Sand Casting

Sand casting is widely used because this process is simple, and almost any material can be cast, no limit to size, shape or weight, low tooling cost. The basic steps of sand casting process are:

1- Selection suitable sand to create sand mold and to control on quality of casting.

2- Put pattern from wood or metal in sand to create mold cavity.

3- Do small hammering on the sand to make stability of the pattern.

4- Remove the pattern.

5- Fill the mold cavity with molten metal.

6- Allow the molten article to cool.

7- break the sand mold and remove the casting product.

The sand casting process is usually economical for small batch size production, but with small limitations, some finishing required, small coarse finish, wide tolerances.

The quality of the sand casting depends on the quality and uniformity of green sand material that is used for making the mold. Figure (22) schematically show a two of parts of sand mold, also referred to as a cope and drag sand mold. The molten metal is poured through the pouring cup and it fills the mold cavity after passing through down sprue, runner and gate. The core refers to loose piece which are placed inside the mold cavity to create internal holes or open section. The riser is used as a container or reservoir to excess molten metal that facilities additional filling of mold cavity to compensate for volumetric shrinkage during solidification. Sand castings process provides several advantages. It can be employed for all types of metal. The tooling cost is low and can be used to cast very complex shapes. However sand castings offer poor dimensional accuracy and surface finish.

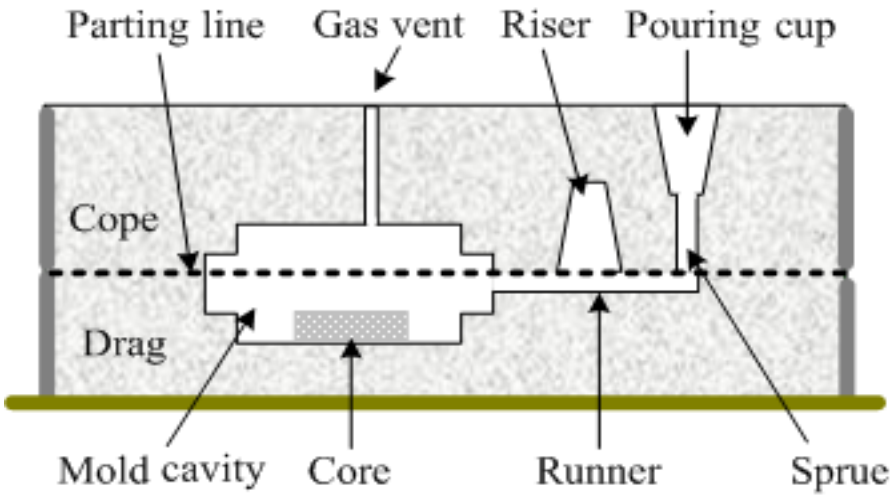

Figure 22 Schematic of sand molding

Moulding Sand

Composition

The main components of any moulding sand are:

(a) Silica sand (SiO_2) 80.8%

(b) Alumina (Al_2O_3) 14.9%

(c) Iron oxide (Fe_2O_3) 1.3%

(d) Combined water 2.5%

(e) Other inert materials 1.5%

Properties of Moulding Sand

The moulding sand should possess the following properties:

1. Porosity or permeability: It is that property of sand which permits the steam and other gases to pass through the sand mould. When hot molten metal is poured into the sand mould, it evolves a great amount of other gases while coming in contact with the moist sand. If these gases do not escape completely through the mould, the casting will contain gas holes and pores. Thus, the sand from which the mould is made must be porous or permeable. The porosity of sand depends upon its grain size, grain shape, and moisture and clay contents in the moulding sand. The quality of sand has directly affects to the porosity of the mould. If the sand is too fine, its porosity will be low.

2. Plasticity: It is very important to made a mold, that property of sand due to which it flows to all portions of the moulding box and taken a predetermined shape under hammering pressure and keep this shape when the pressure is removed. The sand must have sufficient plasticity to produce a good mould. The plasticity is increased by adding water and clay to sand.

3. Adhesiveness: It is the property of sand due to which it adheres to the sides of the moulding box. Good sand must have sufficient adhesiveness so that heavy sand masses can be successfully held in moulding box without any danger of its falling out when the box is removed.

4. Cohesiveness: *It is that property of sand due to which the sand grains stick together during ramming. It may be defined as the strength of the moulding sand. It is of the following three types,*

(a) Green strength: The green sand, after water has mixed to it, must have suitable strength and plasticity for making of mould. The green strength depends upon the grain shape and size, amount and type of clay and the moisture content.

(b) Dry strength: When the molten metal is poured, the sand adjacent to the hot metal quickly loses water content as steam. The dry sand must have the strength to resist of erosion and also the pressure of the molten metal, otherwise the mould may increase.

(c) Hot strength: After the moisture has evaporated, the sand may be required to possess strength at high temperature, above 100°c. If the sand does not possess hot strength, the pressure of the liquid metal bearing against the mould walls may cause mould enlargement or if metal is still flowing, it may cause erosion, cracks or breakage.

5. Refractoriness: It is that property of the sand which enables it to resist high temperature of the molten metal without breaking or fusing. The higher pouring temperature, such as those for ferrous alloys, requires great refractoriness of the sand. The degree of refractoriness depends upon the quartz contents, and the shape and grain size of the particles.

6. Flowability: It is the property of sand due to which it behaves like a fluid so that, when rammed, it flows to all portions of a mould and distributes the ramming pressure equally. Generally, sand particles resist moving around corners. In general, flowability increases with decrease in green strength and decrease in grain size. It also varies with moisture content.