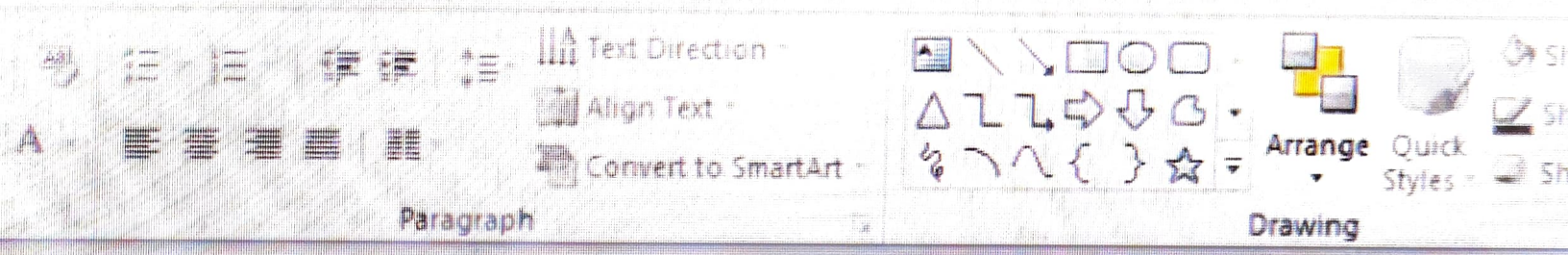
PATTERN LAYOUT AND PATTERN CONSTRUCTION

Pattern Layout:

Steps involved:

- Get the working drawing of the part for which the pattern is to be made.
- Make two views of the part drawing on a sheet, using a *shrink rule.* A shrink rule is modified form of an ordinary scale which has already taken care of shrinkage allowance for a particular metal to be cast.
- Add machining allowances as per the requirements.
- Depending upon the method of molding, provide the draft allowance.



Pattern Colors:

Patterns are imparted certain colors and shades in order to:

i. Identify quickly the main body of pattern and different parts of the pattern.
ii. Indicate the type of the metal to be cast.
iii. Identify core prints, loose pieces, etc.,
iv. Visualize the surfaces to be machined, etc.

the patterns are normally painted with contrasting colors such that the mould maker would be able to understand the functions clearly.

The color code used is,

1. Red or orange on surface not to be finished and left as cast
2. Yellow on surfaces to be machined
3. Black on core prints for unmachined openings
4. Yellow stripes on black on core prints for machinsed openings
5. Green on seats of and for loose pieces and loose core prints
6. Diagonal black strips with clear varnish on to strengthen the weak patterns or to shorten a casting.

MOLDING SAND

- Molding sand are the most commonly used for making all types of molds irrespective of whether they are used for producing casting of ferrous or non-ferrous metal
- Most sand casting operations are used silica sand.
- Sand used to manufacture a mould for casting process is held by mixture of water and clay.
- A typical mixture by volume could be 89% sand,4% water and 7% clay.

CHARACTERISTIC OF MOLDING SAND

- Molding sands are refractory in nature and can withstand temperature of metal being poured without fusing.
- The molding sand do not chemically react with molten metal.
- The sand have high degree of permeability and thus allow gases formed during pouring to escape.
- These strength , permeability and hardness of the sand mix can be varied by changing the structure of sand .

TYPES OF MOLDING SAND

1. **Green sand:**

- It is sand used in the wet condition for making the mould. It is mixture of silica sand with 15-25 per cent clay and 6-8 per cent water
- As explained earlier green sand moulds are not dried and metal is poured in them in the wet condition
- Being damp the sand can be easily worked with hand to give it any desired shape
- This sand is used for producing small to medium sized moulds which are not very complex

2. Dry sand:

- Dry sand is the green sand that has been dried or baked after preparing the mould.
- Drying sand gives strength to the mould so that it can be used for larger castings

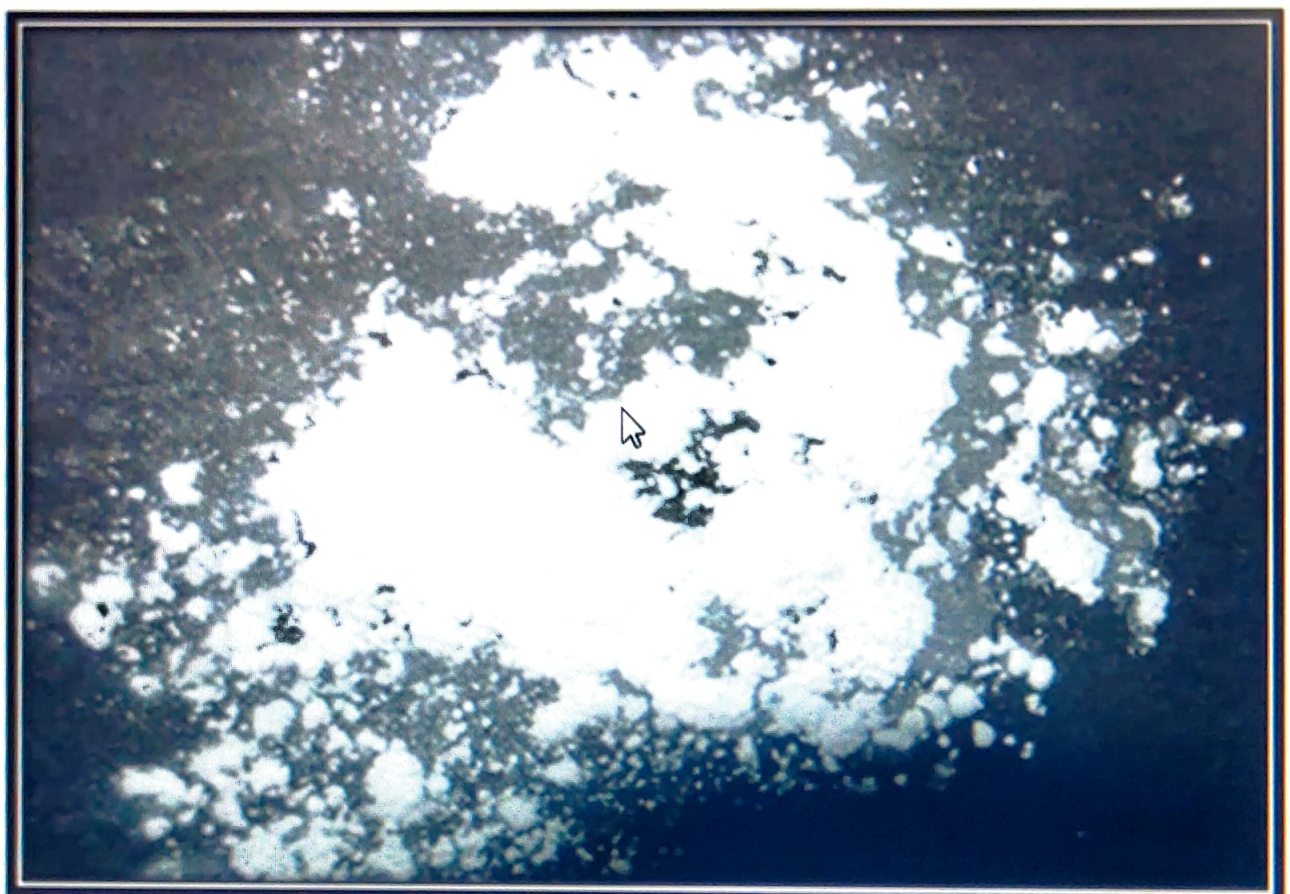
3. Loam sand:

- Loam sand is sand containing up to 50 % clay which has been worked to the consistency of builder mortar.
- This sand is used for loam sand moulds for making very heavy castings usually with the help of sweeps and skeleton patterns

4. Parting sand:

- This sand is used during making of the mould to ensure that green sand does not stick to the pattern and the cope and drug parts can be easily separated for removing the pattern without causing any damage to the mould.
- Parting sand consists of fine grained clay free dried silica sand, sea sand or burnt sand with some parting compounds.
- The parting compounds used include charcoal, ground bone and limestone, groundnut shells, talc and calcium phosphate.

PARTING SAND



5. Facing sand:

- Facing sand is the sand which covers the pattern all around it. The remaining box is filled with ordinary floor sand.
- Facing sand forms the face of the mould and comes in direct contact with the molten metal when it is poured.
- High strength and refractoriness are required for this sand.
- It is made of silica sand and clay without the addition of any used sand.
- Graphite, mollasses etc. may be added to the facing sand. Thickness of the sand layer varies from 20 to 30 mm

FACING SAND

6. Backing sand:

- Backing sand is the bulk of the sand used to back up the facing sand and to fill up the volume of the flask.
- It consists mainly of old, repeatedly used molding sand which is generally black in color due to addition of coal dust and burning on contact with hot metal.
- Because of the color backing sand is also sometimes called black sand.
- The main purpose for the use of backing sand is to reduce the cost of molding.

BACKING SAND

7. System sand:

- This is the sand used in mechanized foundries for filling the entire flask.
- No separate facing sand is used in a mechanized foundry.
- Sand, cleaned and reactivated by the addition of water and binders is used to fill the flask. Because of the absence of any fresh sand, system sand must have more strength, permeability and refractoriness compared to backing sand

8. Core sand:

- Core sand is the sand used for making cores. This is silica sand mixed with core oil. That is why it is also called oil sand.
- The core oil consists of linseed oil, resin, light mineral oil with some binders.
- For larger cores, sometimes pitch or flour and water may also be used to save on cost.

PROPERTIES OF MOLDING SAND

- Strength

1. GREEN STRENGTH:

- Adequate strength and toughness for making and handling the mold.

2. DRY STRENGTH:

- Dry sand must have strength to resist erosion and also the mettalo static pressure of the molten metal or else the mold may enlarge.

3. HOT STRENGTH:

- Hot molten metal
- Metalloid static pressure of the liquid metal bearing against the mold walls may cause mold enlargement, or if the metal is still flowing, erosion, cracks, or breakages may occur unless the sand posses adequate hot strength.

- **PERMEABILITY:**
  - Steam and other gases
  - The mold must be permeable, i.e. , porous to permit the gases to escape.
- **THERMAL STABILITY:**
  - Heat from the casting causes rapid expansion of the sand surface at the mold-metal interface.
  - The mold surface may crack, buckle, or flake off (scab) unless the molding sand is relatively stable dimensionally under rapid heating.
- **REFRACTORINESS:**
  - The absence of melting, softening, or adherence of the sand to the casting makes for better casting surface and easier cleaning of the casting.

- **FLOWABILITY:**
  - The sand should pack well/flow under load.
  - Sands of low flowability may result in non-uniform hardness.
  - Soft molds --- enlargement of the casting or roughness of the casting surfaces.
- **COLLAPSIBILITY:**
  - The molding sand should also have collapsibility so that during the contraction of the solidified casting it does not provide any resistance, which may result in cracks in the castings.
  - Besides these specific properties the molding material should be cheap, reusable and should have good thermal conductivity

- **Adhesiveness**
  - The molding sand should collapse during the contraction of the solidified casting it does not provide any resistance, which may result in cracks in the castings.
  - Besides these specific properties the molding material should be cheap, reusable and should have good thermal conductivity
- **Cohesiveness**
  - It is the property of sand due to which the sand grains stick together during ramming. It is defined as the strength of the molding sand

- **Reusability:**
  - Since large quantities of sand are used in a foundry it is very important that the sand be reusable otherwise apart from cost it will create disposal problems
- **Easy of preparation and control:**
  - Sand should lend itself to easy preparation and control by mechanical equipment.
- **Conductivity:**
  - Sand should have enough conductivity to permit removal of heat from the castings.