**Principles of Casting Technology**
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**Lecture - 36**
**Fettling of Castings**
**Shaking and Cleaning Methods**

Welcome to the lecture on Fettling of Castings. So, in this chapter we will discuss about the shaking processes and cleaning methods of the cast product.

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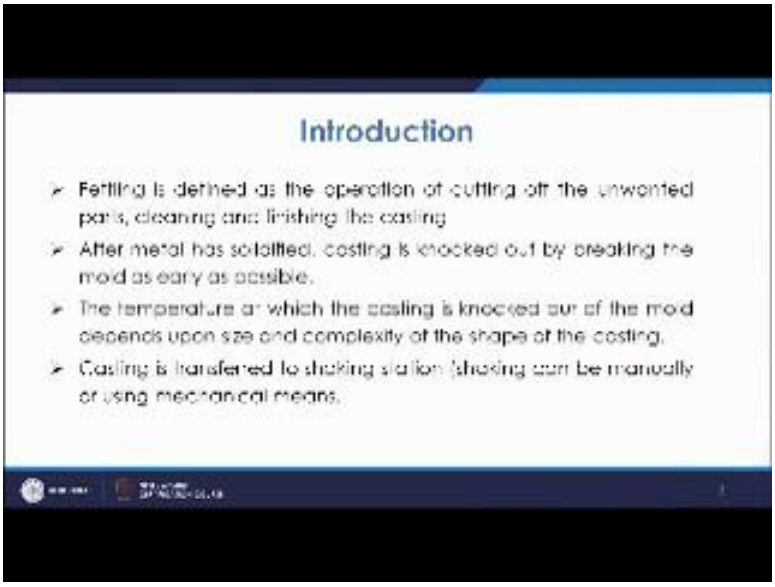


So, what is fettling? Fettling is defined as the operation of cutting of the unwanted parts cleaning and finishing the casting. So, basically when we are making the casting in a sand mould, then we know that at the sand metal interface there are reaction products, also you have the unwanted portions with the casting product. So, these are like the gates, the runners, the risers or the course all these parts are to be removed, once you ensure that casting has solidified and also because of the reaction products and the sand burn on the casting surface, the surface of the casting is not as a smooth as we want. So, basically you need to remove the upper layer and you need to get a proper finish of the casting surface.

So, you have many methods to be done and this all process is known as fettling process which is essential when we go for sand casting, we also go for other castings like permanent mould castings. But there we may not need many of the processes in then because the surface finish may be when better, you may have or may not have the screws and runners with them that depend upon what kind of casting process has been used. So, once metal has solidified, the casting will be knocked out by breaking the mould as early as possible; so breaking the mould in the sense that we assume that the mould is made of sand. Sand mould has to be broken because it is used only once so we are breaking that and taking the mould out.

Now, the temperature at which the casting is knocked out of the mould this is not out of the mould, it will depend upon the size and complexity of the shape of casting. So, basically when we have a plane shaped casting larger size and there is not much of complexity, it may vary from 900 to 1000 degree centigrade for ferrous castings, but then when the intricacies increase and the section thickness also decreases, in those cases these temperatures are basically varying they decrease. So, maybe from 900 or very thin wall sections very thin section cavities, it may go even low as low as maybe 300 degree centigrade. So, this temperature difference is maintained, to ensure that there is not warpage there is no distortion and there is proper certification taking place, it has there is no undesirable effect if the casting is taken out at that temperature mainly for the intricate shaped and thin section castings.

Now, casting is transferred to shaking station. So, first of all when casting is taken out you have the sand lumps by getting adhered to the surface of the casting. So first of all that is to be removed, it may be transferred to a shaking station, where it is shaken and shaken by means of either manual or by mechanical means. So, it is vibrated basically in a grate it is kept on and then it is basically vibrated may be taken out to a different place that is a shaking station and then during the vibration all the loose particles of the sand or which is adhered to the casting surface that is removed. So, this is known as the shaking process, which is removing all those sand which is attached to it.

Now, what we do is we are doing in the different stages this fettling process, so knocking out of dry sand cores. So, we have the dry sand coarse which are there to get the cavities, internal cavities or internal features they are to be removed, then you are removing the gates and risers because they are part of the casting through the (Refer Time: 05:19) up

and pouring bassinette is going and then going through the runners and gates and then riser is also fails. So, they are all the molten metal, they are to be removed.

Extraction of fins and unwanted projections at different places; so what happens while we remove these gates and risers by cutting and shearing operations, then still there are small portions or extracts or fins are there, unwanted projections are there, they are to be also removed. Cleaning and smoothening of this surface is done because the surface finish you do not get in the casting process as you should have.

Then also there is repairing of castings to fill up the glow holes or cracks, because once you get the casting it might have certain kinds of defects like glow whole or even cracks, they are basically repaired. So, that is a repairing process and we also do the straightening the warped or deformed casting. So, under the section of repairing section, that goes on for the process which has deformed or warped because of different conditions under which they have undergone. So, that is done by using the precious that is done by different kinds of treatments like welding or other treatment that will discuss.

Now knocking of dry sand cores; so, this means you have the dry sand cores that is to be removed and that could be done by rapping or knocking with the iron bar, so you can do it using the iron bar you can do by rapping or knocking. And if it is heavier, you can use the pneumatic or hydraulic devices so if is large one you have to use those kinds of devices.

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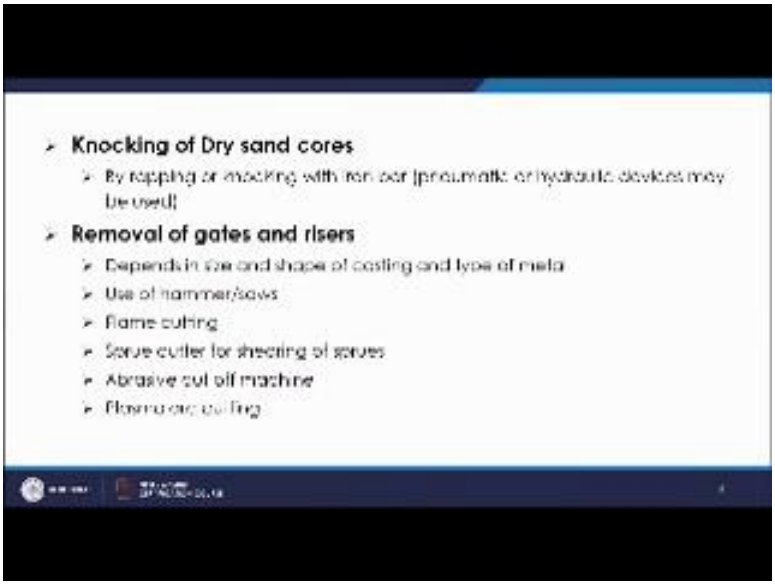

Removal of gates and risers that basically is an essential part, so the type of process which we apply depending upon the size and shape of casting and type of metals. Now the metals may be either brittle or it may be ductile. So, in case of you know brittle materials like grey iron, you can use the hammers, by using hammers you can take these gate and risers off; otherwise you can also use the saws of different type, you have the powers or bands of you have hacksaw. So, you have different kind of saws which are used to cut in that for ductile materials, you have to cut these gates and risers which are attached so you can use these hammers or saws. You can also go for flame cutting of certain gates and risers these processes also can be used, where you use the oxy acetylene type of flame and you cut these projected portions.

Sprue cutter is there which is based on the shearing action. So, you have a shearing blade, basically these sprue cutters you can use these shearing blades; on the basis of shearing, these sprues are also removed. You have also abrasive cutoff machine, using abrasive cutoff machine and using the plasma arc cutting this is also the way by which you can remove these unwanted portions to do the process fast.

Then the next stage is the removal of fins and unwanted projections. So, this process is known as snagging, because you still have the fins and small projections which are still left. So, they are removed using the grinders like different kinds of grinders (Refer Time: 09:31) to grind grinders are there means grinders are there. So, using those grinders you remove these small fins or small projections, which are unwanted you can remove using those grinding machines.

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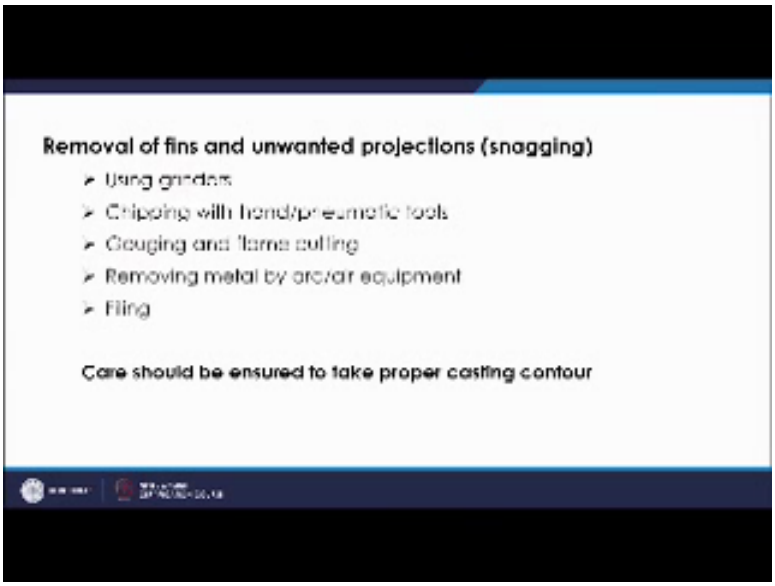


You can also use the pneumatic or hand tools and with chipping process you can remove slowly these unwanted portions or the fins.

Gouging and flame cutting is another method, removing metal by arc or air equipments, in that case also using the arc and using the glowing methods by glowing once you put the arc and blow with air, then the extra unwanted portions will be swept away and in that case you can get the finished or cleaned surface. Filing is another method by which you can get the surface finished. So, these are the different methods while for removing the fins and unwanted effects.

You have to take proper care because it is the kind of finishing process, so you have to see that you do not do mistake because of which the final contour is somewhat distorted. So, because that is the final stages where if you do the grinding mould then indirectly it will undersized. So, that may be against the specification limits so you have to be careful about it. Cleaning and smoothening of the casting; now for cleaning you have the processes like tumbling. So, when the tumbling basically you have a tumbling jar, basically or tumbling vessel is there.

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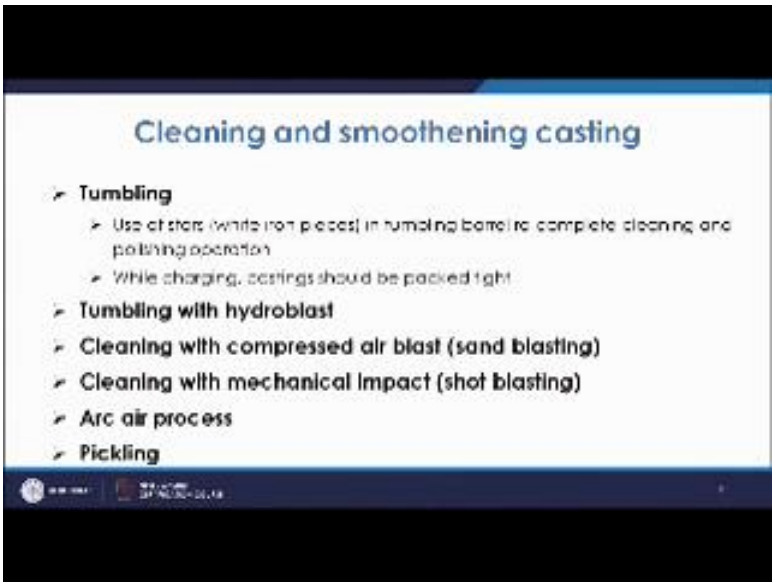


So, that what you use is you are use stars or white iron pieces in the tumbling barrel. So, what is there in that vessel or in that chamber a tumbling chamber is there, in that you pack up these castings. So, that they are in a packed state they are not basically colliding with each other, but in that you are using these white iron pieces and then you are basically rotating. So, in that case you ensure that there is the collision of these white iron pieces, which are basically very brittle or which are very extremely hard. So, they will collide with these pieces and they will make the surface quite finished that is known as tumbling.

So, you have to be careful in that case that care has to be taken that casting should be packed tight; if the castings are not packed tight in that case the castings may in fact be colliding with each other and in that case there may be damage to the parts or projections of the castings. So, that will basically be detrimental. So, in that case you have to first of all ensure that in the chamber this castings are properly placed and then the operation is carried out with the white iron pieces, so that you have proper cleaning.

Tumbling with hydroblast; so in this basically you use the water also, tumbling also going on along with you also use the water, so that the cleaning process is even better. So, in that case normally it is done for non ferrous materials, because for ferrous materials the presence of hydrogen is not very much preferred. So, you go for the non ferrous materials you do. You have also to be taking taking care that the fragile items or

fragile castings should not be put with the heavy items, so that there is damage to the fragile castings.

Cleaning with compressed air blast that is known as sandblasting; in this case you have the chamber in that what you do is you are using the sand, this sand is basically thrown in at a very high speed on the casting surface. So, what happens that because of this sand being thrown at such high speed, this will remove the undue projections and the compressed air is there so at a very high pressure this sand will go and interact with the casting surface it will remove the undue projections on the casting surface.

Cleaning with mechanical impact that is shot blasting; in this case iron shots are used to basically clean the surface. So, in this case what is happening you have equipment, where you use the centrifugal force in that case you have the impellers are there. So, they are designed and then you have the iron shot which is given and is rotated. So, you have the outlets through which these shots go at very high speed and they strike the casting surface and wherever you have undue projections and fins they are removed. So, that is known as shot blasting because you are using the shots or these process, you also use the arc air process because in this case again you have the arc and then you also blow the air over it so that under that blow the surface is cleaned.

Pickling; pickling is the process of cleaning the material with the use of acid. So, it is dipped in the acid and then this process is carried out, the acid normally is hydrofluoric acid at sulphuric acid. So, initially it will be dipped into it for sometime then again taken out cleaned then further it is kept in a neutralizing type of acid I mean solution that is somewhat alkaline and then further it is finally, cleaned with water and used. So, this is basically chemical cleaning that is known as pickling. So, these are the methods of cleaning and smoothening the castings.

Castings which we are taken out need repair in many cases, when we take the casting out there may be formation of cracks, there may be blow holes, in many cases these castings are also warped or deformed because of the difference section thicknesses at different places, different kinds of under cooling, under whose subjection the parts become deformed or they lose their shape. So, you need to repair it. If it is not repaired in that case it has to be rejected. So, either you have to reject it if you feel that with very small

kind of treatment, small level of treatment; if the casting can be put in at in its proper form then you go for repairing the castings.

So, for repairing there are many methods, the methods are like use of the welding process. So, as we know there are different kinds of welding processes which are used for repairing the casting.

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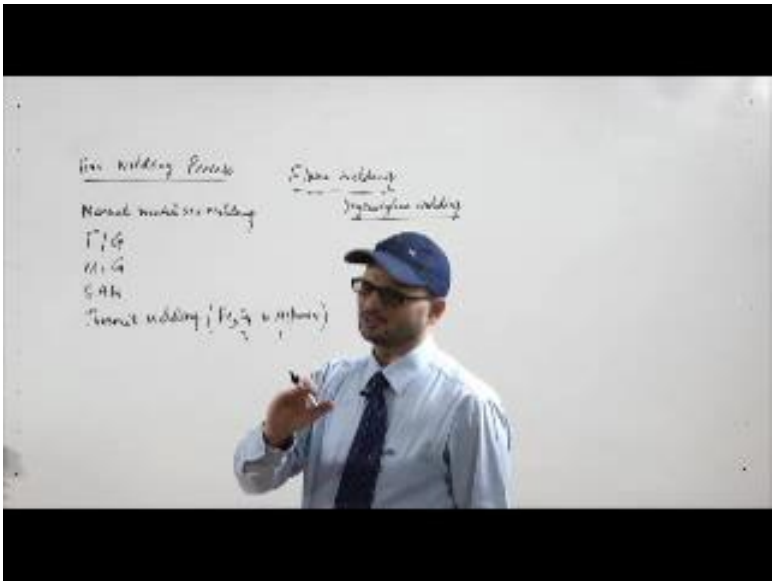

So, if you look at the kinds of welding processes, it will be first of all the arc welding process, you have flame welding process and then you have different kinds of special kind of welding processes. So in the arc welding, suppose you have metal arc welding, manual metal arc welding; now in these cases what you do is, you can do the repair by using the different kinds of welding processes depending upon the kind of job. And also the kind of material which is welded like you do not try to use these processes otherwise for metals like magnesium, like you have flame welding you cannot go for the flame welding correction I mean correction by flame welding for the materials like magnesium.

Now, in the arc welding process, you will have different kinds of processes like you have the manual metal arc welding. So, basically what happens is sometimes very small parts also break from the castings, only because of that small part if they need to be rejected and if it is possible to join them, then you when go for joining. So, you can use the metal arc welding where the welding is carried out with the arc I mean with the electrode which produces the arc and with the help of arc, this repairing work can be done. So,

basically on the surface you can do certain repair jobs, using this manual metal arc welding mostly for ferrous materials.

Now, in these cases normally it is seen that the electrode is having the coating of flux and the composition of the electrode is the same as that of the casting. So, this is the precaution which is to be taken care of. Manual metal arc will be done for most of the materials, if the electrode of proper composition is selected. So, in that case you can also go for the inert gases based welding, in that case you can go for suppose tungsten inert gas welding where you use the non consumable type of electrodes. So, you use the these electrodes only to produce the arc and then you have a filler wire of the same composition which is going out and the inert gas is maintained by the use of certain inert gases like argon or nitrogen or carbon monoxide. So, these are the gases which are used for producing the inert environment in the furnace.

So, then this is used for most of the metals and mostly it is very useful when we do the repairing of castings like aluminum and even for many metals it is used this tungsten inert gas; you have the mig also, where in the mig also you use the inert gas but here you have the consumable electrodes. So, that is consumable electrodes will be there and you have the inert gas of supply. So, your inert environment is maintained and that ensures that you have no reaction product, no contamination of the welded specimen or the place where you are doing the repairing due to welding.

You can use the submerged arc welding, where basically the arc is there in the pool of granular flux, that is how the contamination of the weld pool is avoided because the arc is basically there inside the granular flux and that basically protects from any kind of contamination or any kind of defect which is going on, which is likely to com. You have many other welding processes which are basically used for this repair like you have use of Thermit welding. So, in the case of Thermit welding, this is basically based on the reaction product of reaction which is a very high exothermic reaction between the Fe3O 4 and aluminum pie powder. So, when these mixtures of Fe3O4 and aluminum powder they are mixed. So, Al powder when they are mixed in certain ratio and when it is ignited then basically large amount of heat is generated and basically that this reaction gives you iron plus aluminum oxide. So, this iron is also coming out and in this case you can do the welding of ferrous components. So, because of this exothermic reaction, this welding takes place.

You have also reactions like I mean welding processes like automatic hydrogen welding or even different kinds of welding processes which are used to repair the castings. Now under the flame welding as we know you have the oxy acetylene welding, normally it is welding process is used where you have a gun which produces the flames and there is combustion of the oxy I mean acetylene gas with the oxygen and that produces different kinds of flames, mostly you have three kinds of flames that is oxidizing reducing and neutral type of flame. So, this flame basically does the repair of the casting mostly it will do the pro process of flop suppose you have to do the dam I mean there is damage on the surface like surface cracks are there or blow holes are there, in those cases you go.

So, what is advantage in the case of these frame process fame welding process is that, you have the provision of pre heating or post hold heating that component. So, many a times by properly selecting the kind of operation like you have backhand welding or forehand welding processes, you can see that the part which is repaired that may be either post heat treated or pre heat treated, there we pre heating or post heating of the part, so that the stresses which are likely to be generated undue stresses that maybe removed. So, this way this flame weldings are carried out.

Then using resins impregnation; basically what happens when they you have pores inside in those cases this resins impregnation is the one method. So, in this case you have used these resins to impregnate the material. So, these resins are basically forced and they are basically intended to fill the pores if they are there inside the casting under vacuum, you also use epoxy fillers where you have plastic based epoxies are there. So, these are also used and sometimes you also use the metal powders with these plastic powders to do the repair on the surface of the casting if there are any kind of discontinuation small cracks are there or somewhere some cut is there in those cases you can also use them.

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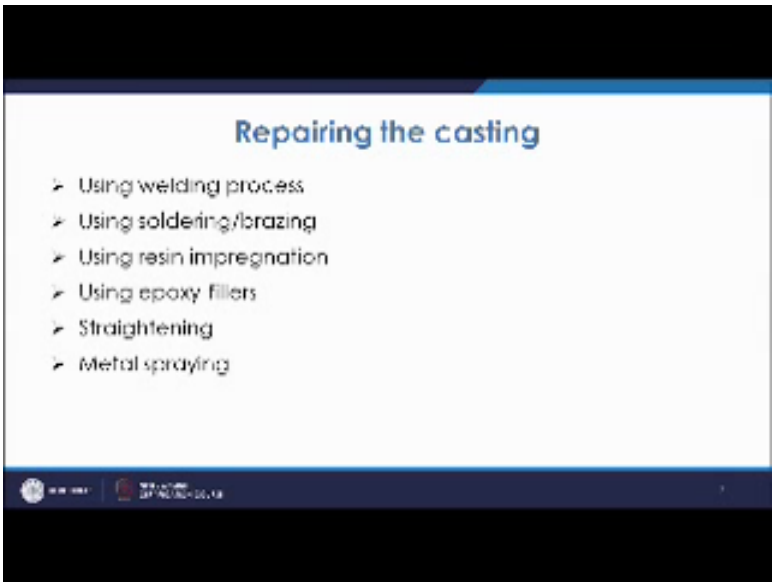


Then the straightening can be done if the metal has deformed and it has lost its shape because of many reasons, then this straightening can be done with the presses. So, either you are with manual or with the hydraulic presses or with mechanical presses, I mean it will be either mechanical or hydraulic. So, you have different kinds of presses you can apply the pressure and you can straighten the material is straight portions can be straightened if it is deformed.

Then metal spraying. So, metal spraying is also another very common method when the job is basically under sized and there is not proper you know dimension, some thickness is still required in that case. The metal spraying is another alternative, where basically metallic powder will be sprayed so, it will be basically it will be gunned then you use the compressed air so that the metal is basically atomized and then it is going on and striking the surface on the contour and you get the proper dimension of the product. So, this way you can achieve the proper dimension of the basically casting product.

So, these are the repairing methods you have the strating and also spraying methods by which you ensure that you get the finished products of desired specifications.

Thank you.