Lecture Note

On

Production Technology (Th-1)

For 3rd semester Mechanical Engg.

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Metal Forming

large set of manufacturing process in which the material is deform plastically to take the shape of the die geometrically.

Metal forming

- Bulk deformation
  - Extrusion
  - Forging
  - Rolling
  - Drawing
- Sheet metal working

2nd

Extrusion

(i) Extrusion is a bulk forming process in which the work metal is forced and compressed to flow through die hole to produce a desire cross sectional shape.

(ii) Ex:- tooth paste.

What is the process of extrusion :-

(i) Extrusion is a metal forming process that produces continious length of uniform and non uniform cross sectional area from a billet.

(ii) By causing the metal to flow under high pressure through a restricted opening called die.

(iii) Extrusion process the major component (i) Container (ii) Die

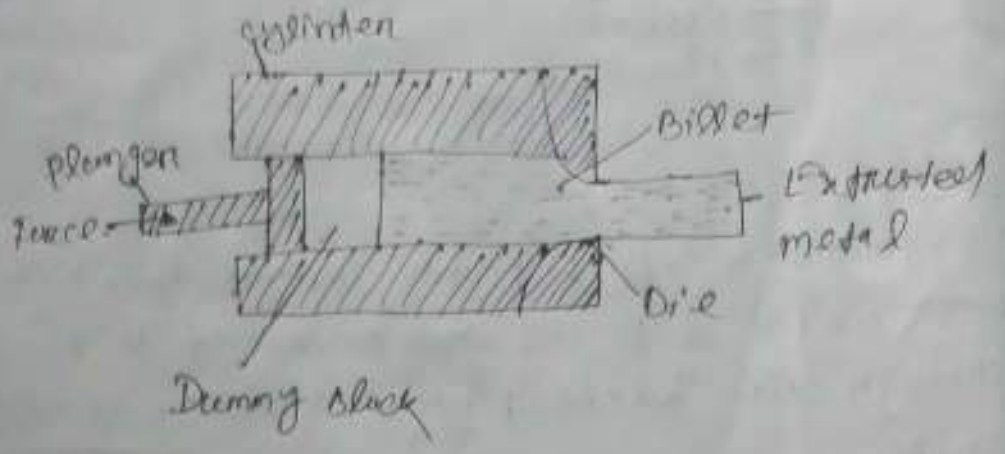
(iv) A heated cylindrical billet is placed in the container and forced out through a steel die by ram applying

Types of Extrusion

(1) Direct extrusion / Forward Extrusion
(2) Indirect extrusion / Backward Extrusion
(3) Impact Extrusion

Direct Extrusion / Forward Extrusion

A metal billet is first loaded in to a container having die holes. A Ram compresses the material, forcing it to flow through the die holes.



(i) In this process some extra portion of the billet will be present at the end of the process that can not be extruded and is called butt.

(ii) It is separated from the product by cutting it just beyond the exit of the die

(iii) In directct extrusion amount of friction exist between the container wall. as the billet is forced to slide towards the die opening

(v) Due to the presence of friction a substantial increase in the Ram force is required.

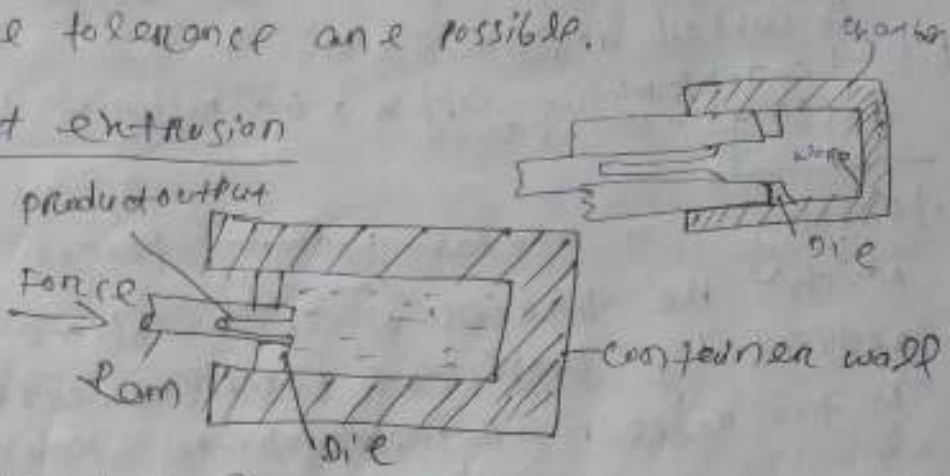
Advantages

(i) Variety of shapes are possible. especially using hot extrusion.

(ii) Grain structure and strength properties are enhanced in cold and warm extrusion.

(iii) Close tolerance are possible.

Indirect extrusion



(i) In this type of extrusion the die is mounted to the Ram and not on the container. As the Ram compresses the metal. it flow through the die hole on the Ram side which is in opposite direction to the movement of Ram is called Indirect extrusion.

Advantage

Better surface quality is achieved in this process no heat cracking happens between the billet and extrusion cylinder interface.

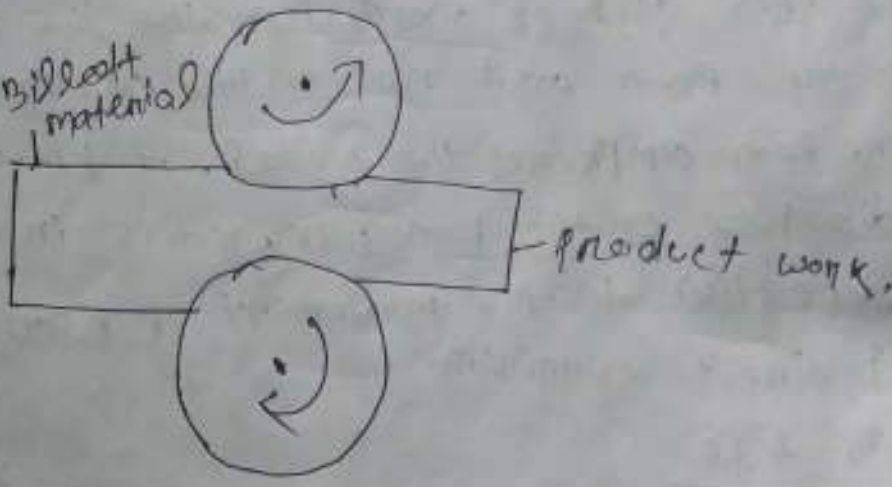
Impact Extrusion

(i) The force is applied on a billet material for a short period of time this extrusion is called impact extrusion.

(ii) Lead, Aluminium, Copper & tin materials used for Rolling in this process.

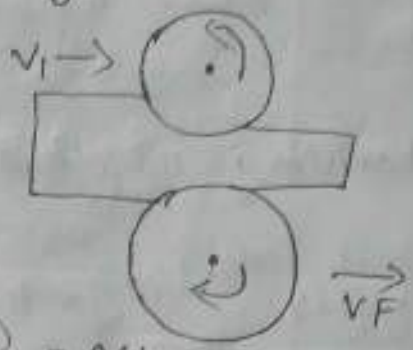
(i) Rolling is a metal forming process in which the thickness of the workpiece is reduced by compressive forces exerted by two rolls rotating in opposite direction.

(ii)



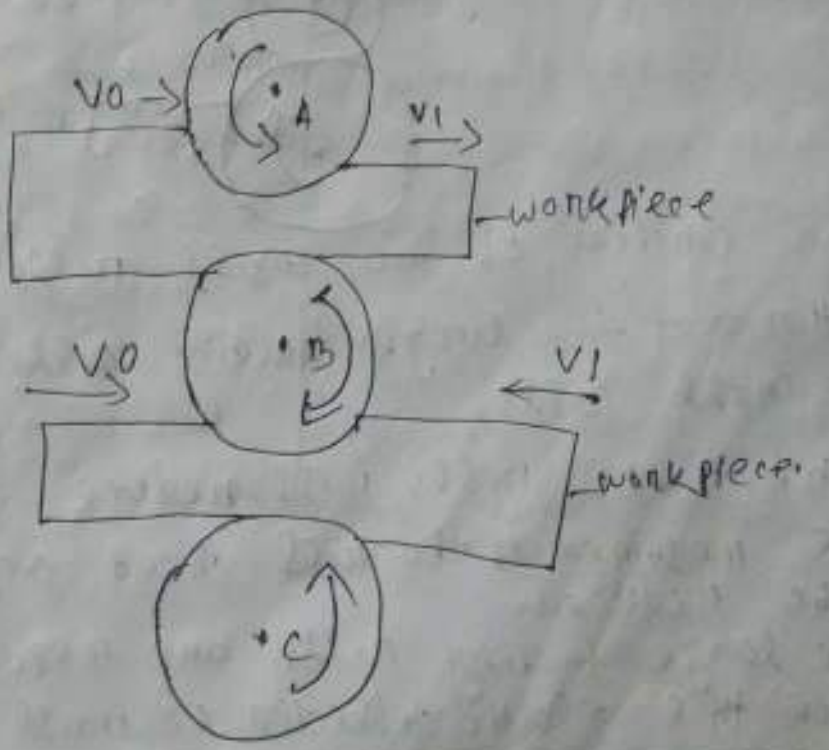
(i) Two high rolling mills
(ii) Three high rolling mills
(iii) Four high rolling mills
(iv) Cluster rolling mills
(v) Tandem rolling mills

Two high rolling mills



(i) This type of rolling mills consists of two rolls. rotating in opposite direction.
(ii) At that time the one roller is rotating in clockwise and other roller is rotating anti clockwise.

Three high rolling mills:



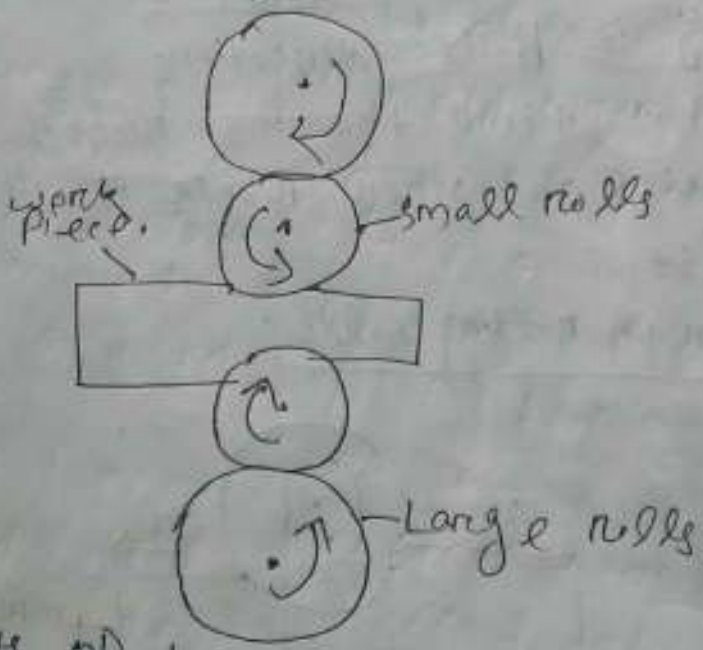
(i) In this case there are three rolls one above the other at a time. For single pass two rolls will be used. The roll direction will not be changed in this case.

(ii) The top two rolls will be used for first reduction and the sheet is shifted to the bottom two rolls and further reduction is done

Disadvantage

(i) Automated mechanism is required to shifted the slab.

Four high rolling mills



(i) This consists of two small rolls for thickness reduction and two large backing rolls to support the small rolls.

(ii) The small rolls will reduce the roll force required as the roll sheet contact area will be reduced.

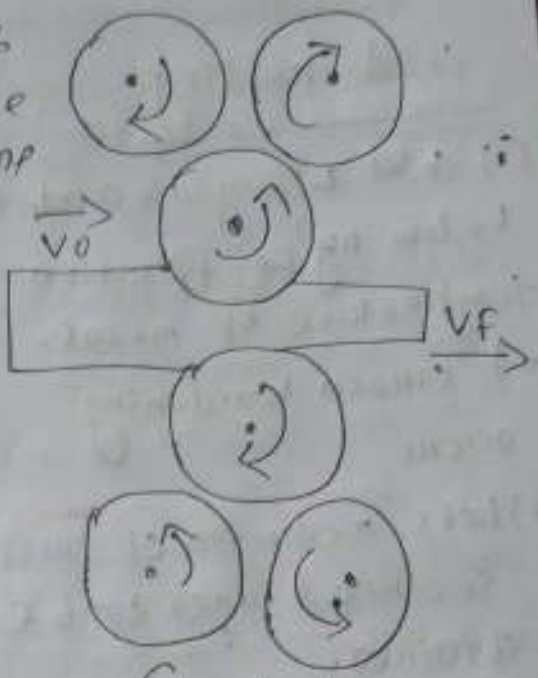
(iii) The large backing rolls are required to reduce the elastic deflection of small rolls.

when sheet passes between them.

(4) Cluster rolling mills :-

(i) This rolling mills consists 6 rollers. two rollers are small and four rollers are larger.

(ii) It is better than four high roller.

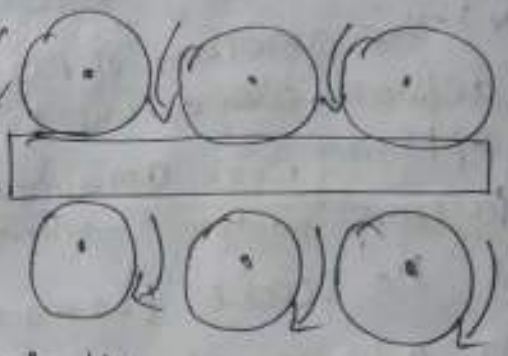


(cluster)

Tandem Rolling mills

(i) This consist of series of rolling station of the order of 8 to 10 in each station.

(ii) thickness reduction given to this sheet with each rolling station the work velocity is increases.



(iii) This types of rolling mills reduce the cost.

→ required to reduce the roll sheet contact area

→

Imp

Difference between cold rolling and Hot rolling.

Cold rolling	Hot rolling
(i) Cold rolling is conducted below the recrystallization temperature of metal.	(i) Hot rolling is conducted above recrystallization temperature of metal.
(ii) Strain hardening occurs	(ii) Hot strain hardening occurs.
(iii) Less reduction of cross sectional area can be obtained.	(iii) Large reduction of cross sectional area can be obtained.
(iv) yield strength increases and ductility decreases	(iv) yield strength reduces and ductility increases
(v) The amount of plastic deformation occurs by applying more amount of power. (hardness is not eliminated)	(v) The amount of plastic deformation occurs by applying less amount of power (Hardening due to plastic deformation)
(vi) No scale formation or oxidation of metal surface occurs. Result good surface finish	(vi) Coarse structure of a cast ingot is converted into a fine grained structure. improves physical properties.
(vii) Require high energy to deform metal	(vii) Poor control over dimension due to thermal expansion
(viii) Good control dimension due to no thermal expansion	

Chapter 2 WELDING

Welding :-

Welding is the process of joining similar or dis similar metal and plastic without using fasteners and adhesives.

Its two type

(1) Fusion welding
(2) Pressure welding

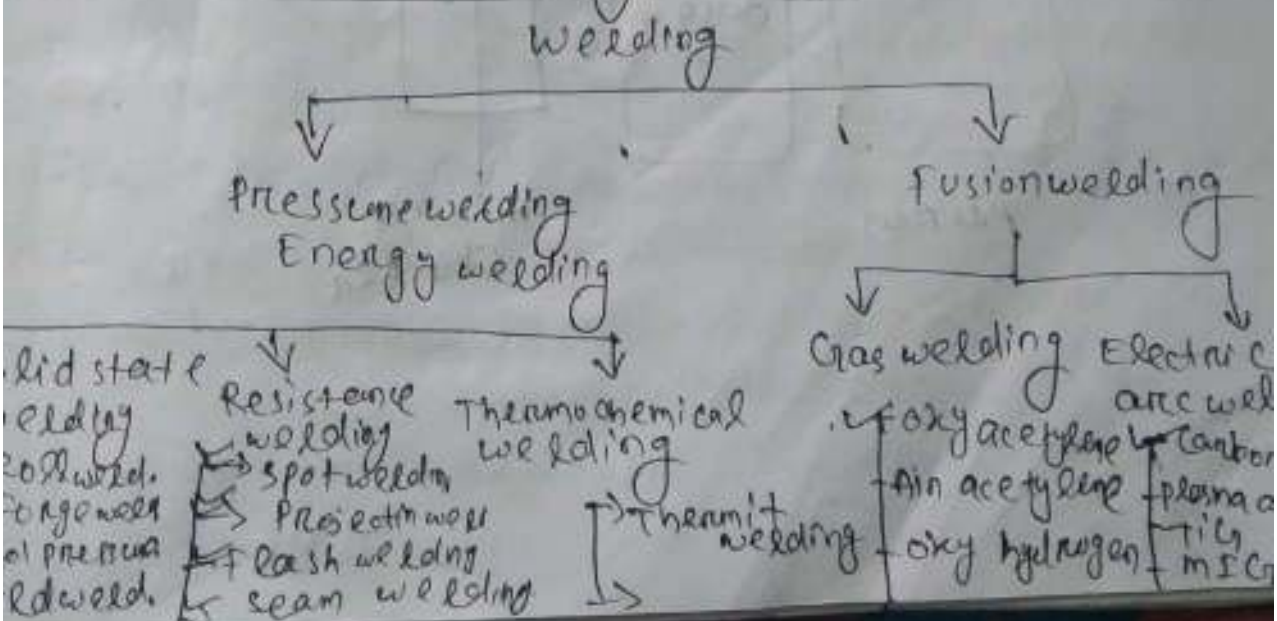
Fusion welding :-

In this process the temperature of end part of base metal which are to be joint raised to their fusion point by the application of heat.

Pressure welding / Energy welding

In this process the end of the metal pieces are heated to their plastic states and than external pressure is applied to joint them.

Classification of welding process



TIG/MIG Jnt

Eg.

Tac - Spot welding
Line - Projection
- Seam
- Flash

2 mark Jnt - why we flux

welding flux

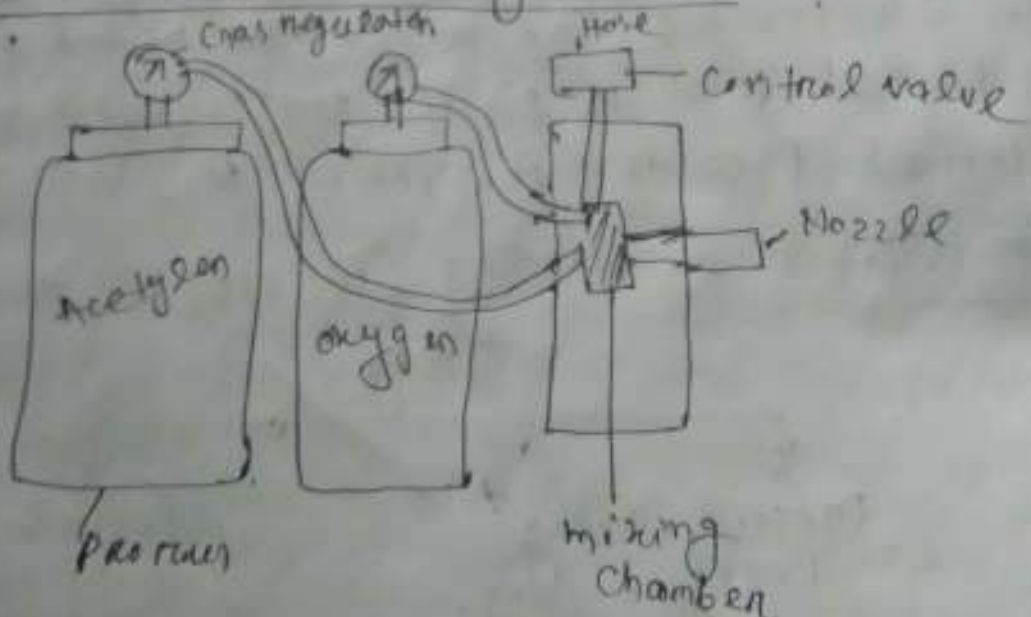
(i) welding flux is a shielding agent and some times act as a prime antioxidising agent which prevent the interaction of surrounding medium like air. and reduced oxidize respectively.

(ii) creates a protective slag over the molten metal

(iii) Reduced splatter.

3mk
Sham
U.V.Jnt

oxy acetyle welding process



(1) oxy acetylen welding is one type of oxyfuel welding. this welding can be used for welding almost all metals and alloy used in engineering field.

Equipment

(1) oxygen cylinder (black)
(2) Acetylene cylinder (maroon)
(3) Blow pipe and torches
(4) Pressure regulator

oxygen cylinder:

(1) In this cylinder oxygen is filled at a pressure 125 kgf/cm^2 – 140 kg f/cm^2 (2) colour black

(2) Acetylene cylinder:
acetyle cylinder → in hight pressure system.
porous mass inside, soaked in acttone which has a capacity to disolve 25 times its on volume of acetylene for every atmosphere of pressure apply.

(3) Blow pipes and torches:

(1) The high pressure system blow pipe has to different passes which are connected to oxygen and acetyle hose pipe.

(1) The blow pipe or torch contains a chamber where both these gases are mixed and then given out through the orifice of the blow pipe nozzle.

Pressure Regulator

(i) Pressure regulators are fixed on the top of the gas cylinder and carry a reducing valve and reduce their pressure before feeding to the blow pipe.

(ii) this pressure is regulated according to requirement by adjusting the spring pressure on the diaphragm by means of pressure regulating screw.

Types of Flame

(i) oxidising flame

(ii) Neutral flame

(iii) carburising flame

oxidising flame

(i) when supply of oxygen is more than the supply of acetylene, this type of flame is called oxidising flame.

(ii) The ratio of O_2 1.15 and acetylene C_2H_2 0.95.

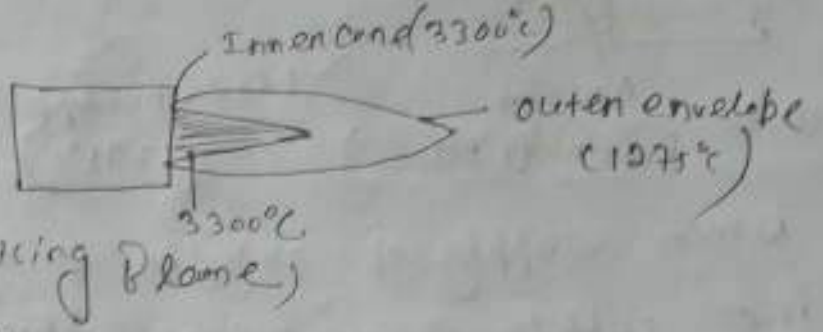
(iii) this flame has a sharp inner cone which is white in colour and an outer envelope. envelope.

(iv) maximum temp is available at the point tip on end of the inner cone.

(v) The outer envelope act as a covering for the molten pool during welding and prevent oxidization of surfaces.

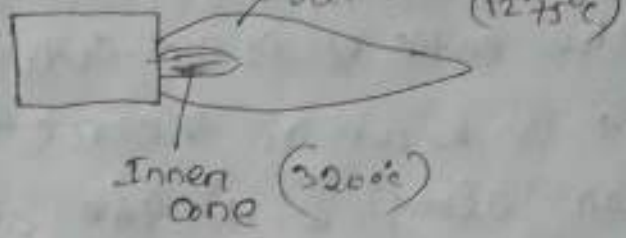
application:-

(i) welding of copper, bronze, brass and zinc



(oxidising flame)

Neutral flame :→



(i) When supply of oxygen is equal to the supply of acetylene, this type of flame is called neutral flame.

(ii) The ratio of O_2 and C_2H_2 is equal to 1.

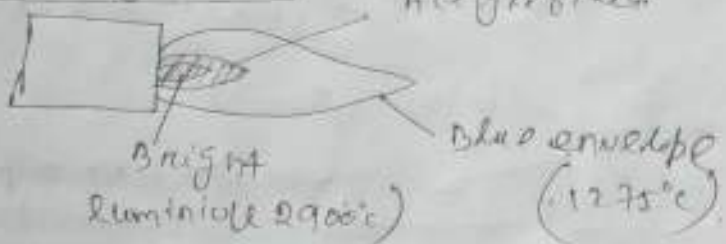
(iii) Its inner cone temp is 3200°c and outer envelope temp is 1275°c.

Applicating

(i) welding of stainless steel, Low carbon steel, cast iron and aluminium.

(c)

Carburising Flame:



(i) When supply of oxygen is less than the supply of acetylene, this type of flame is called carburising flame.

(ii) The ratio of O_2 and C_2H_2 is 0.5 to 0.95

(iii) It is known as the reducing flame

(iv) Near along with the cone an inner tip and outer envelope another layer exist. this ~~layer~~ stage is known as brush or feather.

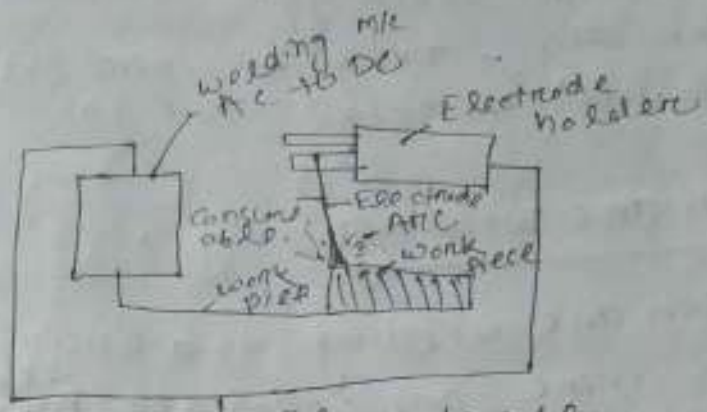
(v) The temperature attend by these flame inner 2900°, outer 1275°c.

Application

welding of high carbon steel, and Ni alloy.

Arc welding process:-

It is a fusion welding process where the heat is generated by the the application



Imp SMAW is same

(i) In electric arc welding the end of the metal piece to be joint are heated locally to the melting temp by bliating an electric arc and then allowed to solidfy to form the welded joint.

(ii) The arc is a flame of intense heat, generated by passing electric current through a highly resistant air gap between the electrode and the work piece.

(iii) The metal electrode is coated with flux which produce gas to shield and protect the welding area from atmospheric air.

(iv) Both alternating AC and DC are used for arc welding.

(v) FOR A.C arc weld a step down transformer is used which receive current from the supply mains at 400-440V. and transform it to the required voltage for welding 80 to 100 volt.

application :- It is used for welding of steel and cast iron. this type of welding is not applicable for copper.

Different arc welding process

(1) Shield metal arc welding (SMAW) etc.
(2) carbon Arc welding
(3) TIG welding - Tungsten inert gas
MIG welding - metal inert gas.

Carbon arc welding :-

(i) carbon arc welding is a fusion welding process where non consumable electrode is concentrated.

(ii) only DC is used in carbon arc welding process.

(iii) The negative terminal of the supply is connected to the carbon electrod and the positive terminal to the work piece.

(iv) A flux is used to prevent the weld metal from picking up carbon from the fused electrode.

application

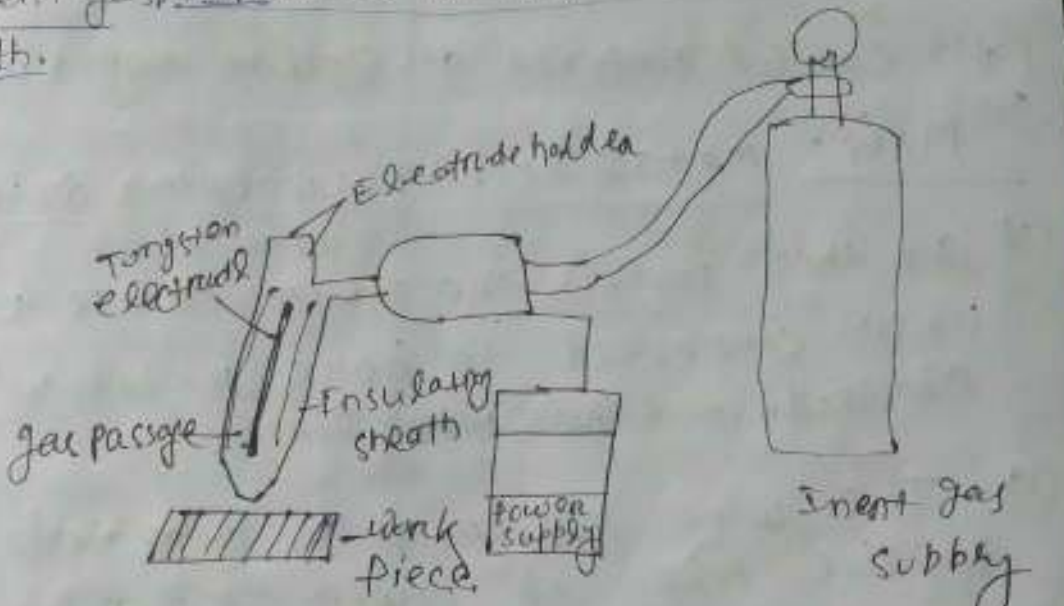
This welding is used for joining steel sheet.

Fig -

TIG - Tungsten inert Gas welding

(i) In this welding process the arc is struck between a non consumable tungsten electrode on the base metal.

(ii) The electrod is held in a special type of electrode holder, which is so designed that a part from holding the electrode, it also conveys a passage around the electrode for flow of inert gas, to provide the protective shield around the earth.



(iii) This gasies shield protect the electrod, molten metal, the arc and adjacent heated area of base metal from atmospheric contamination

(iv) The electrod holder also caries a provision for water cooling and air cooling.

advantage ⇒

(i) TIG weld are stronger more ductile and corrosion resistent. then welds made with ordinary shield arc welding.

(ii) since no flux is used, it is possible to use a wide variety of design joint then conventional shield.

disadvantage

there is a little weed metal splatten that damage the surface of bo the bare metal in traditional welding.

application

(i) Aerospace industry

(ii) use for welding aluminium, magnesium alloy, stainless steel, Nickel alloy and copper alloy.

(iii) it can be combined dissimilar material.

Eg

MIG metal Inert gas welding (MIG)

(i) In this process the power source DC Power connected to bare metal wire electrod. and the workpiece.

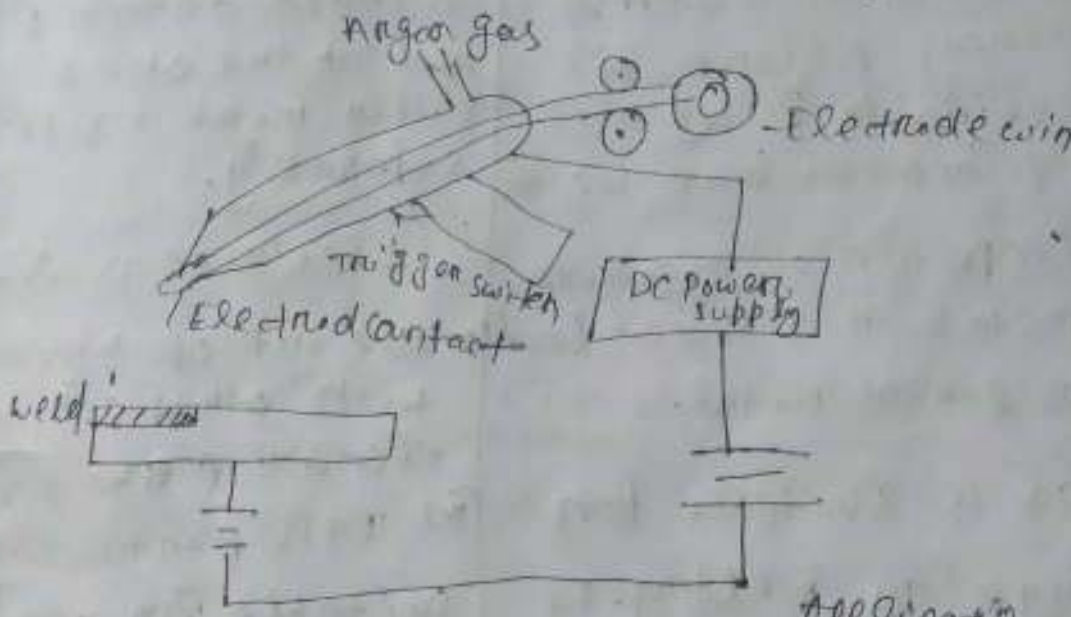
(ii) The wire electrod is connected to positive pole of power source

(iii) The torch is used in this process where the wire electrod ~~Parote~~ Bed Prom sp. through the torch at a constant speed. and the torch is also connected to the hose pipe. carrying shielding gas.

(iv) usually argon is used at shielding gas and sometime mixture of argon and oxygen, helium and argon.

advantages

(i) It is faster than shielded metal arc welding due to continious feeding of bigger metal.
(ii) There is no slag formation.
(iii) It provide higher deposition rate.
(iv) The weld metal carries low hydrogen content.
(v) Deeper penetration is possible.
(vi) more suitable for welding of thin sheet.
(vii) Weld produce are of better quality.



MIG

Application

- Used in Automobile, Sheet building, die making etc.

dis advantages :-

Equipment used is costlier and less portable
It is less adaptable for welding difficult to reach portion.
It is less suitable for outdoor work because strong wind make blow away the gas shield.