Pattern Moulding

Foam Pattern Moulding on horizontal moulding machine

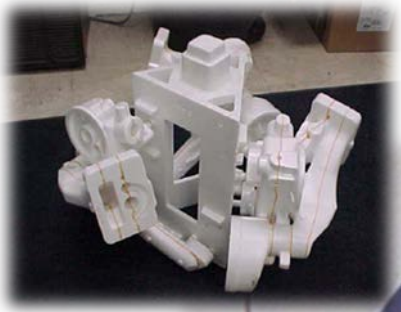
Moulded foam (thermocole) Pattern

The foam (Thermocole) pattern is moulded on a horizontal moulding press which injects the polystyrene in the aluminium tool loaded on the machine.

Steam heating of polystyrene beads converts into a light pattern form that is smooth, accurate, lightweight and looks like the product to be cast.

Foam Pattern Assembly

Foam Pattern Sections and Pattern Gluing Machine



Gluing of Runners & Risers to foam patterns

The moulded foam pattern can be a single pattern, several small patterns or a pattern in multiple sections.

Pattern sections are glued manually or in a gluing machine to form a single pattern. Similarly smaller patterns are glued to a sprue to form a tree

Runners & risers are then glued to the patterns to complete the methoding.

Foam Pattern Coating

Multiple layers of coating applied to pattern

Coating parameters are verified before coating the patterns.

The slurry is mixed continuously to maintain properties.

Cluster may be hand dipped or by automated robot station

The foam pattern is coated with ceramic a slurry to form a ceramic shell coating over the foam pattern.

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Foam Pattern Drying & Burn-off

Automated Drying of coated patterns

Burn-off & Shell Sintering in furnace

Coating parameters are verified before coating the patterns.

The slurry is mixed continuously to maintain properties.

Cluster may be hand dipped or by automated robot station

The foam pattern is coated with ceramic a slurry to form a ceramic shell coating over the foam pattern.

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Sand Compaction & Metal Pouring

Shell placed in flask before pouring

Metal Pouring in flask compacted with sand

Before compaction the shell is placed into the flask and held in position by a fixture or by hand.

The flask is vibrated on a vibrating table to compact the sand and provide packing strength to the hollow shell.

Metal is poured to fill in the hollow shell.

Casting Extraction

Sand dumped on conveyor for reuse

Casting extraction after solidification

Casting is allowed to cool and solidify in sand for a predetermined period.

The loose sand in the Flask is then dumped on to a conveyor for recycling.

Loose sand around the casting cluster helps protect the parts from damage.

Final Casting

Non-Ferrous Casting

Stainless Steel Casting

Ferrous Casting

Ground Engaging Teeth

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LOST FOAM CASTING PROCESS

Comparison With Green Sand

Property	Green Sand Casting	foamcast
Complex Internal Features and Part Consolidation.	Complexity determined by sand core limitations, geometry, strength, and cost.	Extensive and complex internal features (as thin as 3mm), based on detail duplication and pattern assembly in foam.
Dimensional Tolerances	+/- 0.030" is typical depending on part size, complexity, and geometry	+/- 0.005"-0.010" is typical depending on part size, complexity, and geometry.
Surface Finish Capabilities	Depends on grain fineness of sand.	Depends on bead size and ceramic coating grain fineness.
Feature Accuracy	Core movement and shift between mold halves across the parting line limit feature accuracy.	No cores or mold halves to shift and degrade feature accuracy.
Parting Line and Draft Angles	Parting lines and draft angles are necessary for molding.	No parting lines in the mold and minimal draft on tools.
Environmental Costs	Sand recovery requires binder removal	Sand is binder free, so it can be easily and rapidly recovered at low cost.
Tool Life	Wear on wood and metal tools from sand abrasion	Low wear and long life with aluminum tool

Comparison With Lost Wax

Property	Lost Wax Casting	foamcast
Composition of Pattern	Microcrystalline Wax	Expanded Polystyrene Foam
Density of Material used for pattern	Density of Microcrystalline Wax Patterns - 795 kgs./m³, resulting in heavy delicate patterns.	Density of Expanded Polystyrene Patterns - 42 kgs./m³ sufficient for strong, sturdy, dimensionally accurate and light patterns.
Maximum Weight of Cast Part	Well Below 125 kgs.	No limitation of weight of cast part.
Pre-Heating of Ceramic Shell	Required	No required, pouring is possible at room temperature of ceramic shell.
Rejection of Shell during process	The ceramic shell has a tendency to crack during the autoclave process due to the expansion of Wax	The ceramic shell does not crack during the burn-off process as EPS does not expand but evaporates/melts.
Methoding	Difficult and has limitations in addition to the problem of riser backfilling.	Flexible, risers are simply glued on the pattern to suit the methoding. The feeding ability of riser is improved with the use of exothermic sleeves.
Ceramic Shell Thickness	Approx. 10-15mm	Approx. 5-10mm depending on the size of component.

Casting Process Capability

Casting Alloy:

Cast Iron	Grey Iron, Ferrite/Pearlite Ductile Iron, High-Nickel Ductile Iron, Hi-Chrome White Iron
Cast Steel	Carbon Steel, Tool Steel, Hi-Manganese Steel, Heat-resistant Steel
Non-ferrous	Aluminum alloy, Bronze, Brass

Process Capability:

Weight	Size	LinearTolerance	Thickness	Sharpness	Surface Finish
15~2500kgs.	≦1200mm	ISO8062, CT6~9	≧3mm	R0.5	Non-Ferrous, Ra3.2~6.3μm;
					Ferrous, Ra6.3~12.5μm;

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