



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

Coimbatore-35

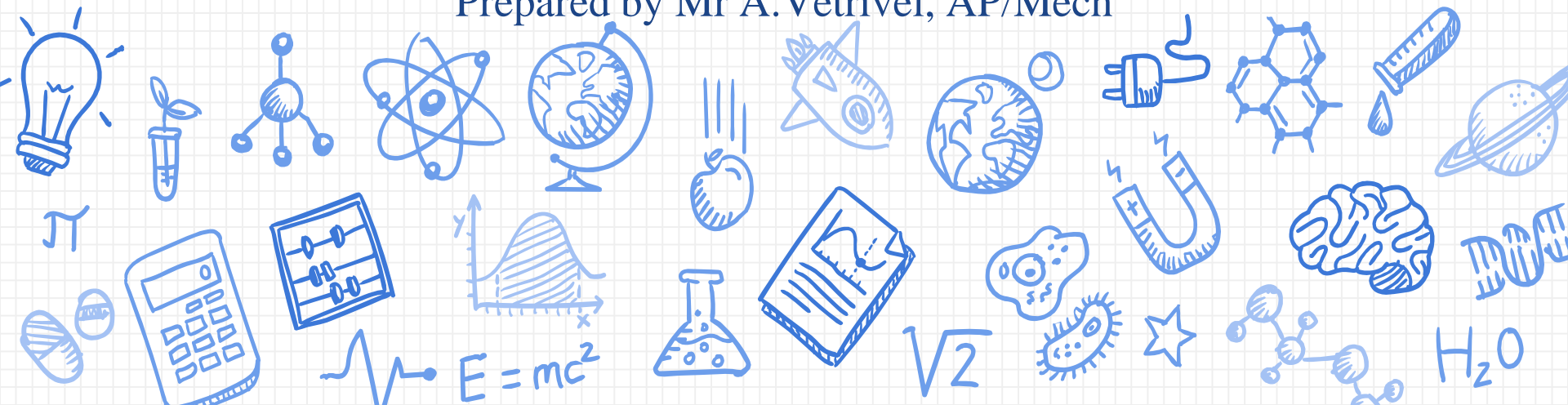



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19MET202 – MANUFACTURING TECHNOLOGY

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A decorative border surrounds the slide, featuring various science-related icons such as a lightbulb, a brain, a microscope, a globe, a test tube, a gear, a rocket, a cell, a magnifying glass, a DNA helix, a water molecule (H2O), a calculator, a microscope, a globe, a test tube, a magnifying glass, a DNA helix, a water molecule (H2O), a calculator, a microscope, a globe, a test tube, a magnifying glass, a DNA helix, and a water molecule (H2O).

MET, UNIT-1, LESSON-6

Types of Special Welding Processes

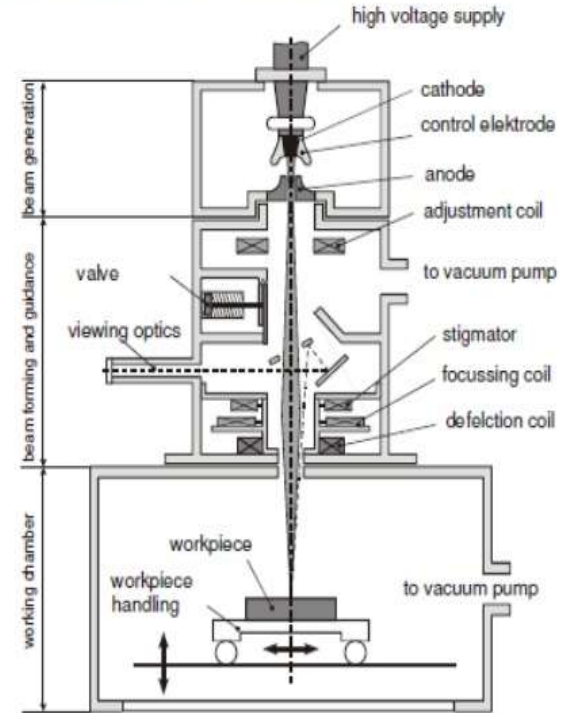
Electron Beam welding

Electron-beam welding is fusion welding process in which a beam of high velocity electrons is applied to two materials to be joined.

Free electrons in vacuum can be accelerated, with their paths controlled by electric and magnetic fields.

Narrow beams of electrons carrying high kinetic energy can be formed, which upon collision with atoms in solids transform their kinetic energy into heat

SCHEMATIC DIAGRAM



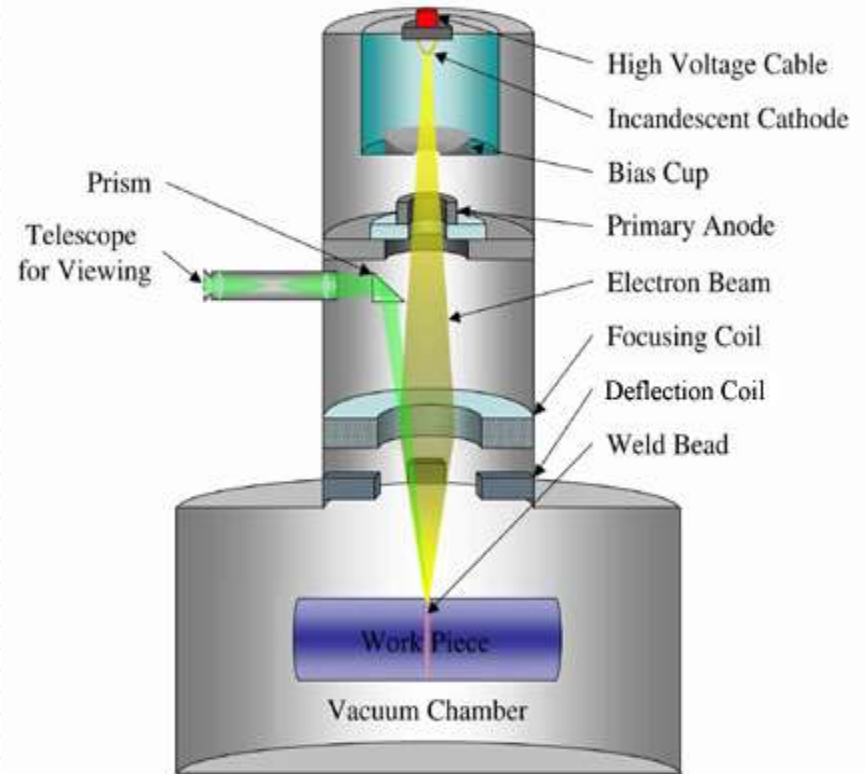
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Electron Beam welding

In an electron beam welder electrons are “boiled off” as current passes through filament which is in a vacuum enclosure.

Electrons are emitted from the heated filament called electrode.

An electrostatic field, generated by a negatively charged filament and a positively charged anode, accelerates the electrons to about 50% to 80% of the speed of light and shapes them into a Beam, having high kinetic energies.

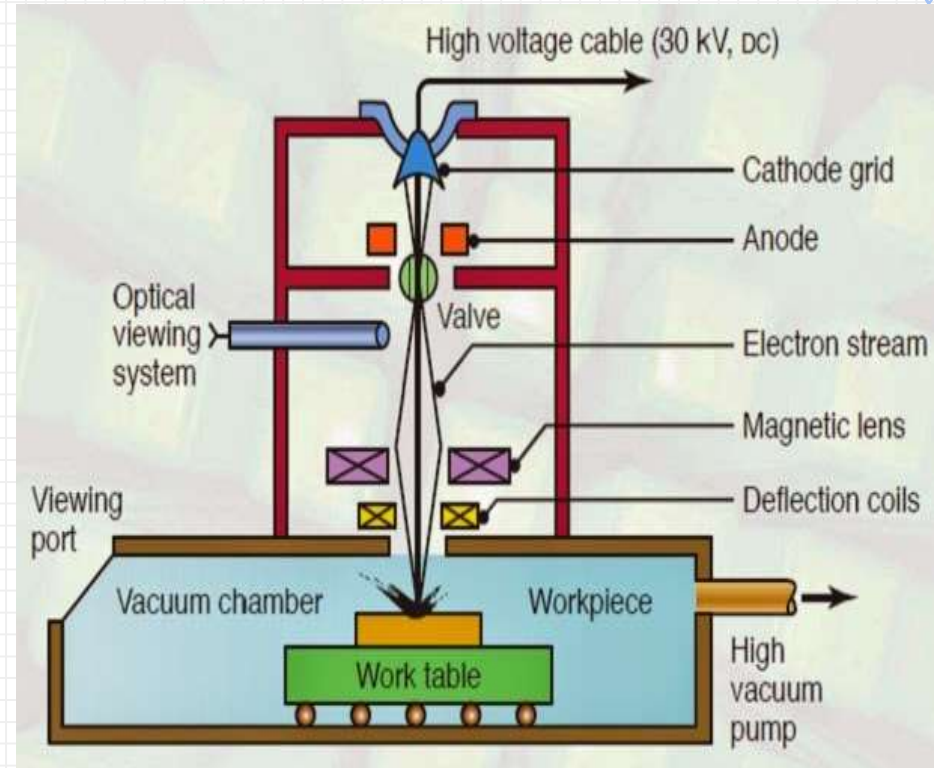


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Electron Beam welding

The stream of electrons then pass through a hole in the anode. The beam is directed by magnetic forces of focusing and deflecting coils.

This beam is directed out of the gun column and strikes the work piece. The kinetic energy of the electrons is transferred to heat upon impact of the work piece and cuts a perfect hole at the weld joint. Molten metal fills in behind the beam, creating a deep finished weld.



<https://tinyurl.com/y5xnh7hb>

Electron Beam welding

Application:

- It is used in aerospace industries and marine industries for structural work
- It is used to join titanium and its alloy.
- This type of welding is widely used to join gears, transmission system, turbocharger etc. in automobile industries.
- It is used to weld electronic connectors in electronic industries.
- This process is also used in nuclear reactors and in medical industries.

Electron Beam welding

Advantages:

- It can weld both similar and dissimilar metals.
- It provides high metal joining rate.
- Low operating cost because no filler material and flux are used.
- It provide high finish welding surface.
- It can used to weld hard materials.
- Less welding defects occur due to whole process carried out in vacuum.

Electron Beam welding

Disadvantages:

- High capital or set up cost.
- High skilled labor required.
- Frequently maintenance required.
- Work pieces size is limited according to vacuum chamber.
- It cannot do at site due to vacuum

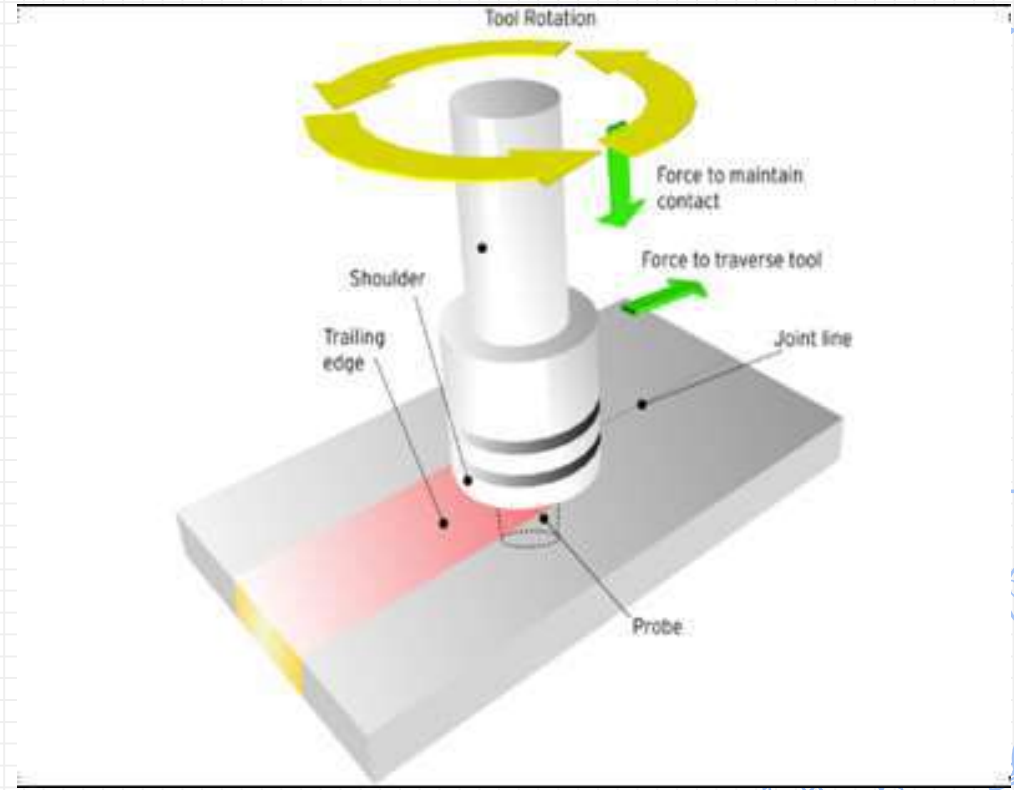
ASSESSMENT

1. In electron beam machine, just after the cathode, there is/are _____
 - a) deflector coils
 - b) a magnetic lens
 - c) bias grid
 - d) port for vacuum gauge
2. Electron is accelerated by _____
 - a) cathode cartridge
 - b) electromagnetic coils
 - c) aperture
 - d) annular anode
3. In the final section of the electron beam gun, electron beam passes through the electromagnetic lens and deflection coil.
 - a) True
 - b) False

Friction Stir Welding

Friction stir welding (FSW) is a solid state joining process (the metal is not melted) that uses a third body tool to join two facing surfaces. Heat is generated between the tool and material.

Frictional heat generated between the wear resistant welding tool and the workpiece along with mechanical mixing heat causes the stirred material to soften without Reaching melting temperature.



<https://tinyurl.com/y5mnevqn>

Friction Stir Welding

High speed steel is used for welding aluminum.

For welding steel and tungsten alloys tungsten and iridium alloy based tool is used.



<https://tinyurl.com/y5mnevqn>

Friction Stir Welding

- **ADVANTAGES**

- Low distortion and shrinkage
- No arc and no porosity
- Can operate in all position
- Energy efficient
- Good mechanical properties fatigue, tensile and bend test

Friction Stir Welding

- **DISADVANTAGES**

- Work pieces must be rigidly clamped
- Keyhole at the end of each weld
- Cannot make joints which required metal deposition
- Initial cost of the machine is very high compared to fusion welding

ASSESSMENT

1. All metallic engineering materials which are _____ can be friction welded.
a) soft b) weldable c) forgeable d) metamaterials
2. Which of the following is not true about friction welding?
a) Dissimilar metals cannot be joined
b) This technique is relatively faster as compared to the other techniques
c) This technique is suitable for any parts of shape or size
d) Sheared surfaces can also be joined by the process
3. Which of the following holds true for friction welding?
a) Hazardous fumes are generated during the process
b) Argon is used as a shielding gas
c) It is a power consuming process
d) There are no solidification defects in the welded parts

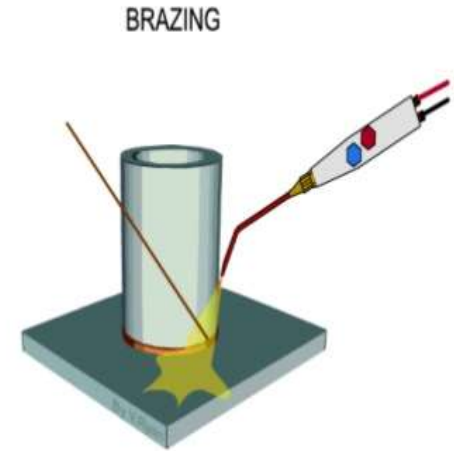
Brazing

- When to use brazing or soldering instead of fusion welding:
 - Metals have poor weld ability
 - Dissimilar metals are to be joined
 - Intense heat of welding may damage components being joined
 - Geometry of joint not suitable for welding
 - High strength is not required

Brazing Methods:

- **Torch Brazing:-**

flux is applied to the part surfaces and a torch is used to focus flame against the work at the joint. A reducing flame is used to prevent the oxidation.



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Brazing

Brazing

- Joining process in which a filler metal is melted and distributed by capillary
- action between faying surface of metal parts being joined
- No melting of base metals occurs
- Only the filler melts
- Filler metal T_m greater than 450 C (840 F) but less than T_m of base metal(s) to be joined.

Advantages of Brazing & Soldering

- **Joining dissimilar metals and non-metals.**
- **Low temperature compared to welding.**
- **less thermal distortion.**
- **Less chance of damage**
- **Speed of joining.**
- **Less manual skills.**



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Brazing

Disadvantages and Limitations of Brazing

- Joint strength is generally less than a welded joint
- Joint strength is likely to be less than the base metals
- High service temperatures may weaken a brazed joint
- Color of brazing metal may not match color of base metal parts, a possible aesthetic disadvantage

Brazing

Brazing Applications

- Automotive (e.g. Joining tubes and pipes)
- Electrical equipment (e.g. joining wires and cables)
- Cutting tools (e.g. brazing cemented carbide inserts to shanks)
- Jewelry
- Chemical process industry
- Plumbing and heating contractors join metal pipes and tubes by brazing
- Repair and maintenance work

Soldering

Soldering

- Joining process in which a filler metal with T_m less than or equal to 450°C is
- melted and distributed by capillary action between faying surfaces of metal parts being joined.
- No melting of base metals, but filler metal wets and combines with base metal to form metallurgical bond.
- Soldering similar to Brazing, and many of the same heating methods are used.
- Filler metal called solder.
- Most closely associated with electrical and electronic assembly.(wire soldering)

Soldering

Advantages :

- • Lower energy than brazing or fusion welding
- • Variety of heating methods available.
- • Good electrical and thermal conductivity in joint.
- • Easy repair and rework.

Disadvantages :

- • Low joint strength unless reinforced by mechanically means.
- • Possible weak or melting of joint in elevated temperature service.

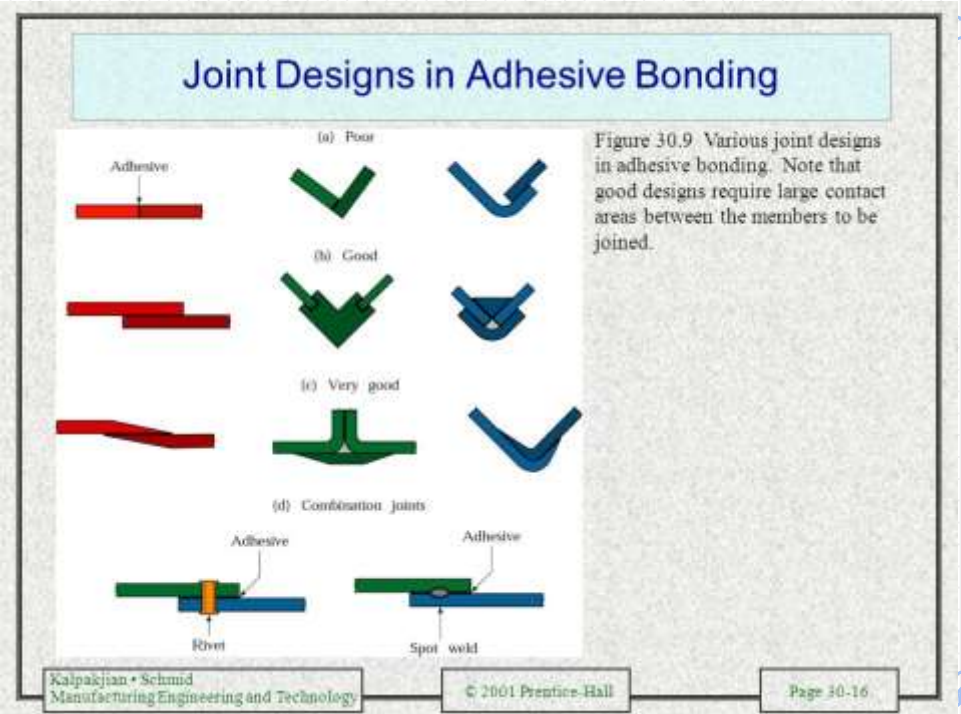
Filler metals in soldering

- Usually alloys of tin(Sn) and lead(Pb).Both metals have low melting
- temperature.
- In soldering copper, copper and tin form inter metallic compounds that
- strengthen bond.
- Silver and antimony also used in soldering alloys.

Adhesive Bonding

An adhesive is a medium that allows the surfaces of two or more components to be attached or bonded together”.

- They are hugely used across the construction industries.
- Mechanical fixings can weaken or affect material structure



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Types of Adhesives

Natural adhesives are made from inorganic mineral sources, or biological sources. A simple paste of natural adhesive can be made by mixing flour and water. **Animal glue** was the most common woodworking glue for thousands of years.

Thermoplastic adhesives – These types of adhesives may be in the form of a solid which softens when heated and when cooled will regain their original form and strength.

Thermosetting adhesives – These types of adhesives are resins which become solid through a chemical reaction or by applying heat. Once set they can not be reformed.

Natural rubber is often vulcanized, a process by which the rubber is heated and sulfur, peroxide or bisphenol are added to improve resilience and elasticity, and to prevent it from perishing. □ Tapes are made from mixing rubbery material with adhesives

Types of Adhesives

BSI Classification

MR – Moisture resistant, Int – Interior.

Adhesive Classification		Moisture resistance		Gap filling	General usage
N	Casein	Poor	Int.	Yes.	Not in general use today
S	Urea Formaldehyde (Thermosetting)	Fair	MR	Some	The most common adhesive used for general purpose assemble work and manufactured boards. Used in plywood and Particleboards.
	Melamine Formaldehyde (Thermosetting)	Good	BR	Types	
	Phenol formaldehyde (Thermosetting)	Very good	WBP	Yes	
	Resorcinol Formaldehyde (Thermosetting)	Very good	WBP	Yes	Used in outdoor timber structures.
	Polyvinyl acetate (thermoplastic)	Poor to good	Int or MR	May be	Internal joinery and veneering.
.S, N	Contact (Thermoplastic)	Fair	Int	GAP	Used for plastic laminates and veneers
S	Epoxy (Thermosetting)		Int	Yes	Very limited use - used to bonad timber to metal

ASSESSMENT

1. The filler metal used in brazing has melting point of above

- a) 200°C b) 300°C c) 420°C d) 520°C

2. Which of the following is function(s) of flux used in brazing?

- a) Protect surface from oxidation
b) Reduce surface tension of filler
c) Assist its penetration
d) All of the above

3. Zinc chloride finds application in

- a) TIG welding b) Thermit welding c) Soft soldering d) Brazing
e) Post weld cleaning

The slide features a light blue grid background. The corners are decorated with various hand-drawn science and technology icons in blue. Top-left icons include a yellow gear with a brain inside, a beaker with 'H2O', a lightbulb, a globe, and a rocket. Top-right icons include a smartphone, a globe with 'SNSCT INSTITUTIONS', a microscope, a cell, a star, and a test tube. Bottom-left icons include a lightbulb, a brain, a molecular structure, a graph, and a book. Bottom-right icons include a heart rate line, a globe, a microscope, a planet, and a rocket.

THANK YOU