



IIT ROORKEE



NPTEL ONLINE
CERTIFICATION COURSE

TECHNOLOGY OF MOLDING

Molding sands and its ingredients

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MOLDING MATERIALS

- **Sand**
- **Metals and Alloys**
- **Plaster**
- **Ceramic**
- **Graphite**
- **Rubber**

Molding sand

- Major production of casting in sand mold
- 1 ton of casting may require 4-5 tons of molding sand
- Sand metal ration may vary from 10:1 to 0.25:1 depending upon type and size of casting and molding method employed.
- Sand: Granular particles resulting from disintegration of rocks
- Most common sand is silica sand (high purity silica sand has sintering temperature of $\sim 1700^{\circ}\text{C}$).
- Shape of grains affect flowability, permeability and compactibility of sand.

Desired Properties of Molding Sand

- Refractoriness
- Green Strength
- Dry Strength
- Hot Strength
- Permeability
- Collapsibility
- Cohesiveness
- Flowability
- Adhesiveness
- Thermal stability
- Reusable
- Other Requirements:
 - ❖ Cheap and Easily Available,
 - ❖ Low Thermal Expansion Coefficient,
 - ❖ Chemically Inert and Non Sticking to the Casting Surface.

Ingredients of molding sand

- Molding sand is a mixture of three or more ingredients.
- Most common sand is silica sand.
- Silica sand principally consists of mineral quartz (specific gravity 2.6)
- Green sand means clay + water + silica sand
- In molding sand, silica is 50-90% (of different grain shape and size)

Different types of molding sand

➤ **Silica Sand:**

Silica grains forms the majority of the molding sand (up to 96%), rest being the other oxides such as alumina, sodium and magnesium oxide. These oxides (impurities) should be minimized to about 2% since they affect the fusion point of the silica sands.

- ❖ Main source is the river sand which is used with or without washing.
- ❖ Shape of the grains may be round, sub-angular, angular and very angular.

➤ **Olivine Sand:**

Contains Minerals Fosterite (Mg_2SiO_4) and Fayalite (Fe_2SiO_4).

- ❖ It is a very versatile sand and the same mixture can be used for a range of steels.

➤ **Zircon Sand (Zirconium Silicate ZrSiO_4):**

Typical composition is

ZrO_2 -66.25%; SiO_2 -30.96%; Al_2O_3 -1.92%; Fe_2O_3 -0.74% and traces of other oxides.

- ❖ It is very expensive.
- ❖ It has a fusion point of about 2400°C
- ❖ Low coefficient of thermal expansion, high thermal conductivity, high chilling power, and high density.
- ❖ It requires a very small amount of binder (about 3%).
- ❖ It is generally used to manufacture precision steel castings requiring better surface finish.

➤ **Chromite Sand:**

It is crushed from the chrome ore whose typical composition is

Cr_2O_3 -44%; Fe_2O_3 -28%; SiO_2 -2.5%; CaO -0.5%; and $\text{Al}_2\text{O}_3 + \text{MgO}$ - 25%.

- ❖ Fusion point is about 1800°C .
- ❖ It requires a very small amount of binder (about 3%).
- ❖ It is used to manufacture heavy steel castings requiring better surface finish.

Special Additives

- Cereals
- Pitch
- Asphalt
- Seacoal
- Graphite
- Fuel Oil
- Wood Flour
- Silica Flour
- Iron Oxide
- Molasses
- Dextrin

CLAY

- Clay is generally used as binding agent in the molding sand to provide the strength, because of its low cost and wider utility.
- The most popular types of clay used are
 - ❖ Kaolinite or fire clay (melting point: range of 1750 to 1787°C)
 - ❖ Bentonite (melting point: range of 1250 to 1300 °C), two types
 - ✓ Sodium bentonite or western bentonite
 - ✓ Calcium bentonite or southern bentonite
- Bentonite can absorb more water which increases its bonding power.
- Sodium bentonites produce better swelling properties (volume increases some 10 to 20 times), high dry strength which lowers the risk of erosion, better tolerance of variations in water content, low green strength and high resistance to burnout which reduces clay consumption.
- In contrast, calcium bentonites have low dry strength but higher green strength.

WATER

- Clay is activated by water so that it develops the necessary plasticity and strength.
 - ❖ Amount of water used should be properly controlled because a part of the water absorbed by clay helps in bonding while the remainder up to a limit helps in improving the plasticity while more than that would decrease the strength and formability.
 - ❖ Normal percentages of water used are from 2 to 8%.

THANKS

