



IIT ROORKEE



NPTEL ONLINE
CERTIFICATION COURSE

SPECIAL SAND MOLDING PROCESSES

Processes based on organic binders

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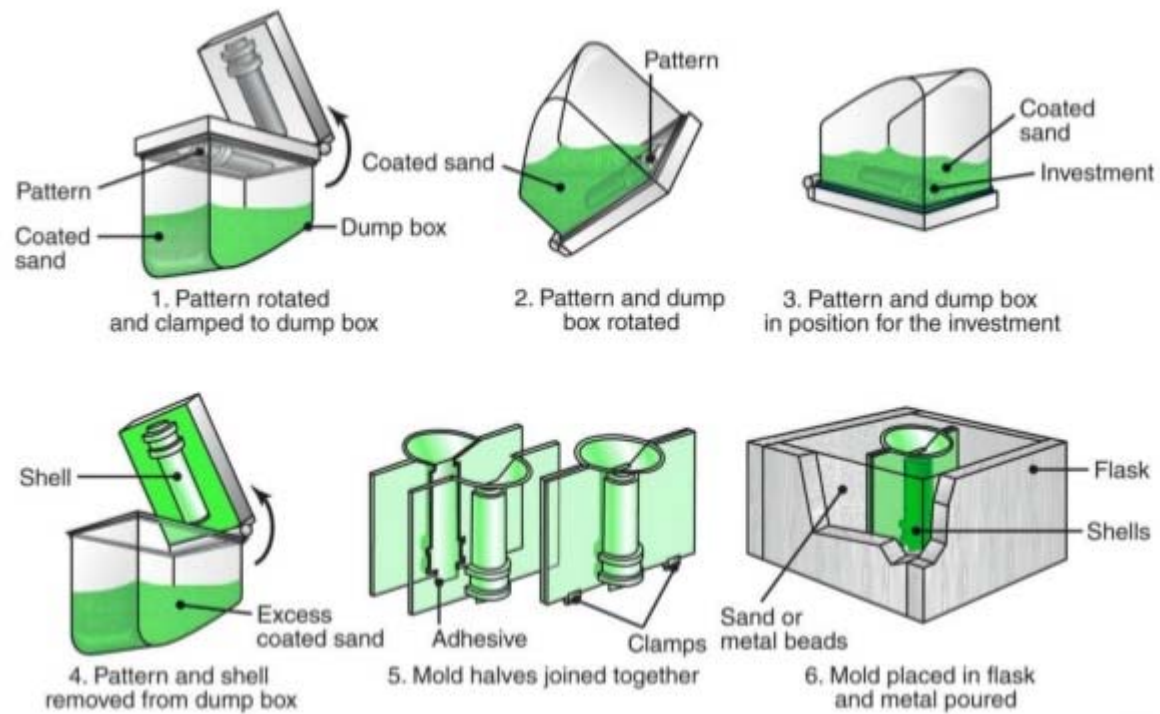


PROCESSES BASED ON ORGANIC BINDERS

- For production of high quality castings (small to medium size).
- Earlier used for making cores (only).
- Process using organic binders include
 - i. Shell molding
 - ii. Hot box molding
 - iii. Cold box molding
 - iv. Alkyd and phenolic no bake process
 - v. Furan process
 - vi. Gas setting resin process

SHELL MOLDING PROCESS

- Fine sand (100-150 mesh) + thermosetting resin.
- Mixture placed against a heated pattern
- Resin cures and sand grains are bonded to each other.
- After preset time, pattern is turned over to allow unbounded sand to be removed, leaving shell of required thickness on pattern.
- Machines are available for core making & molding:
 - Dump box type: for low production rate
 - Blow type: high production rate



RESINS

- Thermoplastic type + polymerizing agent for producing thermosetting characteristics
- Phenol formaldehyde is popular resin
- To control hardening action & to accelerate, hexamethylenetetramine is added to mix.
- Resin (4-6% by weight of sand) + hexamine (14-16% of resin)
- Quality of resin increases with fineness of sand
- Sand should be free of organic materials & clay.
- Additives such as coal dust, MnO_2 , ammonium borofluoride, lignin & Fe_2O_3 are used for resistance to thermal cracking, surface finish (better), resist to distortion & increase strength etc.

- Lubricating material like Zinc stearate, calcium stearate, carnauba wax etc. are used to resin or sand mix for easy release of mould from pattern.
- Sand resin mix may be prepared in three different ways:
 - Hot coating
 - Warm coating
 - Cold coating process

- Hot coating Process: Curing of resin due to dual effect of heat and chemical action of acid catalyst such as hexamine (heating dry silica sand to temperature of 120-175°C) cooling sand mix to ~45°C to prevent lump formation & flowability increases.
 - Used for mass production (since less resin is required)
 - No alcohol used, so no explosion hazard.
- Warm Coating process: Catalyst is used with different resin formation so that curing takes place at ~80°C.
 - Resin in the form of liquid solvent solution.

- Cold Coating Process: Sand + hexa + (resin, dissolved in alcohol).
 - Done at room temperature
 - More expensive as greater quantity of resin required.
 - Alcohol (as carrier of resin) has to be eliminated during mixing operation itself by blowing air.
- The three methods are meant for preparing sand-resin mix just before moulds or cores are required to be made (pre-coated sand)

PRODUCTION CONTROL TESTS ON SAND MIX

- Hot tensile test
- Melt point / stick point test
- Hardness
- Pattern equipment: Material of pattern should
 - Operate at temperature in the range 175-300°C
 - Transferring heat evenly from all over its surface to resin sand mix
 - **Example:** CI, Al-alloy
 - **Application:** Production of casting weighting 200gm to 200Kgs in ferrous and non ferrous metals.

- Advantages:
 - Sand prepared can be transported and stored easily.
 - Less sand required, cores can be hollow.
 - Good accuracy & finish.
 - High rate of production with limited floor space.
 - Moulds & cores can be stored (non hygroscopic).
 - Process used for all cast metals.
- Limitations:
 - Casting size & weight
 - High cost pattern equipment & resin limitation
 - Need expensive equipment for preparing shells

HOT BOX MOLDING

- Resin sand mix blown over heated pattern or core box, not turned over but sand heated and allowed to form sand mass.
- Refinement of shell molding
- Resin used for coating sand grains

COLD BOX MOLDING

- No heating of pattern
- Curing by sampling gaseous catalyst through sand mass.
- Total time to prepare is very less.
- Sand + polyisocyanate binder + alkyd phenolic resin + blowing vapour (TEA liquid atomized in air)

ALKYD NO BAKE SANDS

- Normal drying oils are added with alkyd resins
- Alkyd resins are formed by reaction of phthalic anhydride and glycerol.
- Hydroxyl groups in glycerol reacts with acid group in anhydride to produce large chains.
- Sand system consists binder, hardener (Cobalt or lead naphanate) and catalyst (isocynate).
- ABC system

PHENOLIC NO BAKE SAND

- Phenolics are completely free of nitrogen, so well suited for production of steel.
- Binder in phenolic resins
- Catalyst is paratouene sulphuric acid or benzene sulphonic acid.
- Catalyst initiate further condensation of resin and advance curing by cross linking action

FURAN PROCESS

- Furan resins are core binders
- Resins used are urea furyfuryl alcohol formaldehyde and phenol furfuryl alcohol formaldehyde
- Catalyst is phosphoric acid

SO₂ PROCESS



THANKS

