

The Basics of Investment Casting Wax



Investment Casting Wax

- Wax is the oldest thermoplastic material known to man
- Beeswax was utilized in the lost wax process by craftsmen in the ancient civilizations of China & Egypt
- Today the name 'wax' applies to any substance having wax-like properties
 - better described as industrial moulding compounds
- If the pattern is wrong, the casting will be wrong
- it follows that the choice of wax is critical

Modern Investment Casting Wax

- Modern blends are complex compounds containing numerous components
 - hydrocarbon wax
 - natural ester wax
 - synthetic wax
 - natural resins
 - synthetic resins
 - organic filler materials
 - water

Structure of Investment Casting Wax

- Many variations are formulated to suit differing requirements
- Key properties such as melting point, hardness, viscosity, expansion and contraction, setting rate, etc are all influenced by the structure and composition of the wax compound
- Understanding the properties of the individual components and how they interact is essential in meeting foundries individual requirements
- The complex composition manifests itself in a physical behaviour different to that of other substances

Expansion & Contraction of Wax

- The structure and components used in an investment casting wax will influence the expansion and contraction
- Like other materials wax expands on heating and contracts on cooling
- In comparison with a metal the expansion is relatively high
- Wax expansion and contraction rates are not uniform but vary with phase and structure changes during heating/cooling

Phase Changes of a Typical Wax

- Unlike other homogeneous chemical compounds, wax does not melt immediately on heating but passes through several intermediate states :

solid ➤ plastic ➤ semi-plastic ➤ semi-liquid ➤ liquid

Categorization of Investment Casting Wax

- Pattern wax
 - straight (unfilled)
 - emulsified
 - filled
- Runner wax
- Reclaim & Reconstituted wax
- Water Soluble wax
- other Special wax
 - dipping/patching/adhesive

Straight (Unfilled) Pattern Wax

- Complex compound of many wax and resin components
- Surface finish normally shiny
- Can usually be reclaimed and reconstituted for use on both runner systems and patterns

Emulsified Pattern Wax

- Base materials compatible with emulsifying agents and water
- Emulsified with 7 - 12% water
 - water acts partially as a filler and reduces cavitation
- Surface finish normally smooth
- Can usually be reclaimed and reconstituted for use on both runner systems and patterns

Filled Pattern Wax

- Base materials are filler compatible
- Blended with a powdered, inert filler material insoluble in the base wax
- Filler gives the wax greater stability and less cavitation
 - organic filler material with fine particle size is essential to ensure complete burnout
- With advanced reclaim technology can usually be reclaimed and reconstituted for use on both runner systems and patterns

Specialist Wax

- Compounds used to help the production of finished wax patterns ready for assembly
 - soft repair wax
 - hard repair wax
 - adhesive wax
 - dip seal wax
 - rod wax
 - water soluble wax

Reclaim & Reconstituted Wax

- Customers scrap wax returned to Blayson for reprocessing
 - cleaned & filtered
 - additives to adjust properties to specification
- Reclaim wax for runner systems
- Reconstituted wax for pattern production
 - Reconstituted Filled Wax
 - Reconstituted Emulsified Wax
 - Reconstituted Straight (Unfilled) Wax
- Environmental and economic benefits

Properties of Investment Casting Wax

- The majority of investment casting wax materials are complex compounds of numerous components
 - each included to influence the final properties
- Wax properties are of critical importance to foundries for the production of good castings
- Once a specification has been agreed it is essential that compliance with the limits is maintained
 - supported by process and quality control

Quality Control

- Important for both wax manufacturer and foundry to monitor wax properties
- Strict quality control procedures are essential
- Ensures consistency and compliance with specifications
- BICTA recommended tests :
 - melting (drop) point
 - congealing point
 - ash content
 - penetration
 - viscosity

Summary

- Investment casting wax compounds are complex
 - consist of many different components
 - consequently exhibit a range of properties
- Wax properties influence pattern behaviour in the foundry and ultimately the quality of castings produced
- Correct product choice allied with strict process & quality control procedures is essential