Welding Engineering
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Module - 1
Introduction
Lecture - 5
Protection of Weld Pool

So, in the earlier presentation we have seen that the due to the high reactivity of the molten metal in the weld pool, it reacts with the gasses, atmospheric gases and if contaminates the weld metal which in turn adversely effects the mechanical properties of the weld joint. And therefore to therefore, it becomes a important to protect the weld pool using the different approaches.

In each approach, in each welding process a particular type of approach is used, which includes like the shielding the weld pool with the inactive gases like in shielded metal arc welding process or using the jet of the inert gas or active gases, like in metal of inert gas or tungsten inert gas welding processes or use of the molten flux like in some as arc welding process and electro slag welding process. Today, in representation first we will see the various factors that affect the effectiveness of the shielding of the weld pool, associated with particular approach, and then we will the next module based on the physics of arc welding. So here, we will go like in.

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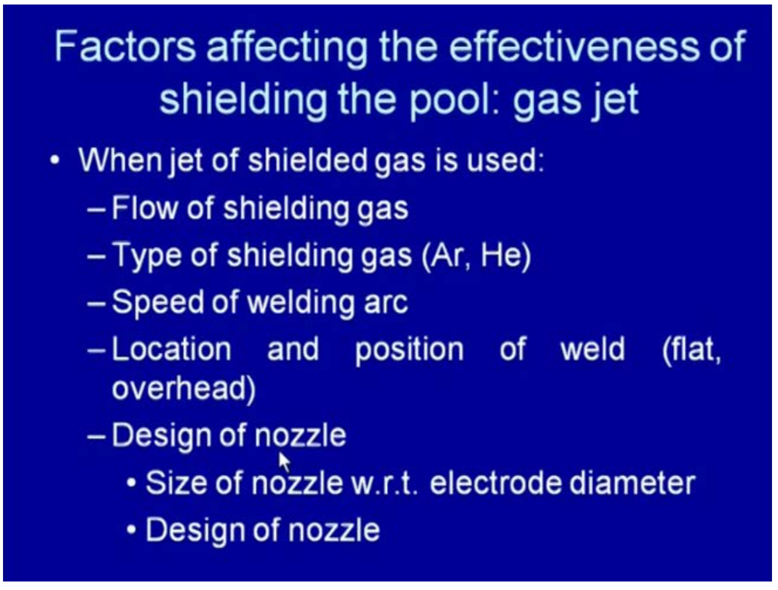

As I said there is one of the approaches which are used to protect the weld pool from the contamination of the atmospheric gases is the use of the shielding gas jet. When the jet is used the various factors associated with the, this approach which effect the protection being provided to the weld pool includes like flow of the shielding gas. The limited flow of the shielding gas make, be insufficient to cover the weld pool from the cover and protect the weld pool from the atmospheric contamination. That is why the flow rate should be sufficient, so that a proper jet can be formed around the arc and the weld pool can be protected effectively, so as to avoid the atmospheric contamination, so as to avoid the contamination of the weld pool from the atmospheric gases.

However, excessive flow rate can increase the cost associated with the shielding gases. The type of the shielding gases are also effects the effectiveness of the this approach significantly like the use of the helium protects the weld pool very effectively. But, being of the lower density it tends to move up from the arc region and therefore, the it sometimes if the flow rate is limited then it can allow the entry of atmospheric gases in the arc zone and in turn can lead to the contamination of the weld pool.

While the argon when argon is used it also provides the effective shielding to the weld pool but at the same time it is heavier also, so once the jet of a the argon gas is used and it forms very effective blanket all around the molten weld pool and the arc is so effectively provides shielding to the weld pool. However, there is a great difference in the cost of a the shielding gas a helium and argon. Helium is normally used for the welding of the critical joints in arrow space and the nuclear reactor and for most of the commercial applications, fabrication like in preserve vessels argon a commonly used.

The speed of the welding arc and when this approach is used also effects the protection to the weld pool a higher speed may allow the entry of the atmospheric gases into the arc region. And the weld pool may come across and may come in contact with the atmospheric gases which can lead to the contamination of the arc. So, the slow welding speed will be forming effective cover all around the arc under the weld pools, so it will provide the very effective shielding where while the high too high welding speed can lead to the contamination of the weld pool by the atmospheric gases. Similarly, the location and the position of the weld also affect the effectiveness of the shielding of weld pool by use of the gas jet. For example, in the down hand near the flat welding position the use of the argon effectively for provides the shielding.

While in case of the helium, in case of the overhead welding the use of the helium hence to provide the effective shielding, when the helium is used in case of the down head welding position or in flat welding horizontal welding positions then it tends to move up during the welding and reduces the effectiveness of the shielding. So, in overhead welding the helium effectively provides the shielding.

So, these are various factors associated with this approach to the shielding to the weld pool which can affect the effectiveness and protection to the weld pool. The another factor associated with the design of the nozzle being used for shielding design of the nozzle being used to, for provide jet of the gases which will be forming a cover all around them arc region to protect it from the atmospheric contamination.

Size of the nozzle with respect to the electrode diameter if there is a gap between that two if then the size of the nozzle and in the electrode diameter the difference between the two is less then it will form very sharp and high speed jet. But, the very small difference can lead to the turbulence in the jet and which can increase the atmospheric contamination.

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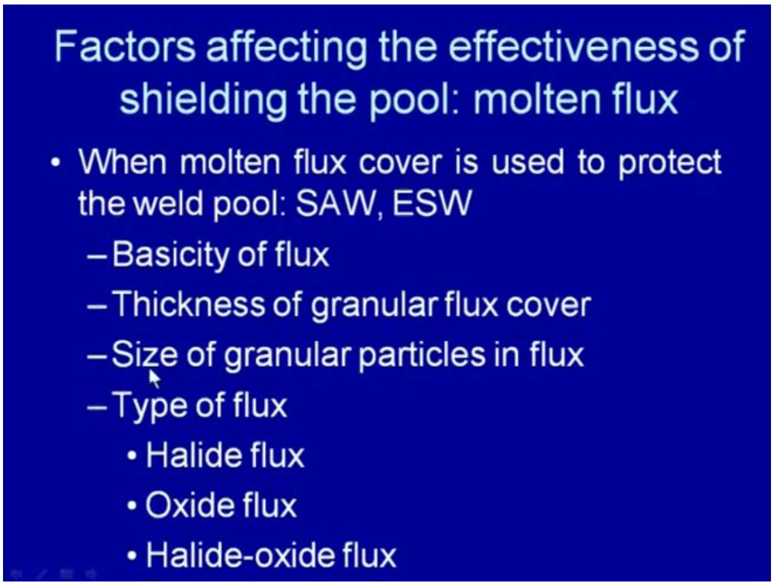

While the too large difference between the size of the nozzle and electrode diameter also can form the jet which will not be having a good speed enough to form a coherent jet to provide effective shielding around them a weld pool. And similarly, did the design of the nozzle also plays a important role in forming the effective shielding around them a weld pool. So, here these are the factors that affect the effectiveness of this shielding the weld pool using the jet of a either inactive gas or the inert gases. We will see the other factors associated with the molten flux approach for protecting the weld pool. The factors that affect the effectiveness of the method being used for protecting the...

Weld pool using molten flux these in this approach is used in the some as dark welding process and at the electro a slag welding process. And the factors associated without these are like basicity of the flux in general the basicity greater than one has to reduce oxygen content and the sulphur content in the weld metal. It is always considered to have basicity around 1.2 to 1.4, otherwise the low while the lower basicity flux is increase the oxygen presence in the weld pool.

The thickness of the granular flux cover around arc is also important though the very thin layer of the granular flux around the arc provides insufficient shielding from the atmospheric contamination that is why there should be sufficient thickness of the granular flux around the welding arc. So, that proper protection to the weld pool can be provided from the atmospheric contamination. Size and the size of the granular particles being used in the flus also effects the effectiveness of this method. With the final particles will get decompose and melt easily and will form the effective shielding, but these will decompose also at the faster rate while the course granular of particles will not be decomposing earlier, but they will take longer time to come to the molten state.

So, depending upon their ability to withstand under the thermal stability under the ability to get decompose at a high temperature. And these factors are influenced by the size of the granular particles and accordingly they effect the protection to the weld pool. Again the type of the flux being used for protecting the weld pool in these processes like some as dark welding process and electro slag welding process.

The three types of the fluxes which are commonly used commercially for protecting the weld pool these are the halide fluxes, oxide fluxed and the halide and oxide fluxes. Halide fluxes are used for very critical applications where the effective shielding is required and as a very and as a very clean weld is needed while the halide and oxide fluxes are used for those applications where marginal amount of the oxide can be tolerated. While for all general purpose welding where the oxide contents does not effect the success of the weld joint in the applications.

So, we can see that there ways factors which effect the effectiveness of the shielding to the weld pool when the molten flux approach is used. And these include the basicity of the flux thickness of the granular flux cover size of the granular particles and they type of flux being used. Now we will see that how the how these approaches differ from each other and how they and how much effective they are when the weld joints are made in protecting the weld pool.

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If you see that effectiveness of the each method for the weld pool is different, because they have the basic principle and the factors associated with each the protection approach is different. And that is why the atmospheric contamination in the weld pool developed by the different arc welding processes is different. And because of the difference in the approach being used by each of the arc welding process is different. That is why the arc contaminations are of the weld pool becomes different we can see this comparison in this diagram where.

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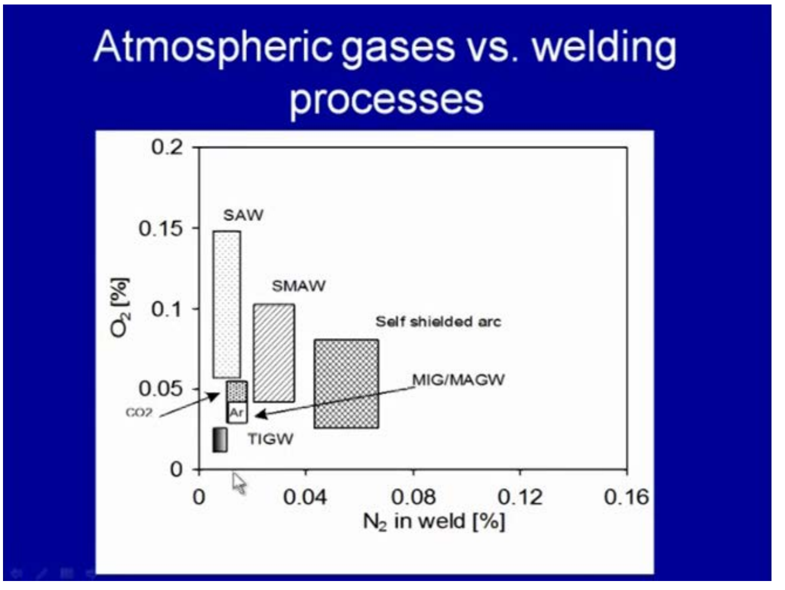

We are starting with the this is the band for, band for the weld joint developed by the tig welding process here in the x axis we have the nitrogen percentage in the weld pool and in the y axis we have a oxygen percentage in the weld pool. And how this per these percentages varied when the different welding processes are used, we can see that the cleanness to weld is offered by the tungsten inert gas welding process. So, here when it and when the weld joint developed using the tungsten inert gas welding process because of the short arc length and very effective and use of the non consumable electrode providing a very smooth and stable arc helps to develop the weld joint having them.

And lowest percentage of the oxygen in the weld and the minimum percentage of the nitrogen in the weld in so keeping in view of this the cleanest weld is produced by the tungsten inert gas welding process. Another welding process is the gas metal or metal active gas welding process or metal inert gas welding process is depending upon the kind of shielding gas is used. If we seen here when the CO 2 gas is used carbon dioxide is used as a shielding gas we call it as metal active gas metal arc gas welding process and when argon is used we call it as a metal inert gas welding process. So, when argon is used the oxygen content in the weld pool is lower than the case when the CO 2 is used. The use of the CO 2 as a shielding gas results in the higher oxygen content in the weld metal. And this is mainly attributed to the decomposition of the carbon dioxide in the arc environment at a high temperature which in turn results in the higher content of the oxygen in the weld.

Further, the some as dark welding process results in the for the higher level of the oxygen in the weld metal and for the same or the lower percentages is of the nitrogen. So, the high percentage of the oxygen in the weld joints developed by this some as dark welding process is mainly due to the decomposition of the oxides which are there in form of the welding fluxes. If we see, the weld joints made by the shielded metal arc welding process are lower in terms of the oxygen content but higher also in in terms of the nitrogen content in the weld joint.

So, these have the moderate levels of the nitrogen and the oxygen and this higher percentage of the nitrogen as well as higher percentage of an oxygen in the weld joint then the metal inert gas or metal active gas welding processes. In tungsten inert gas welding process is attributed to the completely poor shielding of the weld pool being provided by the thermal decomposition of the fluxes around the arc.

And this poor shielding results in the easy entry of the atmospheric gases in the weld pool and which in turn increases the concentration of the oxygen and the nitrogen in the weld region. If we see the self shielded arc welding processes in case of the self shielded arc welding process the nitrogen content is significantly higher than the oxygen, and this results in the comparatively the weld joint with the poor cleanliness under the high percentage of a these oxide oxygen, and nitrogen results in the high percentage of the inclusions of the oxides and nitrides in the weld joints made by the self shielded arc welding process.

So, if we compare the different welding processes in terms of the oxygen and nitrogen content in the weld metal you can see that effectiveness of the each process to protect the weld pool from these gases is a different under the cleanliness to weld is produced by the tungsten inert gas welding process. While the self-shielded arc welding process results in the higher concentration of the oxygen under nitrogen in the weld joint.

So, the effectiveness of effectiveness of the each welding process to shield the arc and the weld pool from the atmospheric gases is not the same and it varies with the approach and the welding process being used for shielding the weld pool. So, we know that in fusion arc welding processes to develop the weld joint the heat applied on to the base metal the surface, so that the base metal can be brought to the molten state. And the base metal is heated to the high temperature it becomes very active and it starts reactions with the atmospheric gases present all around.

And therefore, it becomes important to avoid the presence of the atmospheric gases like oxygen nitrogen and hydrogen in the arc zone and near the weld pool. And therefore, production of the weld pool from the atmospheric gases become important and in the different arc welding process the different approaches are used to avoid the adverse effect of the atmospheric gases on to the weld pool.

And these approaches involve use of the inert gas or the use of the molten slag and the molten flux and the use of the controlled atmosphere like creation of the vacuum and the welding using the electron welding process. So, in the different arc welding processes a different approaches are used for protecting the weld pool from the contamination of the weld pool from the atmospheric gases.

If we see this diagram in case of the some as the arc welding process we find high concentration of the oxygen in the weld while in case of the shielded metal arc welding, we find a the higher oxygen content but somewhat lower than the S.A.W, but a greater percentage of the nitrogen. And in this self shielded arc welding processes the concentration of the nitrogen is significantly higher with the lower percentage of the oxygen.

If we talk about the gas metal inert gas welding process, then the oxygen and the nitrogen content both are found to be lower than the S.A.W, S.M.A.W and in self shielded arc welding processes. Considering this the tig tungsten inert gas welding process, this process develops the weld joint with the minimum percentage of oxygen and nitrogen. Indirectly we can say this process results in the cleanest weld because of the very low percentage of the oxygen and the nitrogen presence in the weld metal.

So, effectiveness, if we see of the different processes to protect the weld pool from the atmospheric gases is different. Some of the processes like the tig and the metal inert gas welding processes, they develop the weld joint with very low level of oxygen and nitrogen while the S.A.W, S.M.A.W and self-shielded arc welding processes, they develop the weld metal with very high concentration of the oxygen and the nitrogen. There are various factors associated with each process of which effect the, which determine the effectiveness of each process to protect the weld pool from the atmospheric gases.

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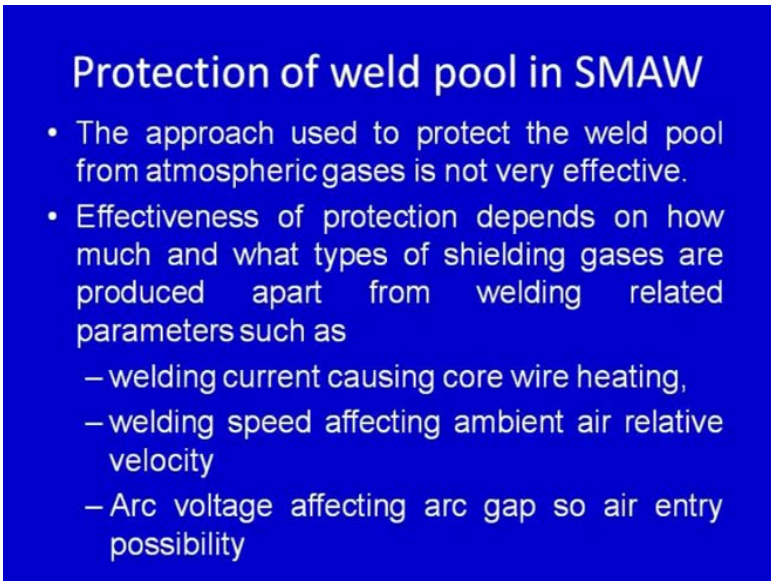

First of all we will be talking about the way by which protection is provided by the SMAW process during the welding to the weld pool. So, the approach used to protect the weld pool in SMAW process is not very effective because a very high percentage of oxygen and nitrogen is found in the weld metal when the weld joint is developed by the shielded metal arc welding process.

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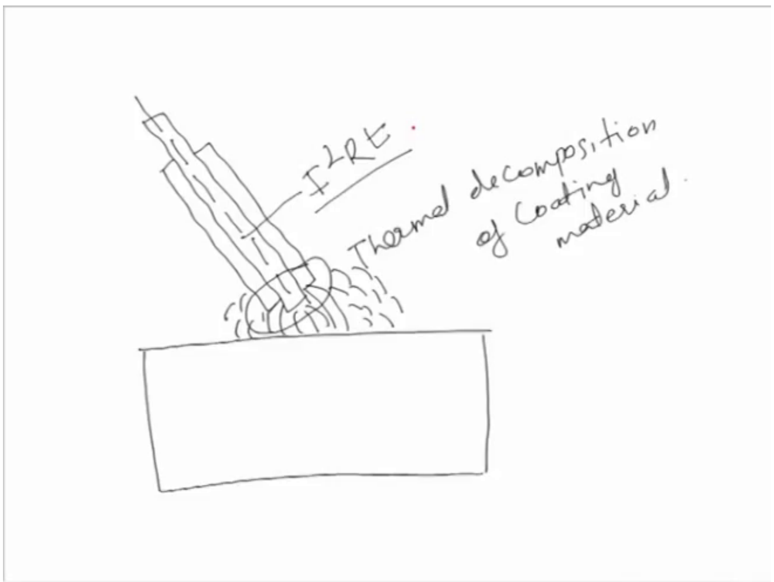

And the reason for this is mainly that the approach which is used in this process is that inactive gases are formed by thermal decomposition of the coating material and these inactive gases form very loose shroud or shielding of the inactive gases around the weld pool. So, effectiveness of the protection in this process depends how much inactive gases are being produced due to the thermality composition of the coating material and what type of the shielding gases are produced apart from the various welding related parameters.

To understand this, if we see this diagram here say this is the base material and this is a the electrode core wire with the coating material around it. And the current flows through the core wire to the base metal and an arc is developed. So, this heat of the arc which is developed is used for melting of the faying surfaces of the base material and the part of the heat is also used for thermal decomposition, thermal decomposition of the coating material. So, by the heat of the arc when the coating material is decomposed lot of inactive gases like the carbon dioxide and in the carbon monoxide is produced and forms cover around the arc and the weld pool to protect it from the atmospheric gases.

Sometimes what happens that if the flow of the ambient gases during the welding is high then the this loose cover being formed by the inactive gases is damaged and the atmospheric gases in that case reach up to the weld pool and contaminate it. At the same time, sometimes if the enap in improper the welding conditions like too high welding current is used.

Then because of the high electrical resistive heating of the core wire itself because of I square, I square R t heating of the core wire this coating material itself is damaged by the electrical resistance heating much earlier then when it should decompose to produce these inactive gases. So, in proper the welding use of improper welding current adversely effects the protection of the weld pool from the atmospheric gases.

Further, if the welding speed is too high then due to the high relative speed of the welding arc with the atmospheric gases will also damage the shielding cover being formed by these inactive gases around the weld pool. And so these will adversely affect the protection being provided by this cover of the inactive gases around the weld pool and around the arc. So, if we see that if the more amount of the a coating material is present then by the thermal decomposition, large amount of the shielding gas will be produced and which will be forming effective cover to protect the weld pool.

So, the thickness of the coating material around the core wire of the electrode and the type of coating material, what type of, the type of the shielding gases, which will be produced by the thermal decomposition of the coating material that will depend upon the kind of coating material which is been used for development of the coating. So, if we see the factors that are determining the effectiveness of protection provided by the SMAW process to the weld pool, this effectiveness depends upon how much and what type of the shielding gases are produced by the thermal decomposition of the coating material.

That raise apart from the welding related factors such as the welding current, if we use too high welding current then the excessive electrical resistance heating of the core wire will be damaging the coating material much earlier. And so it will be reducing the effectiveness of the shielding of the weld pool by the inactive gases which are, which will be formed. Because not much inactive gases will be there around the welding arc if the coating material is decomposed much earlier then when it should due to the excessive high welding current.

High welding speed also affects reduces the effectiveness of the shielding in this process because high welding speed increases the relative velocity with the ambient air and in that case the kind of cover which is formed around the arc and the weld pool that is damaged and reduces and so reduces the effectiveness of the protection in this process. The arc voltage also affects the protection of the weld pool if we use the large arc a high arc voltage, then the high arc voltage will affecting the arc gap in general larger higher the arc voltage. Larger will be the gap and so greater will be the possibility for entry of the atmospheric gases in the arc region to and which in turn will be increasing the contamination of the weld pool from the atmospheric gases.

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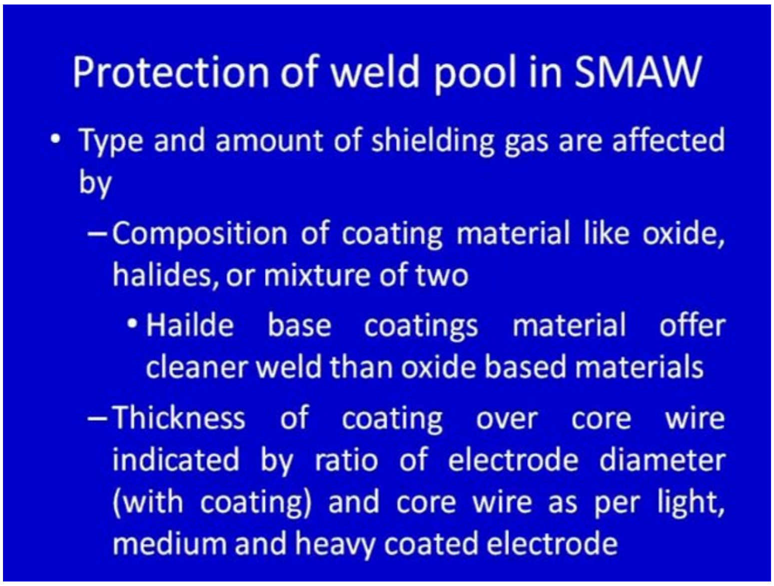

Apart from the type and the amount of the shielding gases which are formed are during the welding, these this the type and amount of the shielding gases which are formed during the welding will depend upon the kind of coating material which has been used for development. If coating around the core wire in SMAW electrodes the composition of the coating materials like composition of the coating material in includes the oxides, halides or the mixture of the two halide based coating materials offer the cleaner weld as compared to that of the oxide based coating materials.

And the thickness of the coating over the core wire also effects the kind of protection which will be provided to the weld pool in SMAW. Thicker is the coating material around the core wire greater will be the amount of the shielding gases which will be generated and so better will be the protection to the weld pool.

And this is indicated by the ratio of electrode diameter with the coating and the core wire and that of the core wires. So, as per and accordingly we classify the different electrodes based on the thickness of the coating around the core wire as light coated, medium coated and the heavy coated. Heavily coated electrodes offer better protection to the weld pool by developing large amount of the inactive shielding gases around the welding arc and so we will be providing the better protection to the weld pool.

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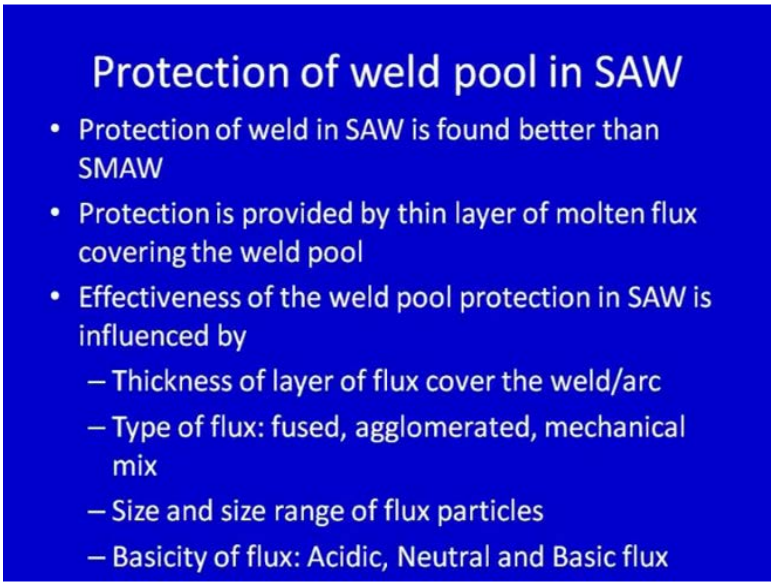

Then, the SMAW is the another SAW that some as dark welding process is another process, which is mainly used for developing the weld joints of the heavy sections and very thick plates, because this process is known to work with the heavy current or very high magnitude of current is used which can range up to the 2000 amperes. So, for a so lot of heat is generated during the welding by the SAW process and to protect the weld pool in this process the molten flux cover is used around the weld pool.

And protection of the weld in this process is found much better than the SMAW process because the weld pool is completely covered by the thin layer of the molten flux. And that flux cover is formed continuously during the welding of the entire length of the work piece. So, the factors that affect this protection of the weld pool in SMAW is mainly governed by the kind of flux which is being used the thickness of the layer of the molten flux forming being formed around the weld pool during the welding and the kind of the size or size range of the flux material which is being used.

So, effectiveness of the weld pool protection in SMAW is influenced by the mainly thickness of the layer of the flux cover. In general greater is the thickness of the flux cover around the weld pool better is the protection, because sometimes insufficient thickness of the cover around the weld pool cover of the flux around the weld pool results in the entry of the atmospheric gases in the weld region, and contaminates the weld metal from the atmospheric gases. Then the type of the flux, that they are various types of the fluxes are used for developing the weld by the SAW process, like the fused fluxes agglomerated mechanical mixed fluxes.

So, the fused fluxes are found to be of the uniform composition and the compositional changes do not take place much with during the storage or with the size variation in the in the flux particles. So, the uniformity in composition of the fused fluxes results in the better protection to the weld pool as compared to the agglomerated and the mechanical fluxes. The mechanical fluxes may use the fused fluxes and agglomerated fluxes in the different proportions to obtain the desired characteristics and composition of the weld metal.

So, if even if the particle size it very fine and it settles down in case of the fused fluxes composition is not appreciably effected. But, in case of agglomerated fluxes if the fine particles settle down then there will be huge variation in the composition of the fluxes, which will be used over a period of time and they will be taken from the storage in the different stages. So, the fluxes flux agglomerated fluxes taken from the bottom of the stores they will be of the different composition as compared to those of the top.

So, the this variation in composition of the agglomerated fluxes also results in the significant variation in kind of effectiveness which is provided to the weld pool from the atmospheric gases. The size and the size range of the flux particles both these factors significantly affect the protection of the weld pool provided in this process because the finer particles melt easily and if the excessive heating is taking place then they can get thermally damaged.

But, if the particles are too large size then they will take long time they will sustain the flux cover for longer period and will provide the effective protection to the weld pool. Then basicity of the fluxes, these there the fluxes can be of the acidic neutral or the basic. In general, the basic fluxes offer the cleaner weld as compared to the neutral and acidic fluxes and increase in basicity from 1.2 to the 2 reduces the oxygen content and the sulphur and phosphorus content in the weld metals significantly. So, the flux composition determining the basicity affects the protection to the weld pool significantly. Acidic fluxes in general results in the higher oxygen content in the weld metal as compared to that of the neutral and the basic fluxes.

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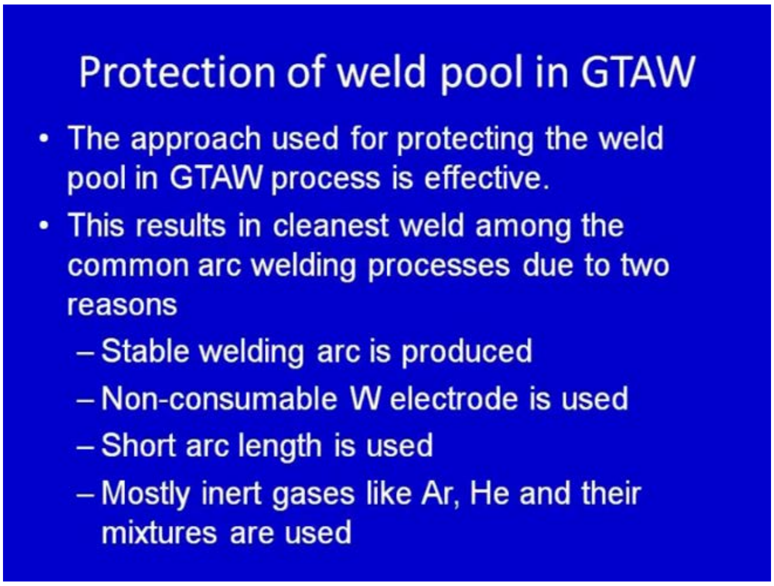

Now, we will see the protection of the weld pool in GTAW process in case of the gas tungsten arc welding process. The protection is found to be most effective because the oxygen and nitrogen content in the weld metal among the different arc welding process is found minimum in case of the weld joints produced by the GTAW process. And this effectiveness of the protection to the weld pool in this process is mainly attributed to the very small size of the arc length. Use of the inert shielding like argon and helium and the development of very smooth and stable arc and because of these factors the entry of the atmospheric gases in the arc region and the weld region is found to be very restricted.

So, to understand this we can see the, if the arc the stable arc is produced then there will be no transient situation. Very stable arc will be resulting in the continuous formation of the shield cover of the inert gases around the arc and the weld pool to protect it from the atmospheric gases. Further non consumable tungsten electrode use since electrode the does not melt in GTAW process and so the stability of arc is very good and the arc length is also largely constant.

And therefore, the chances for the entry of the atmospheric gases in the weld region is formed minimum with this process. The short arc length use of short arc length in case of the GTAW process further discourages the possibility of the entry of the atmospheric gases in the arc region. And the mostly inert gases like a helium and argon or their mixtures are used for development of the shield link cover around the arc and the weld pool.

Well, in case of a the GMAW process and the SMAW and SAW processes the different approaches are used even these gases are mixed with oxygen and the hydrogen in order to have the higher hotter arc and to have the deeper penetration capability, capabilities. But, in case of GTAW process normally these additions are not done and very clean argon and helium are there helium gases are their mixtures are used for development of the weld joint.

However, the effectiveness of the protection of the weld pool in this process is determined by the type of the shielding gas, like helium in general offers the cleaner weld as compared to the argon. But, since this gas is the costlier that is why for most of the non critical applications and where reasonably good quality weld joint is required argon is used and for very critical applications where high quality weld joints are required the helium is used. But, because of the very low density the flow rate of the helium gas is required to be too on the too higher side as compared to that of the argon nozzle, and the electrode size.

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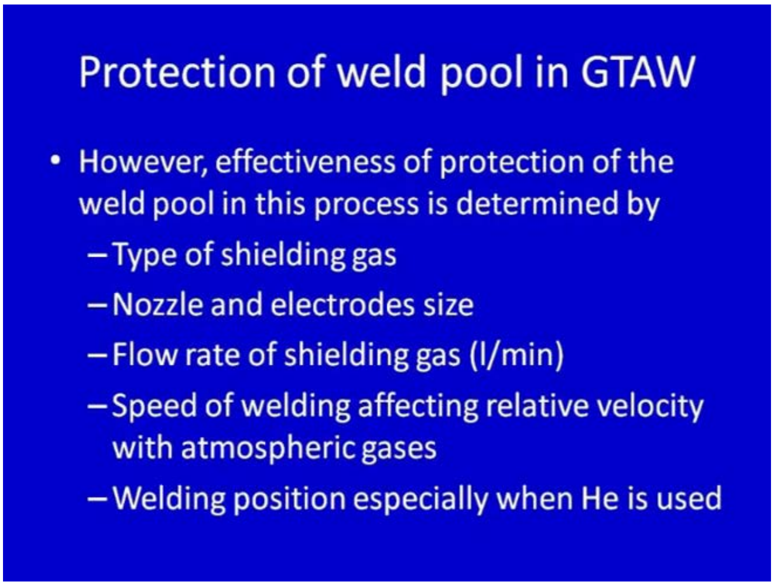

The proper size of the nozzle and the electrode helps in forming a very perfect jet of the inert gas around the arc. And if the improper size of the electrode like the too large nozzle diameter and the very small size electrode is used then either very high flow rate of the shielding gases will be required. Or the very stiff jet will not be not be jet of the in shielding gas will not be formed around the arc and the weld pool to protect it from the atmospheric gases. So, proper size proper gap between the electrode and the nozzle helps to form perfect jet of the a shielding gas coming out of the nozzle to form a proper cover of the shielding gases around the arc and the weld zone so as to protect the weld from the atmospheric gases.

The flow rate of the shielding gas is flow rate of the shielding gases can significantly from 5 litre per minute to the 50 litre per minute depending up on the kind of the shielding which is being used. The speed of the welding and the position where welding is done normally, the helium requires the higher flow rate as compared to that of the argon. Because it becomes lighter in weight as compared to the atmospheric gases, so it tends to come off the nozzle and the shielding cover is not formed very effectively if the flow rate is low.

And the welding speed affecting the relative velocity with the atmospheric gases if the high welding is performed at a higher speed then then the atmospheric gases can damage that cover being formed by these gases around the weld pool. And can increase the protection can reduce the protection to the weld pool from these gases. The position of a the welding especially when helium is used, so in the down hand welding position the helium tends to move up with in case of the overhead welding position movement of the helium in upward direction is helpful.

So, if we see in the down hand position like in the horizontal welding and in the flat position welding. The higher flow rate of the helium is required for protection of the weld pool. While in case of the overhead position welding where helium tends to move up even the low flow rate of the helium will also be good enough. Because it will be trying to move up and will be forming the effective cover around the weld zone.

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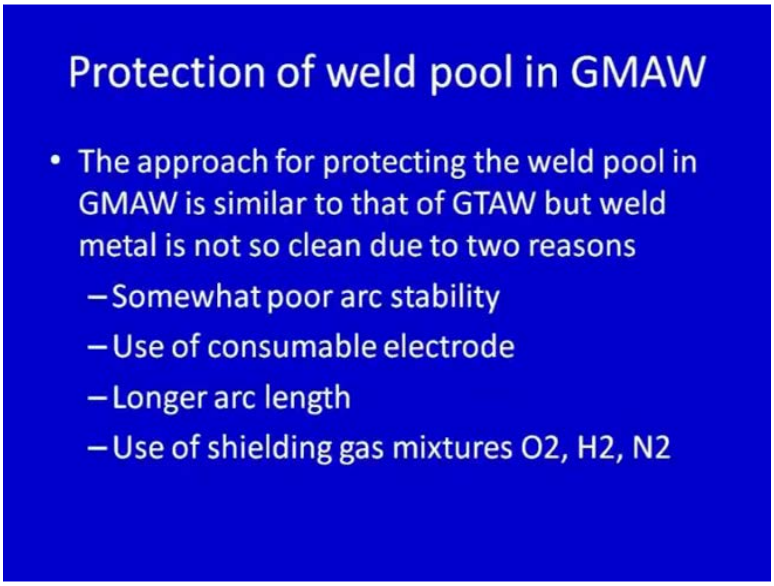

Then the protection of the weld pool in the gas metal arc welding process, the gas metal arc welding process is very commonly used, because it offers the high deposition rate and very good quality weld joint. However, the weld joint is not as clean as that of the GTAW but it is still the cleanliness of the weld is reasonably good for many critical applications. The cleanliness the comparatively poor cleanliness of the weld in GMAW as compared to that of the GTAW is attributed to the mainly two reasons, one is somewhat poor arc stability.

Poor arc stability in the GMAW process is due to the use of the consumable electrode material. Since, the electrode tape is consumed continuously during the welding, so arc is not formed that is stable and stiff as it happens in case of the GTAW. So, the poor arc stability results in somewhat easy entry of the atmospheric gases in the weld region and so it decreases the protection of the weld pool from the atmospheric gases. And so this is the use of the consumable electrode. So, as I have explained as the use of consumable electrode forming somewhat a less stable arc providing the easy entry of the atmospheric gases in the weld region.

And the poor arc stability of the GMAW can also be due the somewhat poor electron immiscibility of a the common materials like aluminium and steel while the same is found to be very good. In case of the GTAW, where tungsten is used as a an electrode so because of the good electron immersing capability of the tungsten it forms very smooth and very stable arc which restricts the entry of the atmospheric gases in the arc region and the weld region. And therefore, a GTAW offers the better protection to the weld pool as compared to that of the GMAW. Further, in case of the GMAW, a longer arc is used while in case of the GTAW somewhat very short arc length is used in.

So, use of the shielding gas in this in GMAW process or the shielding gas mixtures are also used like a argon is a modified with the oxygen or nitrogen, and a hydrogen in order to get the benefit of the high temperature arc which can offer the advantage of the greater penetration capability especially when welding the heavier thick ((Refer Time: 46:22)) and the metals of the high thermal conductivity.

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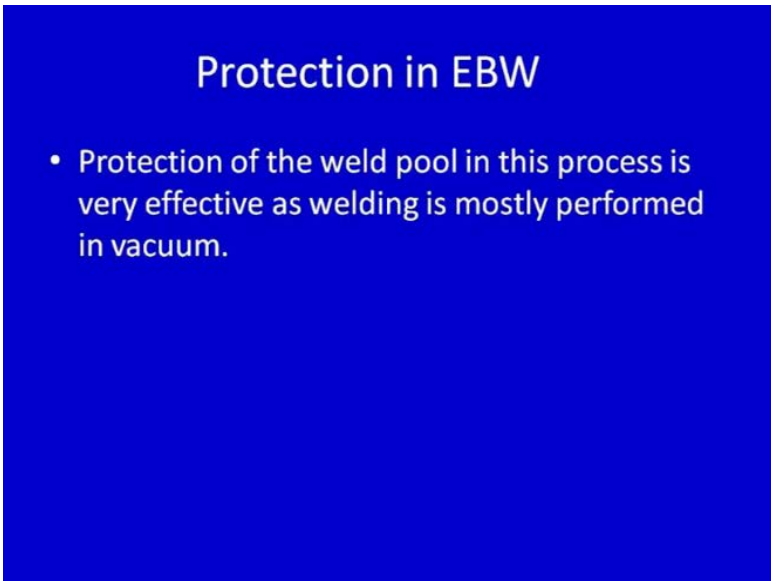

Protection to the weld pool in case of the electron beam welding the approach of protecting the weld pool in case of the electron beam melting process is very simple. In this case the welding is mainly done in the vacuum, so that the atmospheric gases are extracted from the vacuum chamber. And then welding is done by placing the weld the plates to be welded in the fixture, and the beam is directed for melting the thin surfaces of the waste material to be welded.

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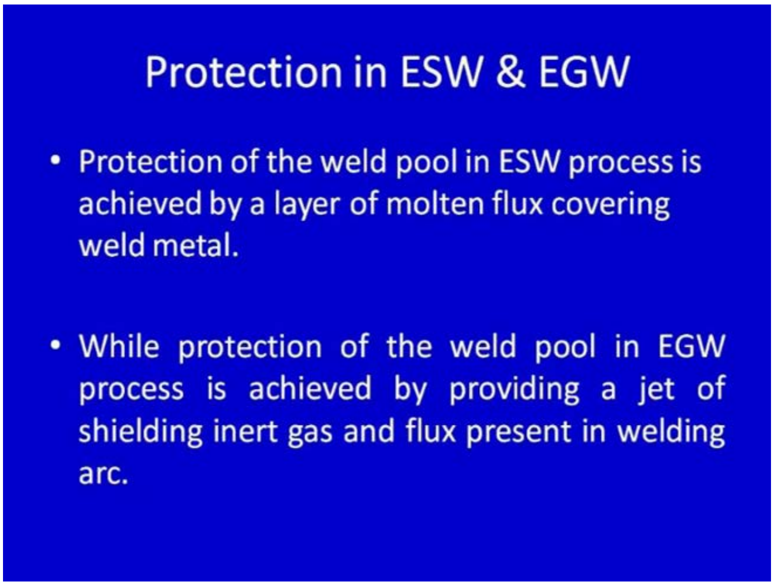

So, the protection to the weld pool in this process is very good. In case of the electro slag and electro gas welding process, the different approaches are used but both these processes are mainly used for very, very thick sections. It is these both these process are based on the vertical up head up hill welding concept where, in one go the weld joint is completed in very, very thick sections which can be as I as the 70 to 80 centimetre or more also.

Protection to the weld pool in SMAW is achieved, electron slag welding process is achieved by a layer of the molten flux covering the weld metal, while the protection of the weld pool in electron gas welding is achieved by providing a jet of the a shielding inert gas. And the flux which is present in the welding arc in form of a means, sometimes the flux code electrodes are also used in combination with the in inert shielding gases for protection of the weld pool from the atmospheric gases in electro gas welding process.