Welding Processes
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Joining Processes for Plastic Part 2

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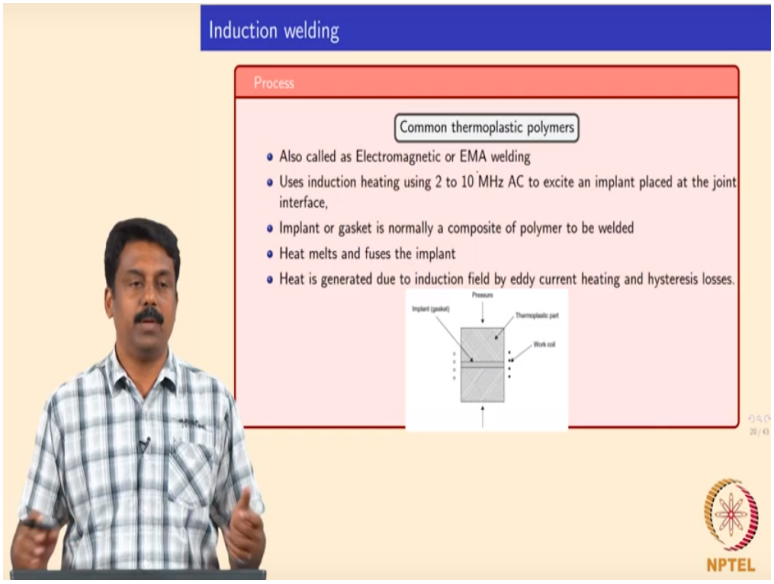

So then the next welding process quickly move on is the induction welding, so induction welding is commonly also used to achieve very high joint efficiency, so generally I mean induction welding how do you use because induction welding when you are using polymers they are not conductive right so how do you use of induction principle, so we add as small in plant so conductive material generally polymers dope with metro particles or some fibers are alloys, so the implants are placed inside the joints to be made and then you apply electromagnetic inductions process, so the implants heat up and built during this process the interface also melts subsequently you do an upset.

So that is why it is also known as an electromagnetic welding or EMA welding, so it is going to be use in very high frequency is AC current automatic current to excite the implant which you placed at the joint, so without implants it is not possible to do that because it can heat up and polymer is using induction principle okay hi is unless he is conducting polymer, so the generally implants are made of the composite the polymer metal, the polymer is the similar polymer what you want a welt and then you add some conductive metal particles or most commonly you also add the graphic fibers so to make it conductive on the implants heat up and melts and doing this

process and the interface also is molten from the heat actually the implant generate, so heat is generated by the induction principle.

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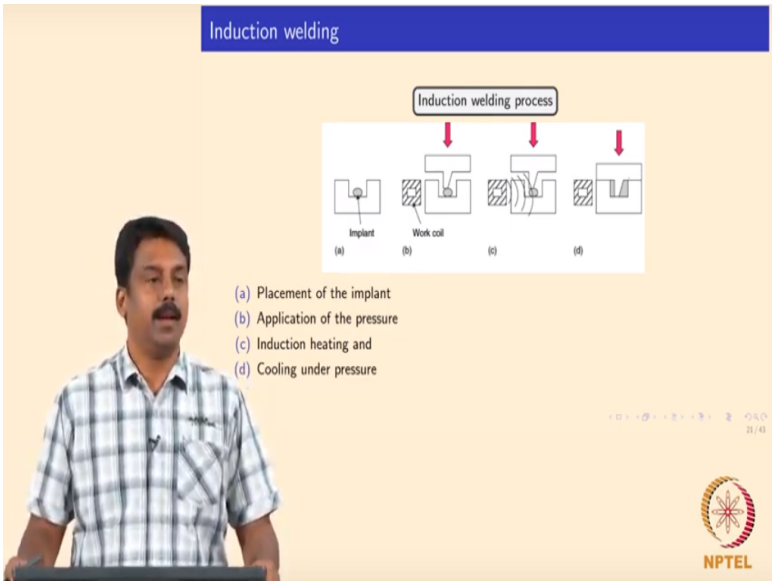

So this is an induction welding process the first to place in implant and you have work while and this two surfaces to be joint, so this is top and this is bottom implant is place and the induction coil send the electromagnetic ways and during this process we implant heats up and then you apply a down work force and then implant melts and joints center-face subsequently the implant can be solidified it is clear induction welding process.

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So these are the component we use (())(02:44) water cans, so water cans you know now a days they are all use in injection molding, so these lamps for example a holding club holders and we can also use it to know a joint polymer opt on to a metals as well, so in these case you do not need a plant a metals heats up and then polymer can be molten and then apply pressure and the they can be joint, so it is commonly used for household application plastic caps to plastic bottles even solar panels it is can be well done, so it can be uses as large irrelevant part that are injection molders then blue mounted, so blue mounting is you know like this blue mounting, so you can heat up the induction and the total part and a polymer can be blow in it to that.

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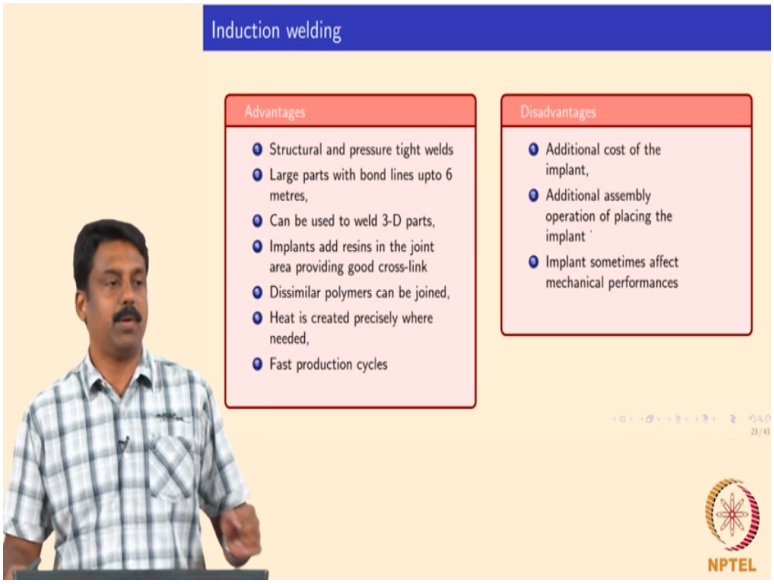

Again what are the advantages disadvantages and you will have to understand the advantages generally you can select the process, so objective of these course is to make you select a welding process for an application unless you know the advantages disadvantage you cannot decide on what process I will have to go I can use a hard pate also but it is not possible to always use the hard plate, so induction melting so if you want to make pressure light joint and these are best process, so you and also use for large bond lines up to six meters you can also use it for three dimensional parts because induction heating electromagnetic can be used.

So the implants composition can we modified to get a very good structural strength, so in simple arc plate the interface may not be good it has not good properties but here you can add extra sintering material the implant itself can increase strength of the joint and the implant can be select such a way that the joining two dissimilar material the implant can be selected which is actually compatible with both polymers, so we can heat of the exactly what he where he want.

So other advantage very precisely we can control it can be very fast production cycle and here the disorder is extra material you add in plant weight in increases, so that is the bigger disadvantage in this process so the we need to place implant that it self's is work, so in sometimes implant affect the mechanical properties if we do not choose properly so that is again disadvantage.

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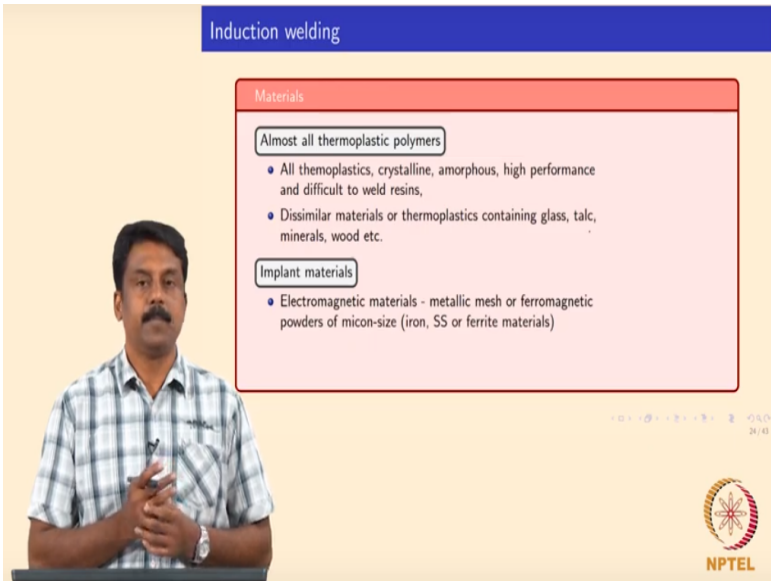

So material so almost all thermoplastic material crystalline, amorphous on high performance difficult to joint and the all can be weld resins in induction welding, so dissimilar materials or thermoplastic containing glass talc minerals wood they all can be weld in the implant material generally it is electromagnetic material generally we use as an metallic mesh ferromagnetic micro mesh is resent in to the inside the implant alright it is clear.

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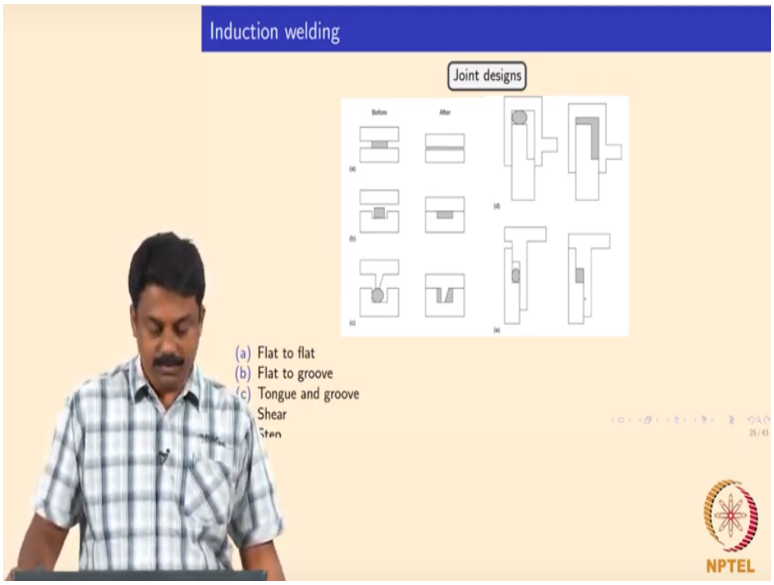

So joint designs again it can placed implant and can proceed once the moments in plant melds and then it can squeeze it make a joint, so this is before, so input flat and flat and then flat to

groove and then tongue and grove which is showed in you previous slide and the shear and step all of them are can be joint alright it is clear good.

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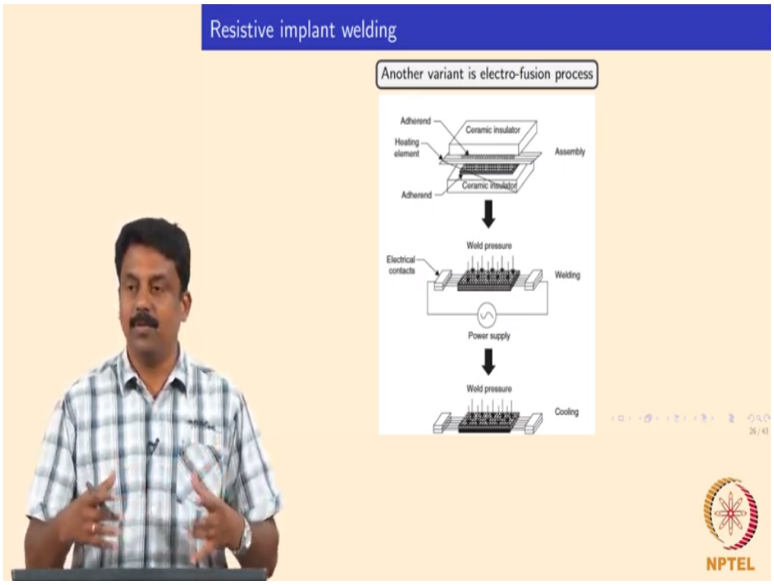

So instead of using induction we can also resist this current the same principle you are saying resistive implant welding you are heating up the implant the resistance heating so in the advantage of these process is in the implant may not be dope with material, so what we need we use an induction coil replace the implant on top of coil melt the implant and subsequently you can take the induction where out.

So for example in this case the insulator and this the pot to be joint is kept between the heating element okay and then apply pressure right and then, so you make a joint subsequently the DMAL fibers would remain the same at the joint alright, so the and these process bit complex because the heating elements you know it has to be selected such a way that it access in five brief force plastics okay, so subsequently we will have to use a consumable the vibrational becomes consumable good, so we will move on to the process and subsequently generally thermoplastic polymers we can met it that is what I said in first slide.

So these welling process are only used for them a plastics which can be heated up N number of cycle thermosetting polymers we cannot used we cannot weld only addressing that is what we will see on subsequent slice and when you are using a thermal plastic it can be heated up one molten in a number of time it is one of the thing is cooling time or cooling or heating times it can

be controlled properly, so otherwise thermo plastics they are all reversible material they do not really change in the middle properties it can heat up on cooled up any number of times.

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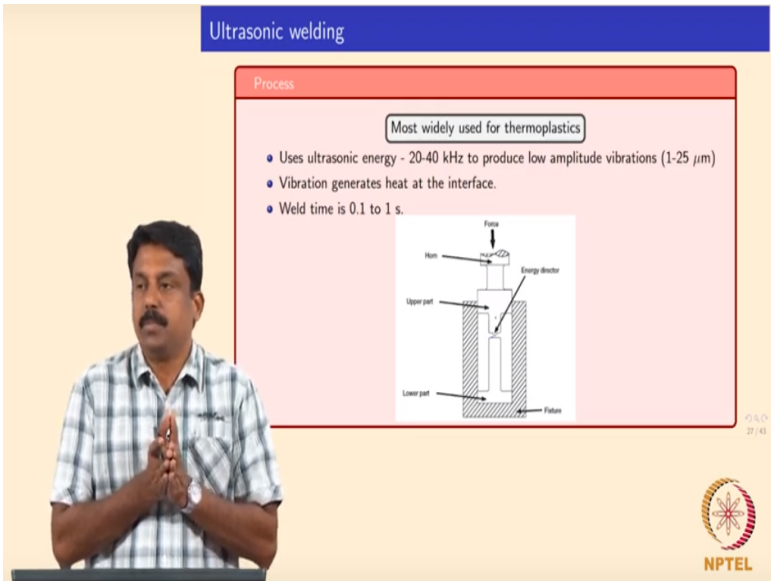

Then the ultrasonic welding so it is also very widely used for thermo plastics and the principles is exactly saying as we saw in ultrasonic welding of metals so we use a very high frequency of ultrasound 25 to 40 hz and to produce the vibrations low and vibration amplitude icons, so vibration heat on the interface right and the process can be extremely fast about very tiny amount one second less than a second and the principle is same and o you have downward force you send him a ultrasonic trans-user's at the interface, interface vibrates in a very low amplitude and it would not see but it them in micron and we use his process and we generate heat friction subsequently you apply an downward force to make a joint alright it is clear.

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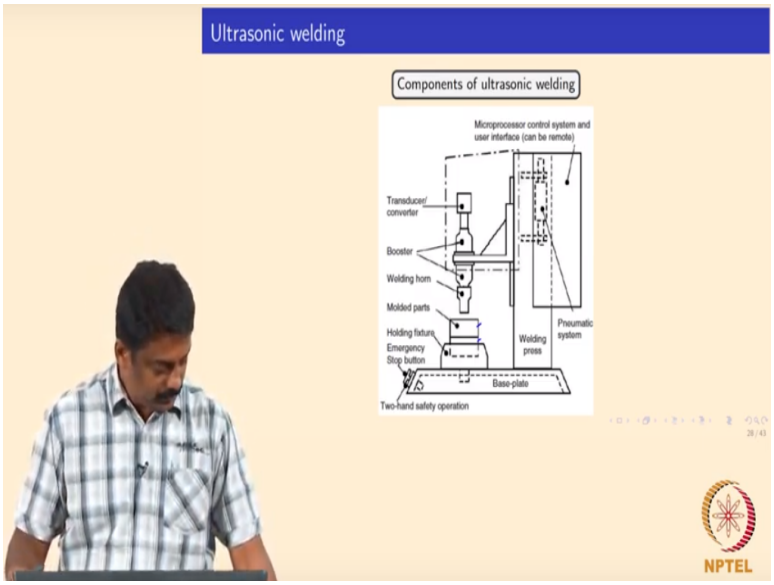

The principle if you look at it as same as you do it in a metal ultrasonic welding, so this interface to be welder so this is an ultrasonic trans-users and the wave guy and this is the best plates, so the holding fixtures and the molding parts and the welding horn and then you apply an ultrasonic vibrations and the interface and then you make a joint, so this is the top and this is bottom plates, the bottom fixture is fix and then top one is bounded to the ultrasonic trans-user waved and then you vibrate the top plate at the bottom plate the bottom plate is fixed generate heat and upon generating sufficient temperature of the interface we applied downward force and the force would make a joint it is clear which is same as we use as ultrasonic welding of so what are the so you do not need ultrasonic frequency as high as the metals here you can we can used the same frequency but the welding time can be extremely short.

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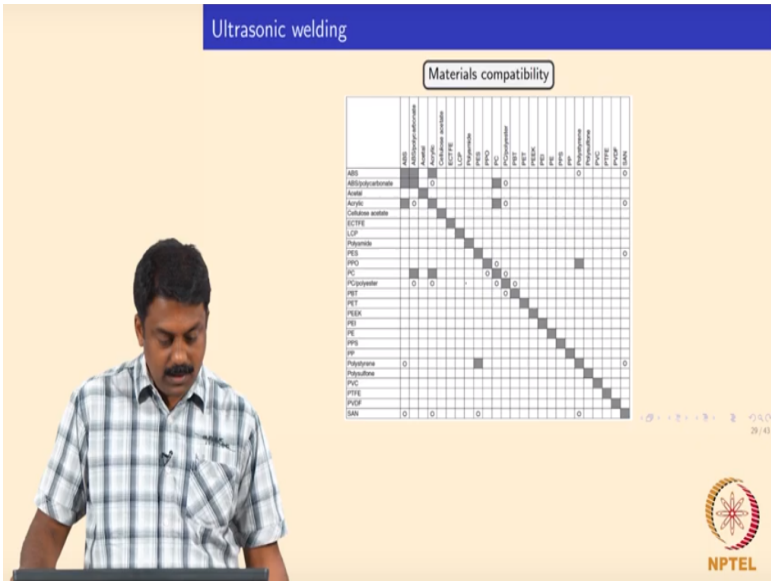

So metal compatibility I just gave this slide for you our friends the ultrasonic welding can be used for almost all the thermoceutic process polymers, you see the diagonal line so the ultrasonic welding is commonly used for thermoceutic polymers for all of them you can used down, and some polymers are listed all the commonly used in polymers you can add the refer it whenever you want good.

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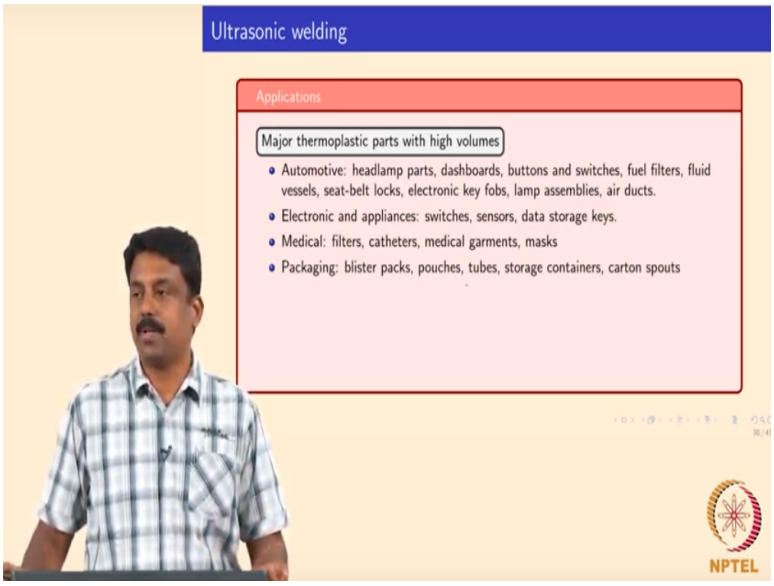

So we will move on to the application and then we will look at that as a bounding, so ultrasonic welding so what are the application automotive applications the majority of parts plastic parts

use in automotive applications there are ultrasonic welders headlamps, dashboards buttons and switches fuel filters, fluid vessels seat belt locks and electronic, key fogs, lamp assemblies air ducks and I just collected from my memory so when I go for automotive industry I look at all the welding processes so these all the part the generally the ultrasonic welders, and ultrasonic welding also used for the electrical electronic applications we also used the plastics and computer mobile phones and hard drive so hard drive case in hard drive insulators there are all ultrasonic welder or medical application

So I have just got it from a hand book filters, catheters, medical garments, marks so even a packaging so the packaging blister packs, tubes, storage containers they are all welder using ultrasonic welding , so the advantage of this process is high volumes for examples the pouches will have to make possibly a day is not it, so we will have to produces as soon as possible hard plates extremely complex we need sometimes the ultrasonic welding the welding time is less than a second in most of the cases so rapid production is possible using ultrasonic welding polymers.

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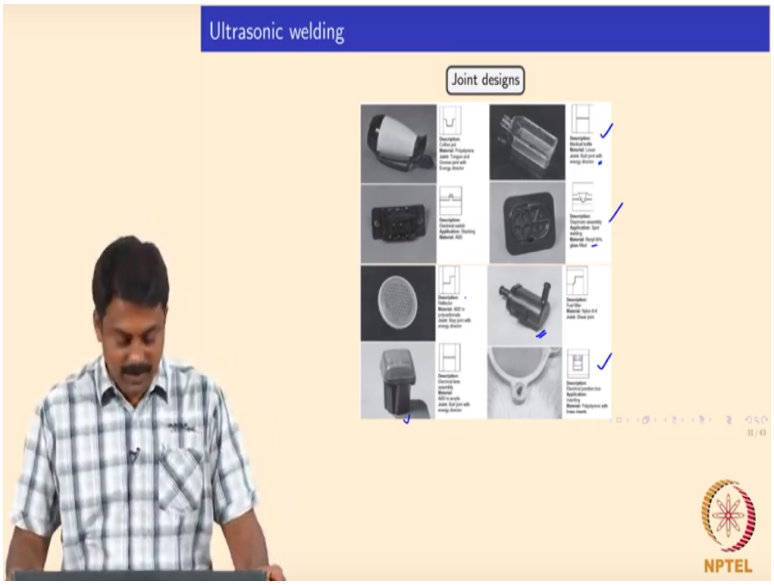

So these are some of the components commonly used coffee pot right, so the musk coffee plot the material is polyester line so town with grow join what you see over here so this is electronic switch by staking joint the reflector for a bicycle, so bicycle the fluster at the back of that so those are all to many joins so lens are some being medical bottle the air form fuel filter for

automotive fill filter electrical junction box, so junction box I do not know whether he have or not you can sealed over there, so those are all done with ultrasonic welding, so nothing it is also has some material is not is like sound and there plenty of polymers and there are use it in measuring applications good.

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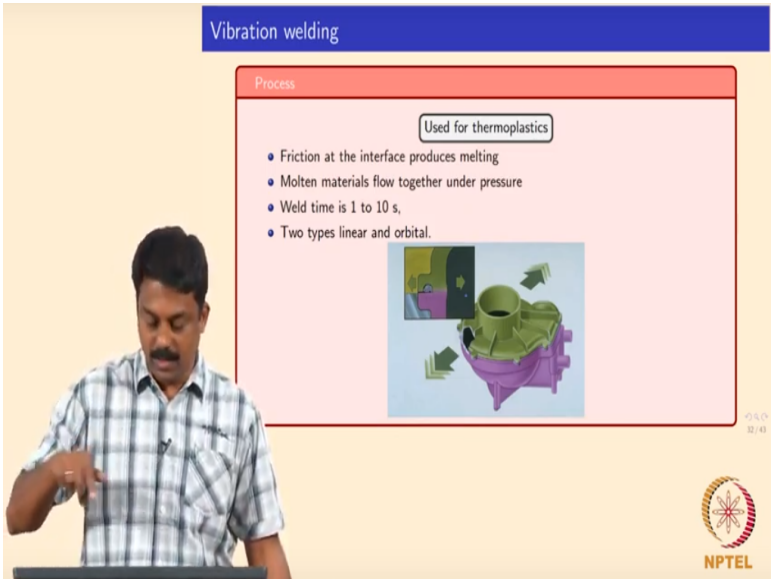

And then similar to ultrasonic welding it can also reduce the frequency increase the amplitude, so ultrasonic vibrations the amplitude are very tiny not even a more then 20 microne 24 microne but it can, so increase vibrations via amplitude reducing the frequency you will still generate heats, so this kind of the large amplitude vibrations can be applicable if you want a weld a large cross sections a bigger part the principle is same the friction and interface produces the heat subsequent a melds and then your play pressure the molten material flows any larger time than the ultrasonic welding.

Because amplitude of every one is larger and in this case the parts to be welder should have some symmetry, so otherwise you cannot joints this two process parts also you can linear or economic doing orbital in linear vibrations, so it can be like this or it must be orbital vibration the (()) (15:43) I showed you in another fixture welding or that is vibrational welding is not it so you have an analytical or linear vibrations.

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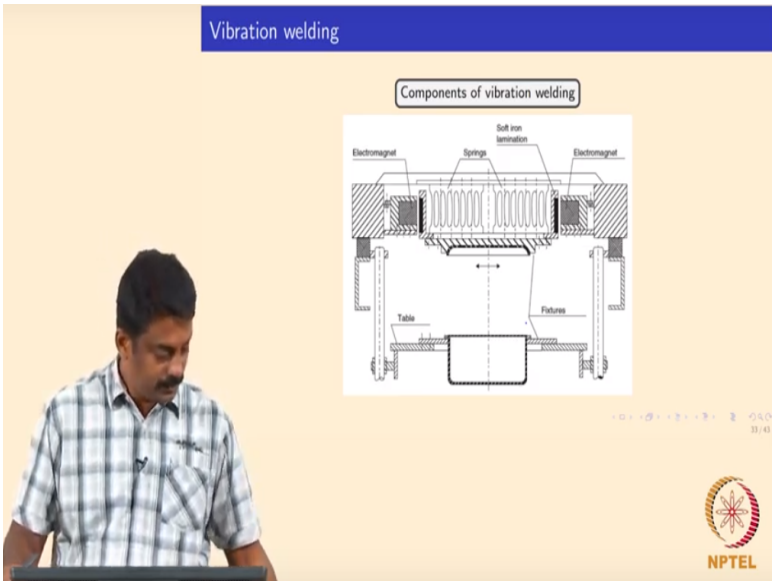

So this is a sematic so this is a container to be welder so another dimension object, so the bottom what is fixed within vicious the top is mounted with electromagnetic vibrations in it this been attached and this part goes in there and this vibrates in this case linearly a top and then subsequent I mean after appoint heating the interface then you also applied downward force and then the two parts can be joint is it clear good.

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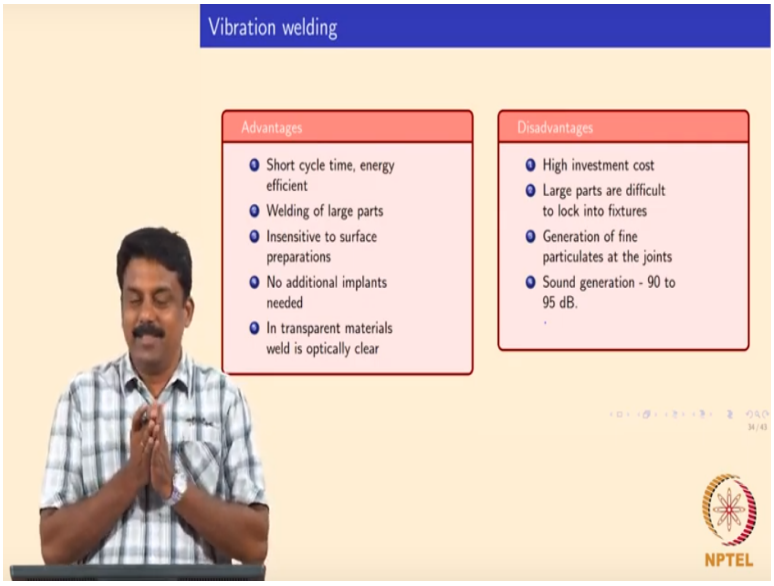

Again advantages again, so this are very important to select a welding process, so what are the advantages vibration welding it is short welding time and then the efficient make a huge a larger

parts and surface vocation we do not need to worry about it because it is going to be smoothen we do not need an extra implant like an resistance implant or a reduction implant welding in transparent material weld is clear optical is clear it is also very important so if you have a well seen which is opaque and if you are making and an container it would be transparent then then your product appearance goes down, but it has an high investment cost because you need to developed the fixes and then trans-uses the clamping mechanism.

So the larger parts very difficult to lock, so this process is also very dirty because it is produces a lot of very tiny particles during vibrations and it also very noisy as well , so 90 to 95 decibel and it is very noisy extremely noisy, so what is the noisy level of sound and rock show there was a lot of debates, about the noise level of Saarang rock show last year we mess it during at 2018 January I mean this his January it is 90 to 90 decibel, so it is very-very loud, so the sound generation it can be noisy I personally idea like a the surface rubs I feel goose-bumps or can I cannot rhetoric the face even a friction welding I do not look it I just have goose-bumps somehow I do not know and it can also be noisy extremely noisy good.

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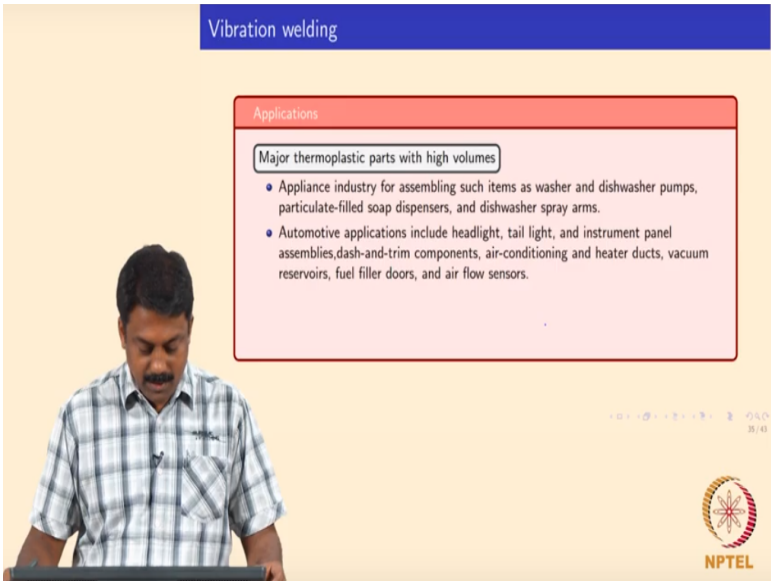

So what are the applications of these, so the high volumes so mainly appliance industry like for example for water bottles washer and dishwasher pumps soap dispensers dishwasher spray arms for example, so (())(19:09) is not very rarely used yeah either vibrations welding or ultrasonic

welding instrument panels components, air-conditioning, heater ducts, vacuum reservoirs air flow sensors etcetera good.

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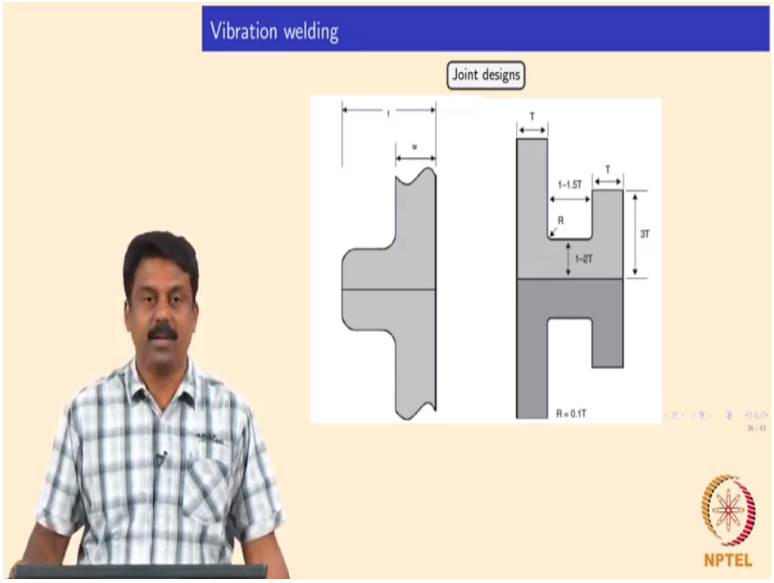

So joint design so the symmetry should be maintained so to otherwise you dissipation can be very tricky in vibrational welding.