

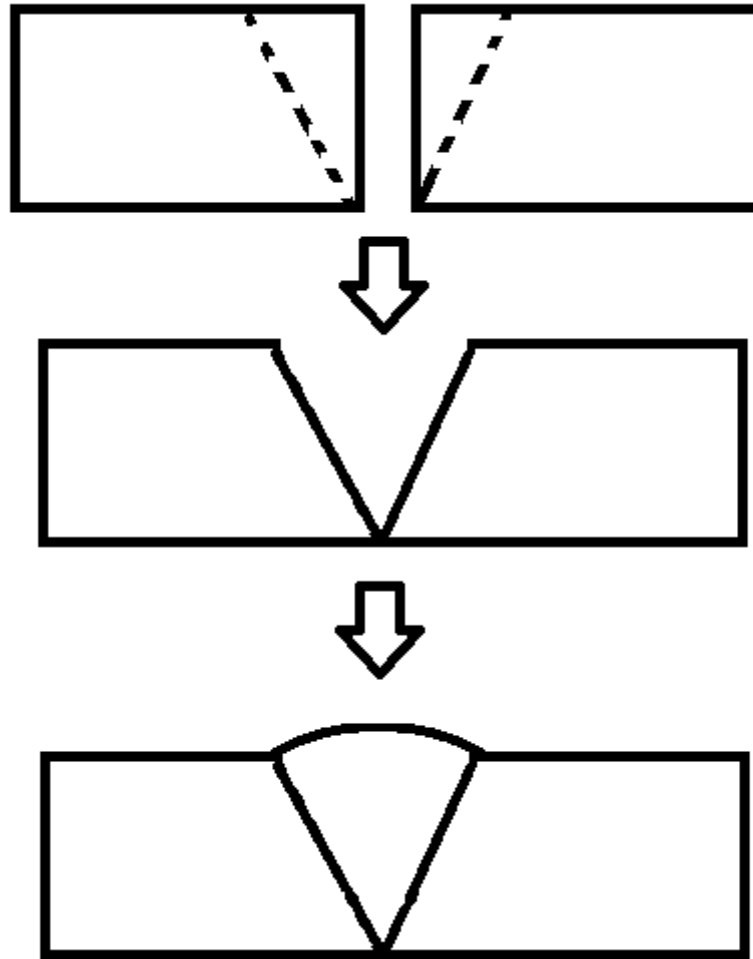
MEM 3501

Welding Technology

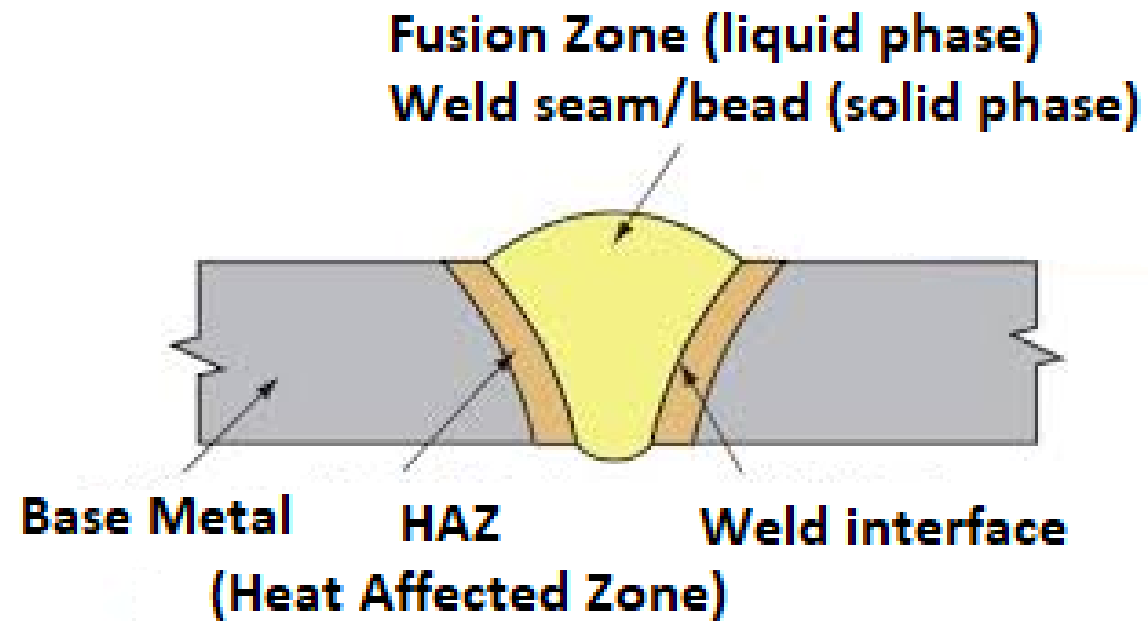
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Joining Processes



Joint



Fusion Zone (FZ)

A fusion zone is a section of material that is present after an object has been welded. A fusion zone begins and ends at the portions of the material that have been coalesced, and will have a chemical composition that is a mixture of the substrates being welded together and any additional filler material that may have been used.

The fusion zone is often confused with other parts of the the weld. The fusion zone is strictly the portion of materials that have undergone melting. The material that has been altered due to the heat of the welding, but not fully melted (the heat affected zone), is not considered the fusion zone.

Fusion Zone (FZ)

The fusion zone will be comprised of all the welded materials and any welding filler material (if one was used). However, the fusion zone may not have an equal balance of all the materials that were welded. The amount of each parent material in the fusion zone is known as the percent dilution. The prevalence of one material over another in the fusion zone can vary widely as a result of welding technique, material thickness and material type.

Fusion Zone (FZ)

The fusion zone itself is comprised of several parts. The section of the fusion zone that protrudes over top of the base material after welding on the side of the material where welding was initiated is known as the face reinforcement portion of the fusion zone. The portion of material that protrudes on the side of the material opposite of the initial welding is known as the root reinforcement.

HAZ (Heat Affected Zone)

The heat affected zone (HAZ) is a non-melted area of metal that has undergone changes in material properties as a result of being exposed to high temperatures. These changes in material property are usually as a result of welding or high-heat cutting. The HAZ is the area between the weld and the base metal.

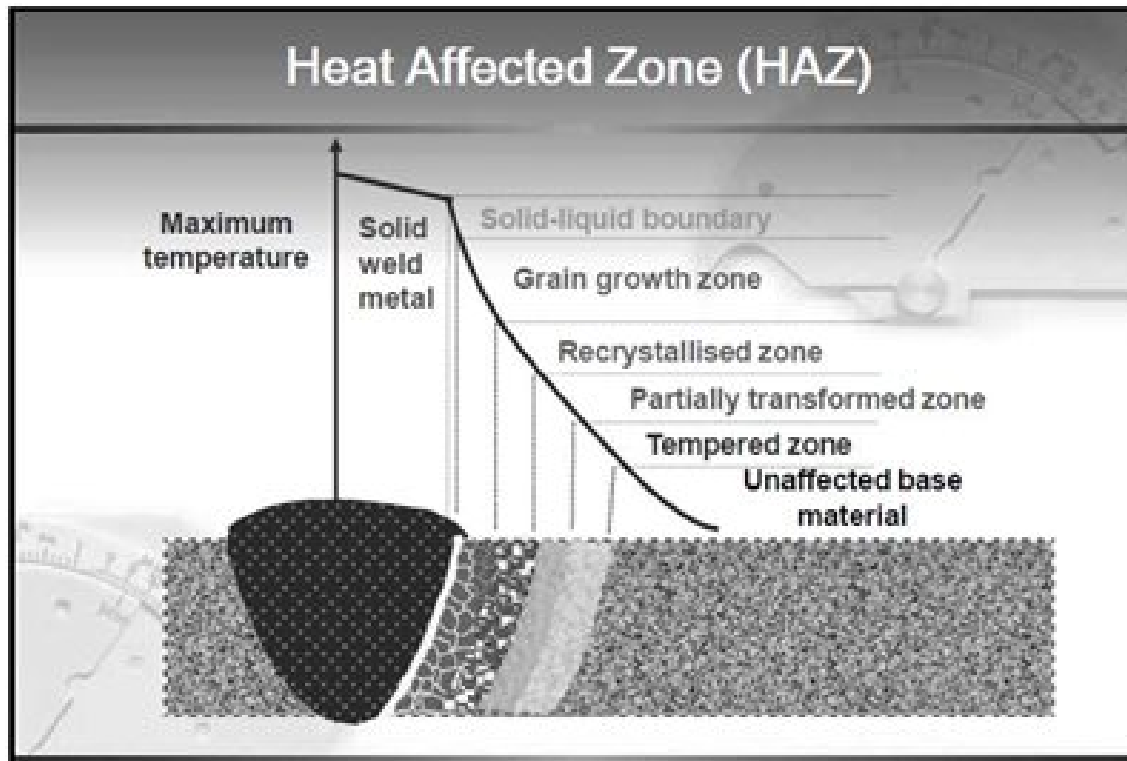
HAZ (Heat Affected Zone)

The heat affected zone is influenced by the level of thermal diffusivity, which is dependent on the thermal conductivity, density and specific heat of a substance. Those materials with a high level of thermal diffusivity are able to transfer variations of heat faster, meaning they cool quicker and, as a result, the HAZ is reduced. On the other hand, those materials with a lower coefficient retain the heat, meaning that the HAZ is wider. Generally speaking, the extension of the HAZ is dependent on the amount of heat applied, the duration of exposure to heat and the properties of the material itself. When a material is exposed to greater amounts of energy for longer periods the HAZ is larger.

HAZ (Heat Affected Zone)

With regard to welding procedures, those processes with high rates of heat input will cool faster, leading to a smaller HAZ, whereas slower rates of heat input will have a slower rate of cooling, leading to a larger HAZ. In addition, the size of the HAZ also grows as the speed of the welding process decreases. Weld geometry is another factor that plays a role in the HAZ size.

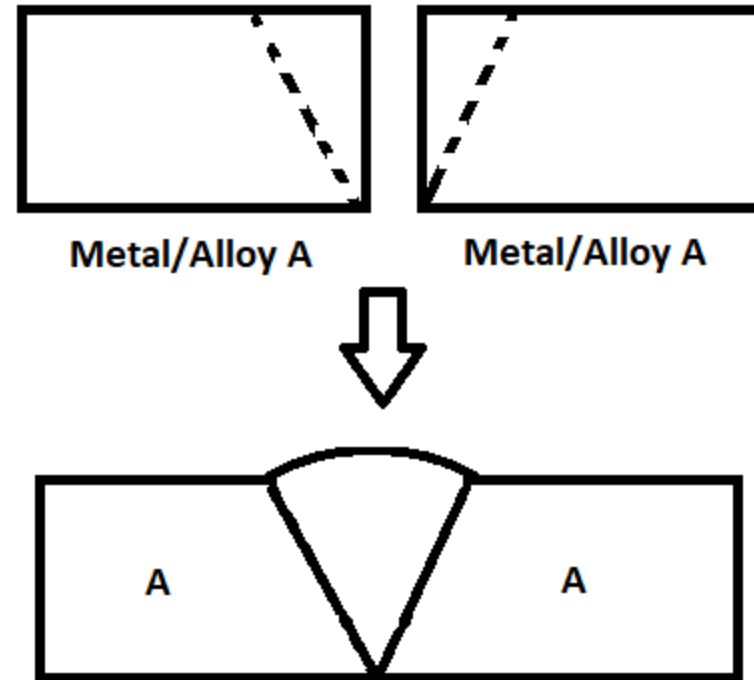
HAZ (Heat Affected Zone)



Base Metal

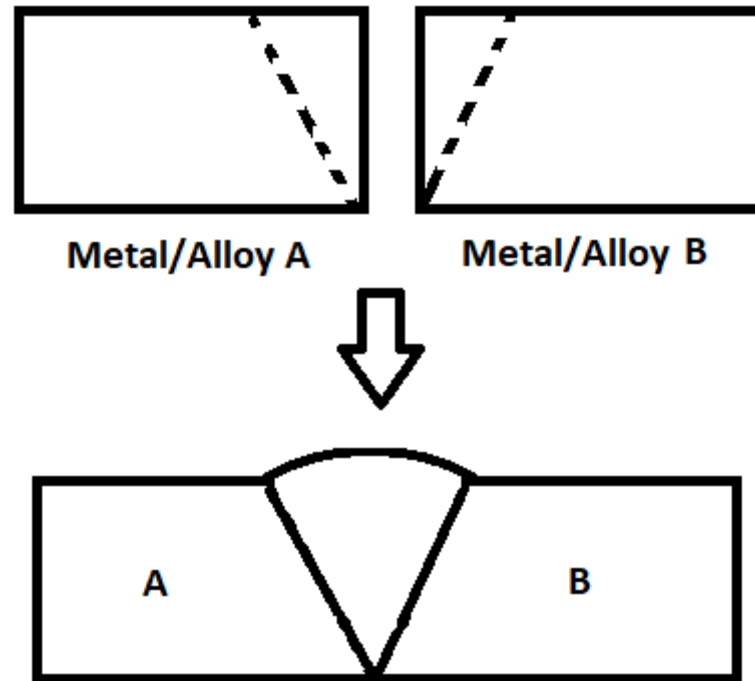
A base material is the parent material to which a coating or plating is applied. The term base material helps to differentiate between the overall part, the various layers and the original base material. Base materials are very important in coating, electroplating, welding and soldering.

Similar Welding



If we join same metal/alloy, it is called similar welding

Dissimilar Welding



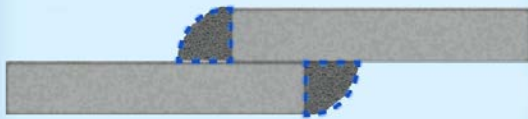
If we join different metal/alloy, it is called dissimilar welding

Types of Joint

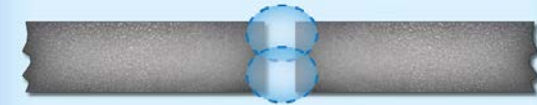
The basic weld joint designs in fusion welding can be classified as the butt, lap, T-, edge, and corner joints. The surface of the weld is called the face, the two junctions between the face and the workpiece surface are called the toes, and the portion of the weld beyond the workpiece surface is called the reinforcement.

Types of Joint

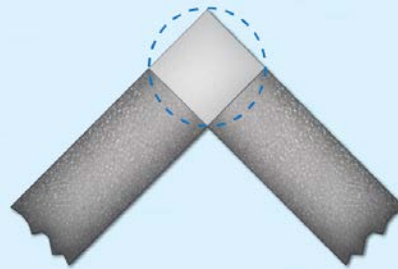
Lap Joint



Butt Joint



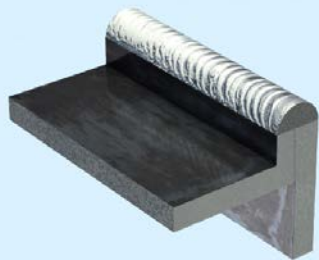
Corner Joint



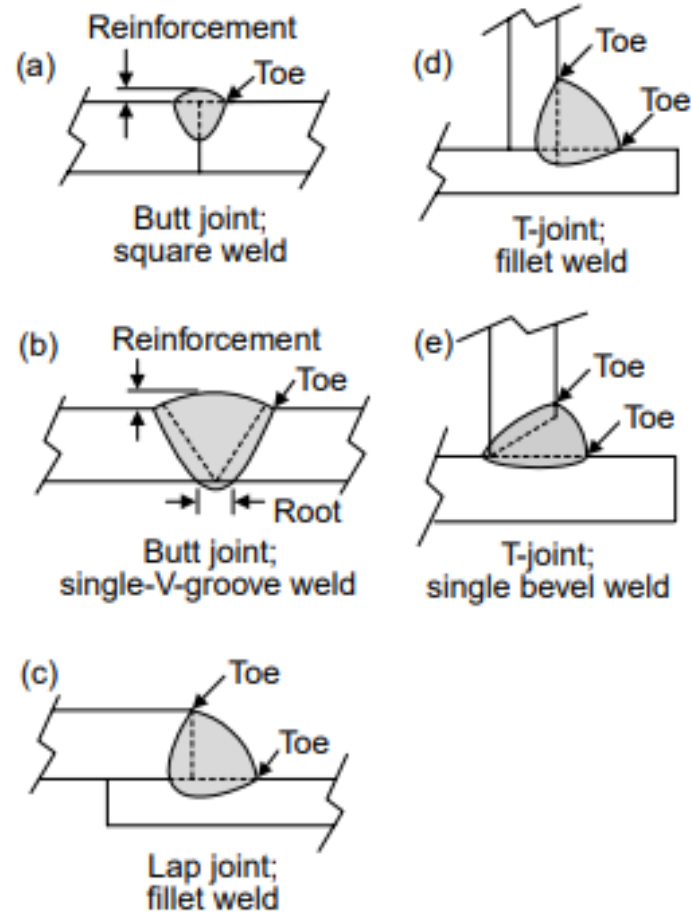
Tee Joint



Edge Joint



Parts of the weld seam



Common Terms

Arc Burn

- Arc burn is a metallurgical notch caused by ground clamps or striking an arc on the base metal at any point other than the weld groove or immediate area that will be covered with the weld cap.

Base Metal

- The base metal is the metal that is to be welded or cut. It is commonly referred to as the workpiece.

Butt Weld

- A butt weld is a joint between two workpieces that are aligned on the same plane.

Cover Pass

- The cover pass finishes the welded joint. It is higher than the adjacent surface and overlaps the groove.

Common Terms

Filler Pass

- The filler pass follows the hot pass and fills the weld groove flush, or almost flush, with the surface of the workpieces.

Fillet Weld

- A fillet weld is the joining of two workpieces with triangular cross-sections at approximately 90 degrees.

Heat-Affected Zone

- The heat-affected zone is the area of metal near the weld metal that was not melted during welding, but did experience changes in its mechanical properties and/or microstructure due to the heat applied.

Common Terms

Hot Pass

- The hot pass is the pass immediately following the previous pass.

Polarity

- Polarity is the manner in which the electrode holder and workpiece connect to the electrical supply. This can be either direct current electrode negative, or DCEN, meaning straight polarity or direct current electrode positive, or DCEP, meaning reverse polarity.

Common Terms

Spot Weld

- Spot welding is the process in which the weld pieces are pressed together with pressure, then a current is passed through them in a small spot and the two pieces are melted together at that location. Spot welding can be performed on metals from 0.5 to 3 mm.

Root Bead

- Root bead, is the first pass in the weld. It is typically made without any weaving motion.

Weld Groove

- Weld groove refers to a V- or U-shaped groove created by the beveling of the workpiece edges that will be joined.

Common Terms

Weld Metal

- The weld metal is the portion of the base metal that is melted during the welding process.

Weld Pass

- A weld pass is a single progression of welding along the joint. After a complete pass, it is referred to as a weld bead.

Welding Electrode

- In arc welding, the electrode is used to pass current through the workpiece to fuse the two pieces together.