

Welding Technology

Welding Methods

Fusion welding methods

Solid state welding methods

Fusion Welding Methods

- Oxy-acetylene Welding
- Shielded Metal Arc Welding (Manual Metal Arc Welding)
- TIG Welding
- MIG Welding
- MAG Welding
- Submerged Arc Welding
- Plasma Arc Welding
- Electron Beam Welding
- Laser Beam Welding

Oxy-Acetylene Welding (Principles)

It is one of the common fusion welding method.

The oxy-acetylene welding process combines oxygen and acetylene gas to provide a high temperature flame for welding.

The process provides enough heat for joining the materials.

The chemical reaction between acetylene and oxygen is exothermic in nature.

Oxy-acetylene flame may also be used for all types of brazing.

Oxy-acetylene welding is a manual process.

Oxy-Acetylene welding is a fusion welding process in which welding is done by heating workpiece with flames obtained from oxyfuel gases.

In these process, a mixture in proper proportion of such as acetylene, liquefied petroleum, methyl acetylene propane, natural gas and hydrogen are burnt to get flame.

This flame can be used to melt the metal and flame is directed by welding torch.

A filler metal is sometimes added, which is available as rod or wire with or without flux

Oxy-Acetylene Welding

Blister Gas:

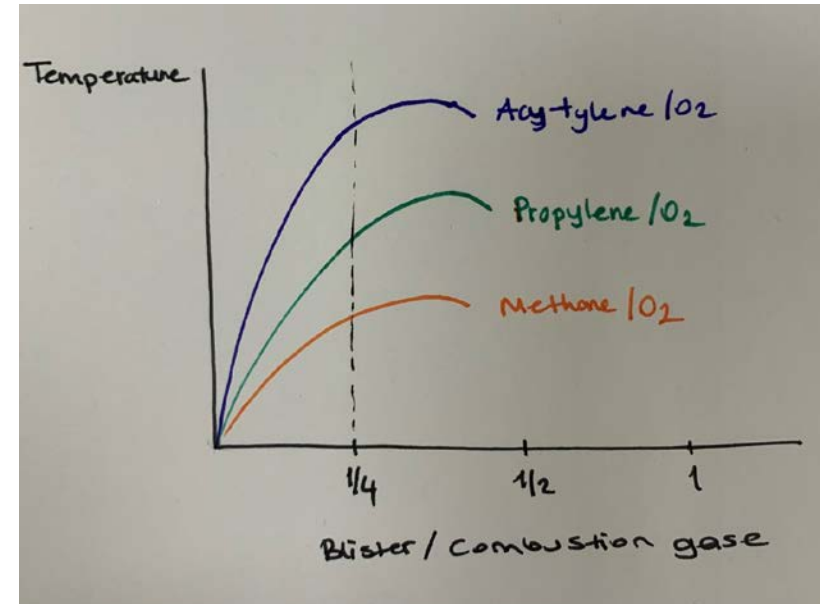
Oxygen (O_2)

Combustion Gas:

Acetylene

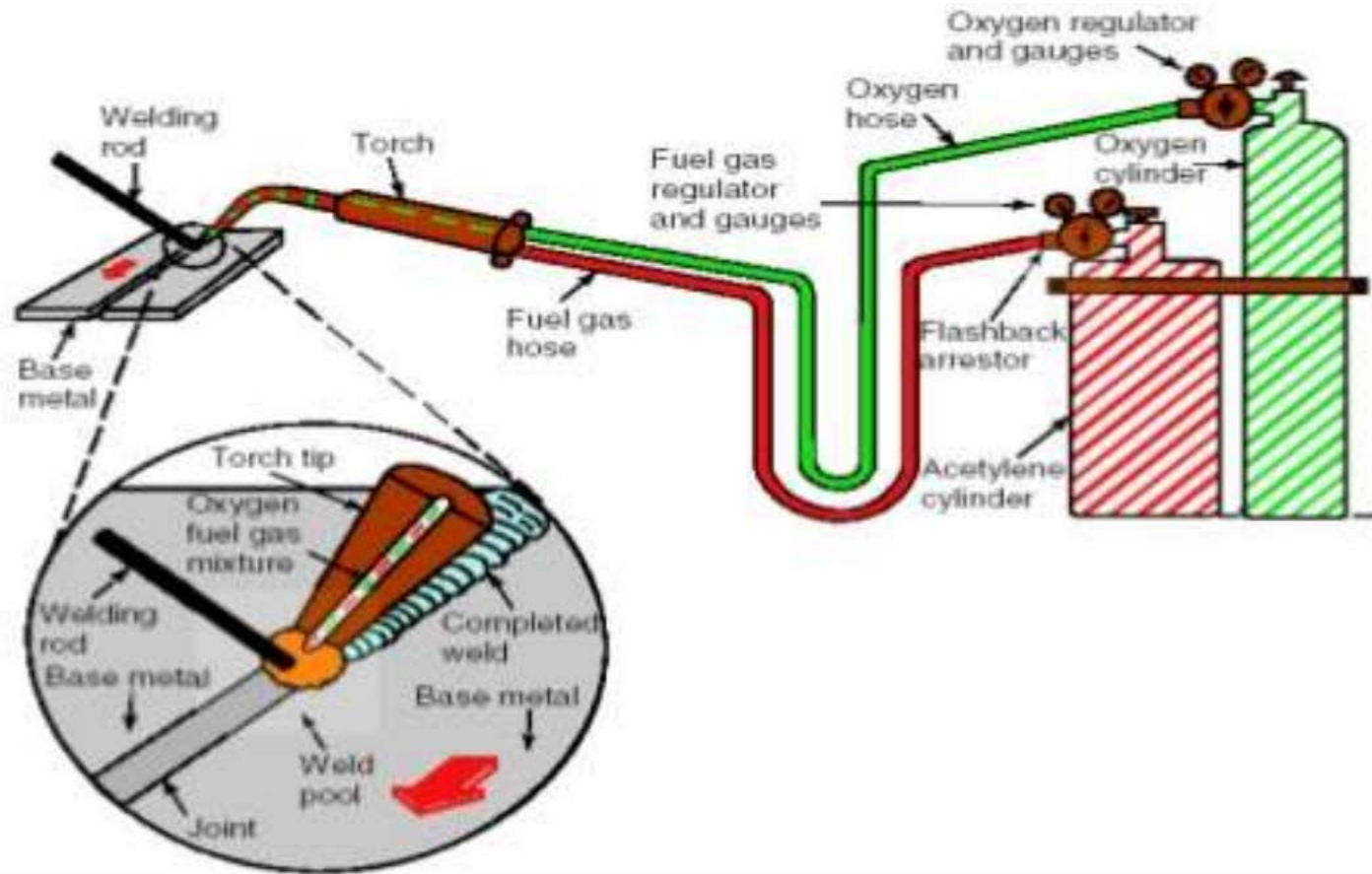
Methane

Propylene



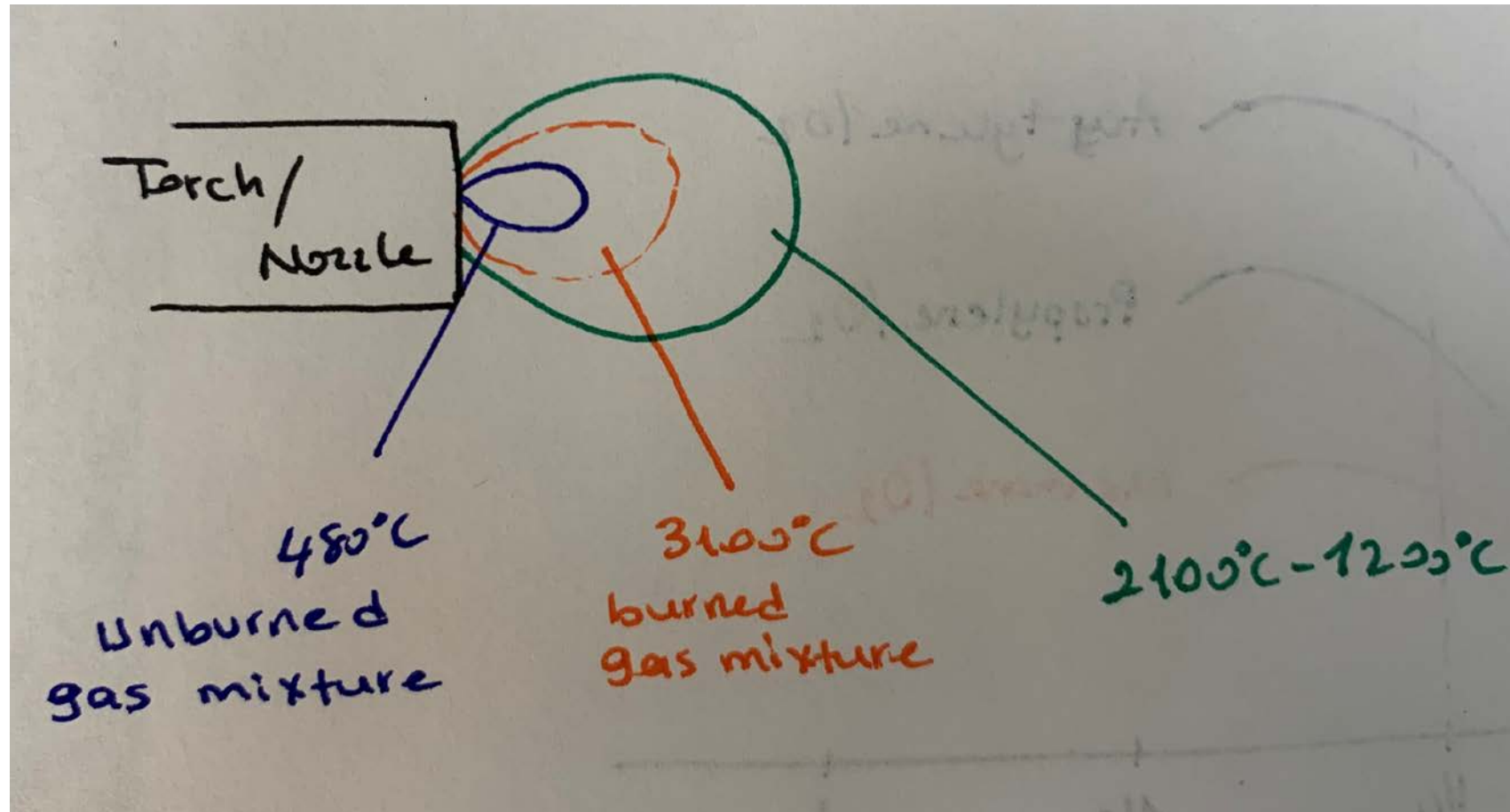
The flame temperature obtained from mixture of blister and combustion gases should be chosen at the best values for providing the melting of materials.

Oxy-Acetylene Welding

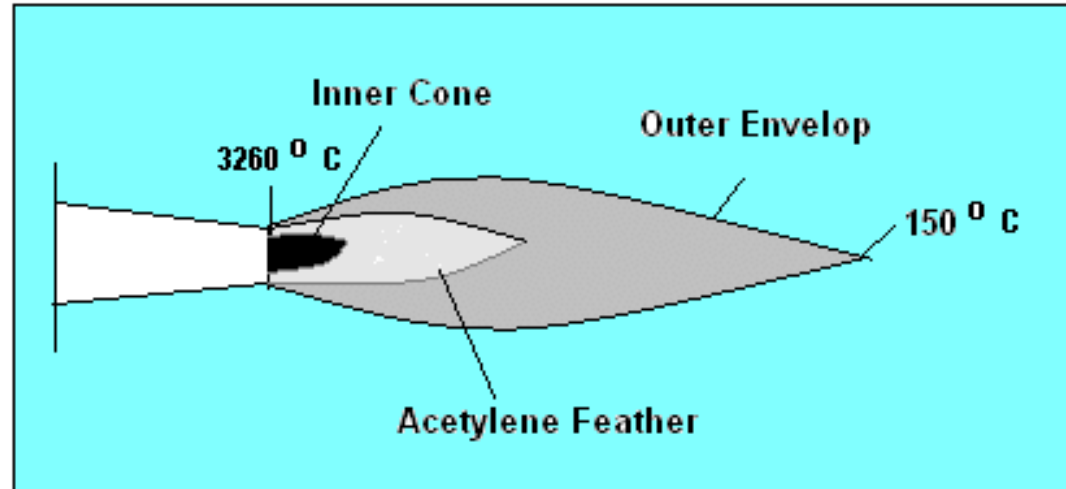
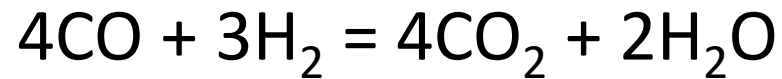
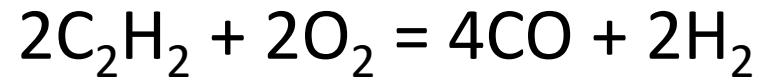


Firstly, oxygen valve is opened, and oxygen is fed to mixing zone for cleaning the gas channels. Then, acetylene vent is opened, and the flame is formed by firing the acetylene.

The characteristic of the flame



Reactions

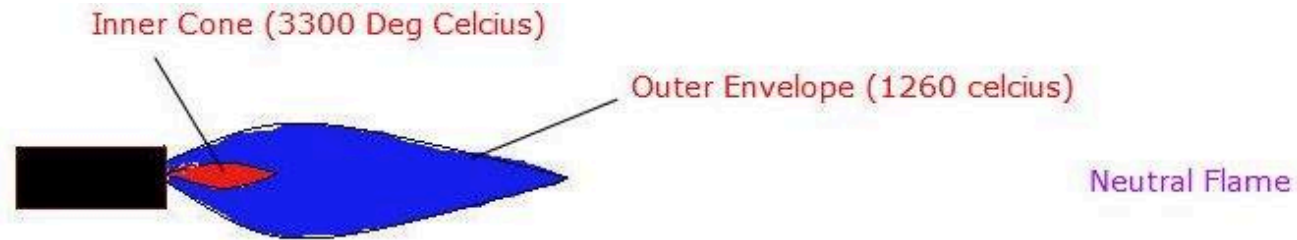


Welding process is carried out by using mixture of acetylene and oxygen gases. The flame comprises of 3 zones;

Unburned gas mixture/480 °C.

Burned gas mixture/3100 °C.

Flame tip/2100-1200 °C.



50% oxygen + 50% acetylene
Neutral flame
Steel



↑oxygen + ↓acetylene
Oxidizing flame
Copper and brass



↓oxygen + ↑acetylene
Carburising flame
Cast iron

Neutral flame

If acetylene and oxygen are present in equal proportions(1:1),then neutral flame is produced.

For most welding operations, neutral flame is used, since it has least chemical effect on heated metal.

Oxidizing flame

If flame has high oxygen content (ratio of oxygen and acetylene is 1.5:1), then oxidizing flame is produced.

Such flame are used in welding of copper and copper alloys(brass and bronze).

This flame is harmful for steel because it oxidizes the steel.

Carburising flame

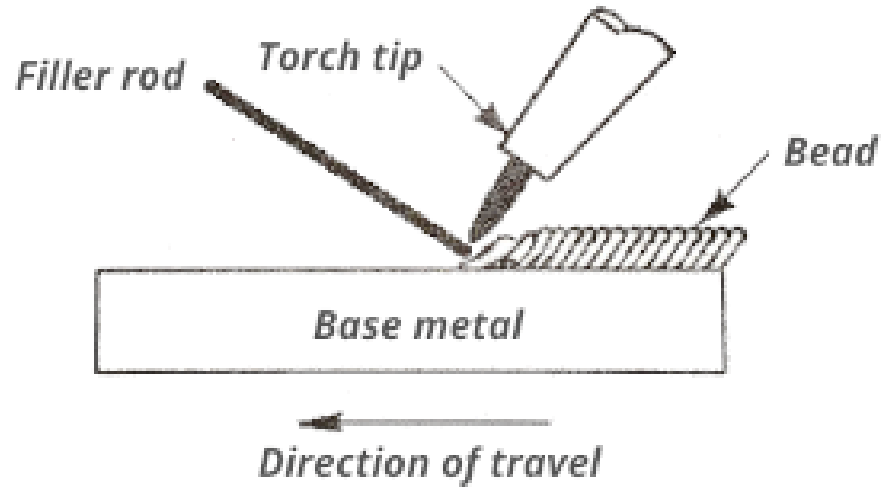
These flame contain excess of acetylene.

It is suitable for application of requiring low heat.

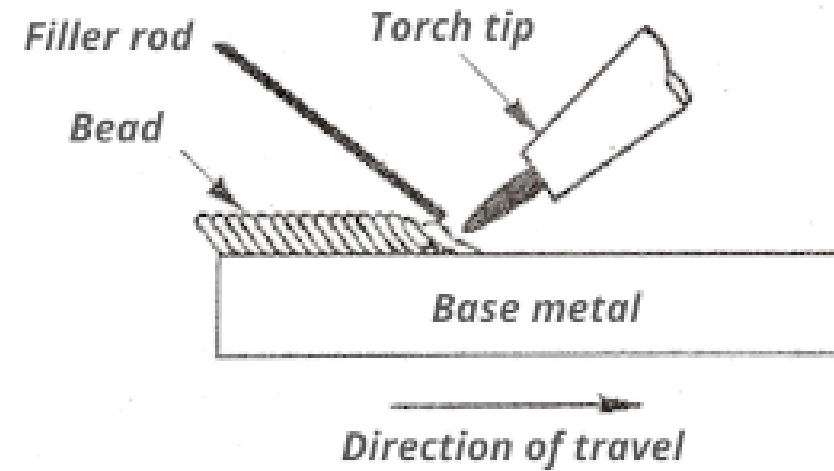
Carburizing flame is used in welding of monel metal, nickel, high-carbon steel and many of non-ferrous.

Steel is rarely welded by using this flame.

Gas welding techniques



(a) Forehand technique



(b) Backhand technique

Forehand technique is relatively used in thin metal.

Backhand technique is used on heavier or thicker base metal.

Advantages

The equipment cost is low and requires little maintenance.

It is portable and can be used anywhere.

The gas flame is generally more easily controlled.

The process can also be used for cutting.

Filler metal can be properly controlled.

Can be used in all weld positions.

Limitations

The process is very slow. Therefore, it has been largely replaced by arc welding.

Proper operator training and skill are also essential.

In some cases, there is loss of corrosion resistance.

Less efficiency ,since the heat transfer rate is poor when compared to arc welding.

Heat source is not concentrated ,a large area of the metal is heated, and distortion is likely to occur.

Main Hazards

Fire caused by heat, sparks, molten metal or direct contact with the flame.

Explosion when cutting up or repairing tanks or drums which contain or may have contained flammable materials.

Fire/explosion caused by gas leaks, backfires and flashbacks.

Fire/burns resulting from misuse of oxygen.

Crushing or impact injuries when handling and transporting cylinders.

Materials Suitable for Oxy-Acetylene Welding

Plain carbon steel and low –alloy steel.

Cast iron (best results)

Stainless steel

Aluminum and magnesium

Copper and copper alloys

Mild steel

Lead

METAL	FLAME
MILD STEEL	NEUTRAL
LEAD	NEUTRAL
GREY CAST IRON	SLIGHTLY OXIDISING
ALLOY STEEL	NEUTRAL
ALUMINIUM	SLIGHTLY CARBURIZING
NICKEL ALLOY	SLIGHTLY CARBURIZING
COPPER	NEUTRAL