International Journal of Mechanical and Industrial Technology **ISSN 2348-7593 (Online)**
Vol. 5, Issue 1, pp: (1-6), Month: April - September 2017, Available at: www.researchpublish.com

Effect of Moulding Sand to Generate Casting by Moulding Process

Mr. Rone, Mr. Pawan Kumar

Student at Delhi institute of technology management and research, M.TECH (2014-2016)

***Abstract*: manufacturing processes are those processes through which the product or the component will be generated. The maximum products in the industries are generated by the help of moulding through which castings are generated or then final product are obtained. In the moulding process the first task is that to manufacturing the mould. As we know that the mould is generated by the moulding sand and how we improved or increase the strength of the mould by improving moulding so we have some experiment which increases the hardness and the strength of the mould which provide the casting or metal as per requirement.**

***Keywords:* Moulding Sand to Generate, manufacturing the mould.**

1. INTRODUCTION

The need of moulding is to generate the mold, through which different shape and size of metal are manufactured. .in this process the molten metal is poured into the mould, which filled the space present into the mould and after solidification at predetermined temperature. it takes the proper shaper by the help of different machining operation these whole process are under the moulding. There are some aspects which directly or indirectly affect the metal which generated during the moulding process. These are sand ,pattern, allowances and the metal of feeding metal into the mould.

The main aspect is the moulding sand which directly affect the material during its manufacturing. There are different kind of sand are used during the manufacturing operation of casting there are the following constituents through which the moulding are prepared.

1. Silica sio2 86-90%
2. Alumina al2o3 8%
3. Iron oxide fe2o3 2-5%
4. And oxides of Tn,Mn,Ca and some alkaline compound.

These sand are classified into the following type.

1. Green sand when the sand is in its natural state which means it have 18-30% clay and 6-8% water it is termed as green sand.

2. Dry sand:- it is generally made of natural sand but dried or baked to removed the moisture to provide it to great strength.

3. Loam sand:- these are those sand which have 50% clay and 18-20% moisture.

Facing sand:- facing sand consist of 10-15% of sand, it is a mixture of plumbs powder and graphite.

4. Backing sand:- it is the mixture of sand material and the coal powder.

5. System sand:- it is used to provide higher strength to the moulding.

6. Parting sand:- it is clean free silica sand dust.

7. Core sand :- it is silica sand mixed with core oil.
8. Co2 sand:-in Co2 sand, the silica grains, instead of being coated with natural clay are coated with sodium silicate.
9. Shell sand:- these are synthetic sand coated with phenol or urea-formaldehyde resin.
10. Facing sand:- it firstly applied to the pattern , so that only it, comes in contact with the molten metal.
11. Backing sand:- these are applied as back up mechanical support to facing sand. These are permeable to allow gases to escape.

There are different compositions of sand, these are as:-

Chromites ($FeCr_2O_4$), black, angular sand, are highly refractory and chemic ally un reactive, and it has good thermal.

Stability and excellent chilling properties. However, it has twice the thermal expansion of zirco n sand, and it often contains hydrous impurities that cause pin holing and gas defects in Castings. It is necessary to specify the calcium oxide (CaO) and Silicon dioxide (SiO_2) limits in chromites sand to avoid sintering Reactions and reactions with molten metal that cause burn-in.

Olivine minerals (so called because of their characteristic green color) are a solid solution of for striate (Mg_2SiO_4) and fealties (Fe_2SiO_4). Their physical properties vary with their Chemical compositions; therefore, the composition of the olivine used must be specified to control the reproducibility of The sand mixture. Care must be taken to calcine the olivine Sand before use to decompose the serpentine content, which Contains water.

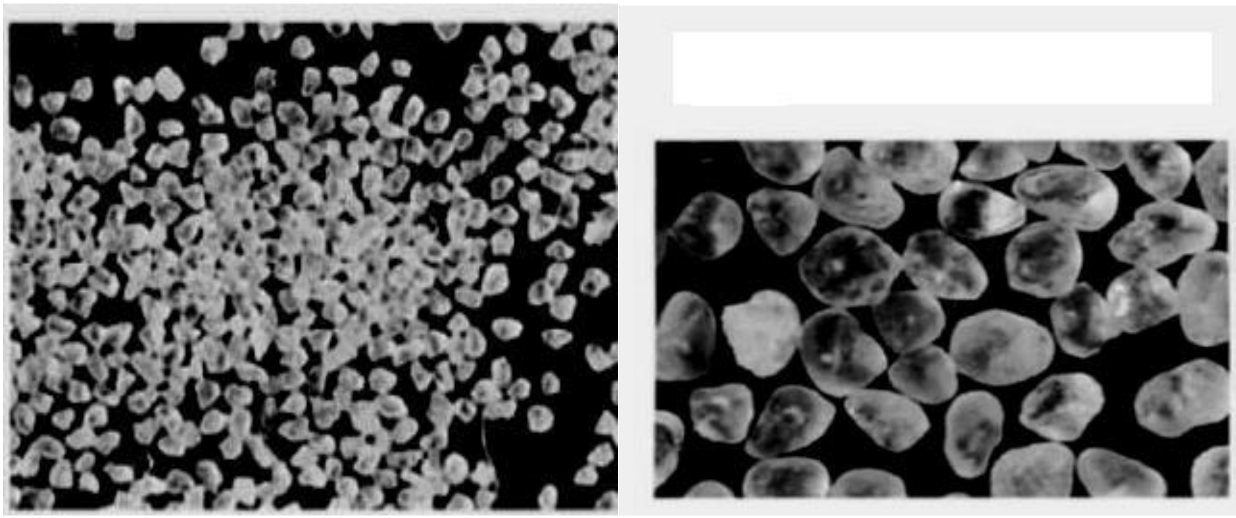
• The specific heat of olivine is similar to that of silica, but its Thermal expansion is far less. Therefore, olivine is used for Steel casting to control mold dimensions. Olivine is somewhat Less durable than silica, and it is an angular sand.

Zircon:

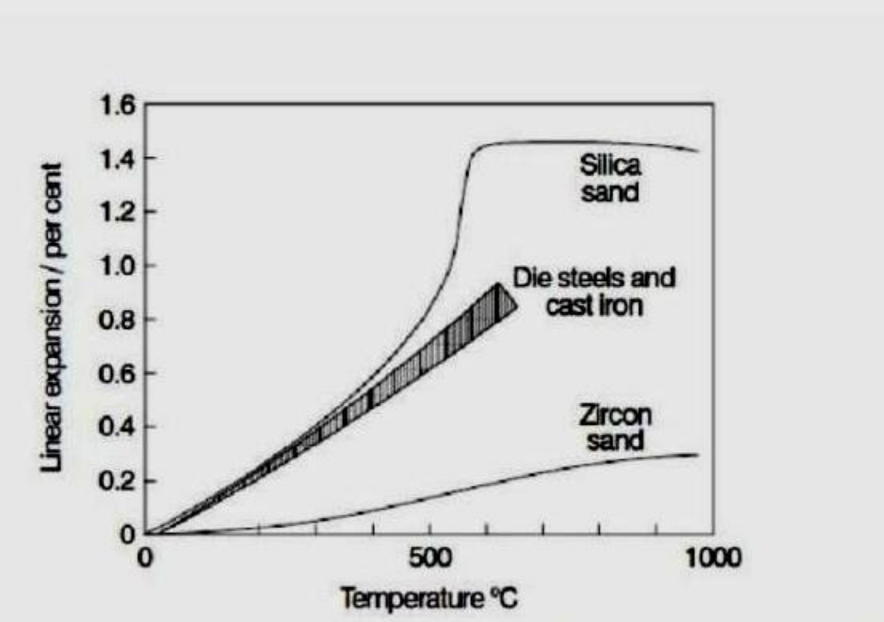
Zircon is zirconium silicate ($ZrSiO_4$). It is highly refractory and Possesses excellent foundry characteristics. It's primary advantages are a very low thermal expansion, high thermal Conductivity and bulk density (which gives it a chilling rate about four times that of quartz), and very low reactivity with Molten metal. Zircon requires less binder than other sands Because its grains are rounded. The very high dimensional And thermal stabilities exhibited by zircon are the reasons it is Widely used in steel foundries and investment foundries Making high-temperature alloy components.

Alluminiumsilicate:

Aluminum silicate (Al_2SiO_5) occurs in three common forms: kyanite, sillimanite, and andalusite. All break down at high temperatures to form mullite and silica . Therefore, aluminum silicates for foundry use are produced by calcining these minerals. Depending on the sintering cycle, the silica may be Present as cristobalite or as amorphous silica. The grains are highly angular. These materials have high refractoriness, low thermal expansion, and high resistance to thermal shock. They are widely used in precision investment foundries.



The Grains Particles Which Is Shown In Figure



2. PROPERTIES OF MOULDING SAND

1. Green strength: The green sand, after water has been mixed into it, must have adequate strength and plasticity for making and handling of the mold.

2. Dry strength: As a casting is poured, sand adjacent to the hot metal quickly loses its water as steam. The dry sand must have strength to resist erosion, and also the metallostatic pressure of the molten metal, or else the mold may enlarge.

3. Hot strength: After the moisture has evaporated, the sand may be required to possess strength at some elevated temperature, above 100 ^{o}C. Metallostatic pressure of the liquid-metal bearing against the mold walls may cause mold enlargement, or if the metal is still flowing, erosion, cracks, or breakage may occur unless the sand possesses adequate hot strength.

4. Permeability: Heat from the casting causes a green-sand mold to evolve a great deal of steam and other gases. The mold must be permeable, i.e. porous, to permit the gases to pass off, or the casting will contain gas holes.

5. Thermal stability: Heat from the casting causes rapid expansion of the sand surface at the mold- metal interface. The mold surface may then crack, buckle, or flake off (scab) unless the molding sand is relatively stable dimensionally under rapid heating.

6. Refractoriness: Higher pouring temperatures, such as those for ferrous alloys at 2400 to 3200 F, require greater refractoriness of the sand. Low- pouring-temperature metals, for example, aluminum, poured at 1300 F, do not require a

7. High degree of refractoriness from the sand.

The responsible for the permeability and compactness of the sand. Granular particles have higher strength but lower permeability, whereas round grains have higher strength but lower strength. To carry out these test, a sample of dry sand weighting 50 grams, free from clay is placed on the topmost sieve bearing U.S series equivalent number 6. A set of standard testing sieve having U.S Bureau of standard meshes 6,12,20,30,40,50,70,100,140,200 and 270 are mounted on the mechanical shaker. the above sample is shacked about the 15 minute. After this, weight of the sand retained on each sieve can be obtained.

To obtain grain fitness weight of the sand retained by each sieve is multiplied by 2, which gives percentage of weight retained by each sieve. These are again multiplied by the factor as below.

The A.F.S (American Foundry Men's Society) grain fitness number are

$$\frac{\text{AFS= total product}}{\text{Total sum of percentage of sand retained by different sieves}}$$

• Sand reclamation begins with the removal of tramp and foreign materials, such as core rods, metal spills, slag, and paper, and the disintegration of lumps of sand. Then organic and inorganic binders are removed by attrition (scrubbing) and/or thermal methods. Dead clay is removed as fines. The sand is then brought up to specification by the addition of new sand, clay, and other sand additives.

Sand testing:

There are regularly or periodic test are necessary to determine The quality of foundry sand. The properties of moulding sand depend upon the shape size compositions and distribution of sand grains.

The sand is either test by chemical and mechanical methods. Mostly in the field world mechanical testing are preferred. The most important test to be conducted for any sand are grain fitness, permeability and strength test.

In order to perform these test the sampling of sand is done. the sample may be taken directly from the sand mixer, conveyer and the hopper.

Grain fitness test: granular particles of various sizes and shapes provides variable interstices and hence are directly

		Sand Retained			
Sieve	Sieve Size	Weight	%Weight	Multiplier	Product
Number	(Microns)		2*Wt		4th *5th
6	3360	_	_	3	_
12	1680	_	_	5	_
20	840	_	_	1	_
30	590	_	_	20	_
40	420	0.25	0.5	30	15
50	297	0.62	1.24	40	49.6
70	149	1.18	2.36	50	118
100	105	2.22	4.44	70	310.8
140	74	7.99	15.98	100	1598
200	53	10.95	21.9	140	3066
270	_	10.5	21	200	4200
Pan		9.46	18.92	300	5676
Total		43.17	86.34		15033.4

$$\text{Grain fitness number} = \frac{\text{total product}}{\text{\%sand retained}}$$

$$= 15033.4/88.2$$

$$174.1186$$

Permeability test: - permeability test is the condition of porosity and thus is related to the passage of gaseous material through the sand. It expressed the volume of air in cubic centimeter that will pass per minute under a pressure of 10 kg/m^2 through a special of sand 1 square centimeter if cross sectional area and one centimeter in height.

There are four condition of permeability

(a). **base permeability** :- it is the permeability measured in a specimen of packed dry sharp sand.

(b). **green permeability**:- it measures in a specimen made of moist moulding sand.

(c). dry permeability :- it is the permeability measured in a specimen made of moulding sand and dried at about 100 to 110^{o}C.

(d) **Baked permeability**:- it is the permeability measured in a specimen made of sand with thermo setting binders and baked at some temp above 106^{o}C.

Permeability test is conducted with a specimen usually of 20 to 26 cm^2 cross sectional area and 5.08 cm height, placed in a instrument cup, which provides a mercury seal, specimen under controlled conditions.

International Journal of Mechanical and Industrial Technology ISSN 2348-7593 (Online)
Vol. 5, Issue 1, pp: (1-6), Month: April - September 2017, Available at: www.researchpublish.com

Permeability number p can be found mathematically by formula given below:

$$P = \frac{v.h}{p.a.t}$$

P= permeability number to be determined.

V = volume of air passing through the specimen in cm^2 h = height of the specimen in cm

p = pressure in air

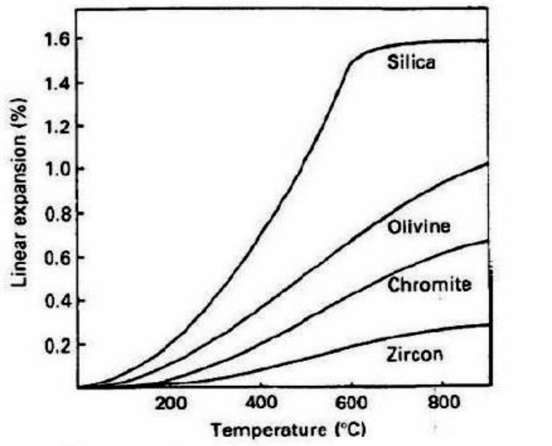
a = cross sectional area

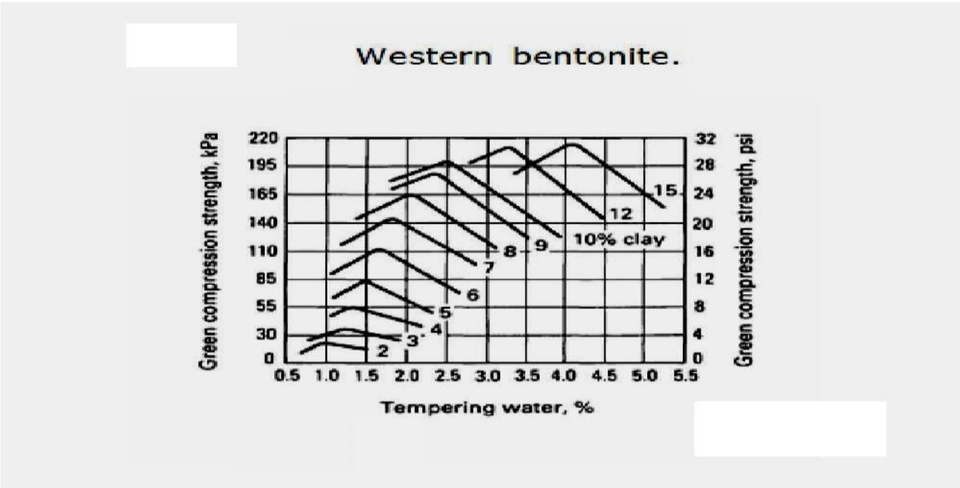
t = time for air to pass in minute.

$$P = \frac{200*50.2*60}{10*20*25} = 120.48$$

Range for green permeability

S.No	Type Of Sand		Perm. No.
			Less Than
1	Loam		5
2	Moulding Mixture For Cast Iron		0-80
3	Moulding Mixture For Bronze		35
4	Moulding Mixture For Aluminum		20-40
5	Dry Sand For Steel		60-100
6	Green Sand For Steel		150-300





Calculation of average grain size

The adoption of the ISO metric sieves means that the old AFS grain fineness number can no longer be calculated. Instead, the average grain size, expressed as micrometres (μm) is now used. This is determined as follows:

1 Weigh a 100 g sample of dry sand.
2 Place the sample into the top sieve of a nest of ISO sieves on a vibrator. Vibrate for 15 minutes.
3 Remove the sieves and, beginning with the top sieve, weigh the quantity of sand remaining on each sieve.
4 Calculate the percentage of the sample weight retained on each sieve, and arrange in a column as shown in the example.
5 Multiply the percentage retained by the appropriate multiplier and add the products.
6 Divide by the total of the percentages retained to give the average grain size.

Example

ISO aperture (μm)	*Percentage retained*	*Multiplier*	*Product*
≥710	trace	1180	0
500	0.3	600	180
355	1.9	425	808
250	17.2	300	5160
212	25.3	212	5364
180	16.7	212	3540
150	19.2	150	2880
125	10.6	150	1590
90	6.5	106	689
63	1.4	75	105
≤63	0.5	38	19
Total	99.6	–	20 335

Average grain size = 20 335/99.6
= 204 μm

3. ANALYSIS

By the help of permeability we conclude the permeability number through which we decide that what type of sand are required for the manufacturing of mould. These are very essential test required for the determination of which type of material required for the making of mould. Here height influences the material and area of cross section also alter the property of the material and influences its strength.

REFERENCES

[1] M. Liewald, T. Schiemann, Cmletzko forging proces,(2)material science op khanna,(3)production technology (r.k jain)