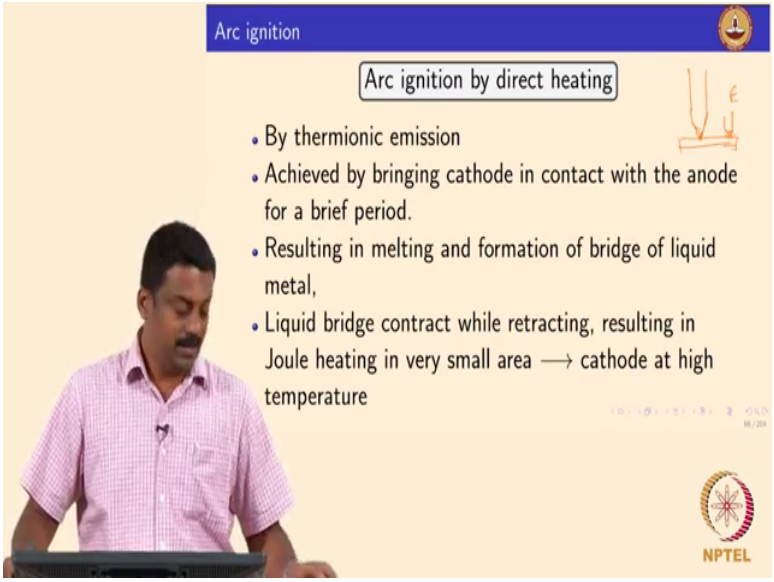
Welding Processes
Prof. Murugaiyan Amirthalingam
Joining and Addictive Manufacturing Laboratory
Department of Metallurgical and Materials Engineering
Indian Institute of Technology (IIT)-Madras
Arc ignition mechanisms Part 02
Mod_03 Lec_12

(Refer Slide Time: 0:17)



We ignite the arc by direct heating, so just strike an arc by touching cathode anode which is not that straightforward okay, so if you keep on touching it you will not strike an arc okay, so you need to retract the electrode slowly, so then you can strike an arc okay, so it is done by thermionic emission because the moment you have an arc circulating, so then you will have actually heating, triggering the heating of the system okay.

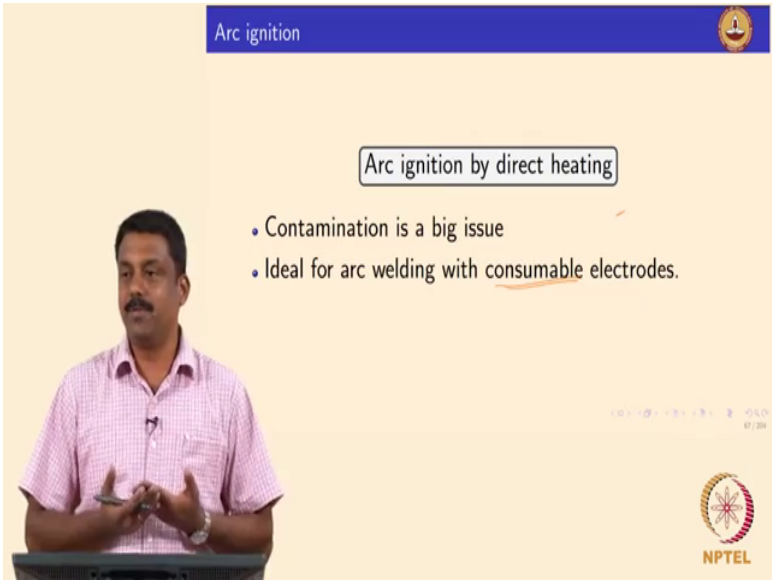
So you keeply, so you keep the electrode and base material in contact for very brief time to increase the temperature and then slightly retract okay with electrode what will happen then you have interface melted and while interacting because suffix tension whatever the molten drop forms at the surface will start contracting is not it, so you have an electro tape okay on the base material, so if it is in touching so you will start melting here and if it retracting and then tip I am just exhilarating, you will have a conical the liquid bridge forming is not it because un-suffix tension of the liquid.

While doing so what happens then now you are reducing the gross section significantly okay, so you will have a same amount of E sent and after melting if you retract it you create and a bridge between the electro tip and work phase and this liquid now can generate much higher

heat because of this galactic field because the resistivity of liquid and liquid is much much higher than in insolvent state and that to allow in the smaller construction area, the temperature would be increased significantly and to in this process because of the heat, super heating of this liquid bridge would also heat the electrode surface leading to thermionic emission yes.

So it is very important when you are doing and direct the ignition by direct heating, so you make a start circulating and then slowly retract the electrode to form liquid bridge and to in this process you heat up the electrode surface, cathode surface, the high-temperature leading to thermionic emission okay and this is commonly use for consumer welding process because in consumer welding process anyway you need to melt the filler and proceed it to at the base material, it is not be using it for non-consumer welding process for example in gas tungsten arc welding, it is not ignite the arc by substituting or direct heating because you would melt up the melting the tungsten and your weld will be contaminated by the tungsten is not it, so you will also change the electro tip angle because of this direct heating and you will also start contaminating your weld material with melton tungsten okay.

(Refer Slide Time: 3:50)



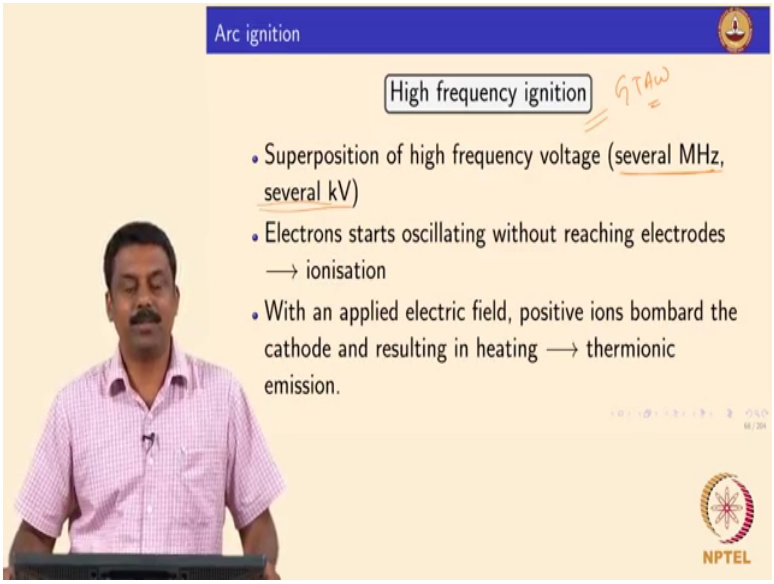
So this direct heating method is commonly used for consumer welding process okay for non-consumer welding process is generally it would not be using this okay you either use the electric breakdown or the one I am going to be teaching the next slide right it is clear, for consumer welding process for GMAW or in SMAW are minor material arc welding like you know it is done in construction sites for example with simple minor material arc welding

electrodes, so they would not be doing the electric brake down that guy would deceivingly get in a electric shock if they doing in a voltage pulses.

So in a minor material arc welding the most of the time it is done by short-circuiting is not it, have you seen someone doing it okay, so you would just touch the electrode and the base material leading to joule heating, melting up interface locally and then when you retract it you form a liquid bridge leading to a reduction of cross-section, in case in resistivity leading to heating up electric surface and then thermionic emission.

So this is the physics behind the welder touching the electrode to the base material yes is clear, so now you understand if a man does it now okay, so this guy ignite the arc by thermionic emission is not it good,

(Refer Slide Time: 5:19)



So the third method which is very popular which commonly used for arc ignition is by high-frequency ignition, so what we do is in this case we just apply the high-frequency electric field okay several megahertz and sometimes we also use it but most commonly used is use high frequency current and when you apply high-frequency current the electron would not reach the end would because your loss would be changing the polarity in most of the cases okay.

So doing this process they gain energy obviously when the electrons are oscillating so they would also collide with each other and with gas items and then they would gain energy, when the energy again equals to EI, you would trigger an ionisation okay, so the moment you have the ion triggered the same from like in a voltage breakdown, an electric breakdown, the ions

would reach the cathode bombard, create the second electrons and heat up the cathode leading thermionic emission, so advantage of these method is when you are applying an high-frequency ignition, you may not need a voltage peak okay, so when you need in high-frequency.

So the your, the current values can be isolating electric field values, so that the electrons would start isolating, doing this process they gain energy, if the energy was to NS as energy you trigger avalance yes, it is clear and this sees commonly use high-frequency but there could be some funny incidence when you are using a high-frequency ignition.

So most of the times when you are doing automated welding process and you have all the servo motors controlling the motion of your electrodes for example table is moved okay, the servo motors are very sensitives for high frequency ignitions because when you apply high-frequency you also generate a very strong magnetic field, very brief period during while applying very high-frequency.

So during this process there will be the electromagnetic inductions leading to jamming of these motors okay, so most of the cases in lab students would come and tell me the motor is not moving when I ignite the arc okay obviously it will not move because then you have influence of high-frequency current under the servos, the controls, the electronic signals okay.

So generally that is why we always have some delay when you are doing high-frequency ignition from the ignition point to the motion of the table okay, if you start moving the motor the point of ignition then the high-frequency inductions can influence these electric circuits boards okay and the moment you ignite the arc by high-frequency then you can change to the conventional whatever frequency or even needs a state current without any pulsing okay.

So the pulse was versus modern pulses which are actually used nowadays, they are capable of doing high-frequency ignition, so then here you can choose if you look at now a labs all the pause there were option by direct heating or if it could ignition you can choose based on that, in most advanced process is which will see in next class, they are all microprocessor controlled, there were computer inside okay.

So now if you want to ignite the arc by high-frequency ignition you can tell the processor that I want high-frequency ignitions, so it will, so for impose a high-frequency pulse before the answer it of you have conventional wave form okay, so then there dependably same as the previously explained arc ignition by electric breakdown, the moment electron gains its energy

EI that is it, we have job done okay, so these again the most commonly used for gas tungsten arc welding GTAW okay and in old days when the high-frequency systems are not available, how did they ignite the arc in gas tungsten arc welding? Okay.

Student: Organ gas welding,

Prof Murugaiyan: Organ, not the gas welding, so generally they use and short-circuiting medium so for example you can use a graphite rod, insert it between the tip of tungsten and the base material okay so that you are also circuiting okay, so that is also commonly use or you also have pilot arc to ignite a main arc like he said that is also possible okay, so these three are the common ignition methods right, it is clear.