## Reflection Assignment

**Topic:** Read the article below and write a short reflection

**Criteria:**

1. One paragraph (4-7 sentences)
2. Maximum 12 pt. font, Times New Roman.
3. Double spaced text

**Deadline:**

1. **4.10.2020 by 3:00pm**
2. Any work not turned in on time will be graded a **ZERO.**

**REMINDER:**

1. If you have any questions, feel free to ask.
2. Office hours Tuesday and Thursday, 8:00 to 11:00am
3. jkotarski@sun-tech.org
4. 570.966.1031 x149 leave a message.

# Effects of Shielding Gases in GMAW

Using the right shielding gas is essential not only to prevent porosity but to get proper penetration, the mechanical properties you desire including weld strength, and overall weld quality. In order to select the right shielding gas you need to consider the following:

- Alloy of filler metal
- Material thickness
- Mode of GMAW (spray, short-arc, & globular)
- Welding position
- Desired penetration profile
- Cost

**The typical welding gases are**:
Carbon Dioxide
Argon
Argon blends (with Carbon Dioxide, Helium, Nitrogen, Hydrogen and Oxygen).
Gases can be separated into two categories: Inert and Reactive.

## Inert Gases

Argon and Helium are inert gases. This means that neither gas will chemically react with the molten weld pool. Argon is the most widely use inert gas since it is readily available and inexpensive compared to helium. It produces a finger-like penetration profile (see images below). Helium has a very high thermal conductivity compared to Argon and it is used for a hotter arc. It is also used on stainless steel tri-mix gas. Helium provides a broad but shallow penetration. Helium and argon are usually mixed when welding aluminum that is 1” or thicker or in thinner sections to compensate for an undersized power source.

## Reactive Gases

Carbon Dioxide, Oxygen, Nitrogen and Hydrogen are reactive shielding gases. These gases combine chemically with the weld pool affecting mechanical and chemical properties of the weld metal. Carbon Dioxide is the only one that can be used alone. All can be combined with Argon to get binary shielding gas blends. With the exception of stainless steel tri-mixes, most are only a combination of Argon and one of the reactive gases.

Image 1 below shows effects on bead contour and penetration for the various gases. Figure 2 shows the effect of oxygen versus carbon dioxide when used in argon blends and 100% carbon dioxide.

FIGURE 1: Bead contour and penetration patterns for various shielding gases

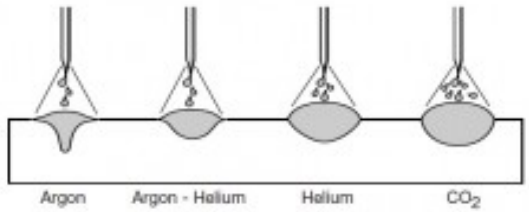
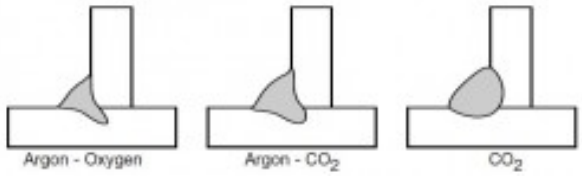



FIGURE 2: Relative effect of Oxygen versus $CO_2$ additions to the argon shield




The table below shows the most common welding gases used in arc welding by material type. It also shows which gas to use according to the desired mode of metal transfer (i.e. Short Circuit or Spray). Other gases can be used, especially in argon blends, but these are the most common.

| Common Shielding Gas for Arc Welding | | | | | |
|---|---|---|---|---|---|
| | Arc Welding Process | | | | |
| Material | TIG | Flux Core w/ Gas | | MIG | Metal Core [1] |
| | | | Transfer Mode | | |
| Carbon Steel | 100% Ar | 100% $CO_2$ or 75Ar/25$CO_2$ | Short Circuit | 100% $CO_2$ or 75Ar/25$CO_2$ | 100% CO2 or 75Ar/25$CO_2$ |
| | | | Spray / Pulse | 90Ar/10$CO_2$ [3] | 90Ar/10$CO_2$ [3] |
| Low Alloy Steel | 100% Ar | 100% $CO_2$ or 75Ar/25$CO_2$ | Short Circuit | 75Ar/25$CO_2$ [4] | 75Ar/25$CO_2$ [4] |
| | | | Spray / Pulse | 98Ar/2$O_2$ [5] | 98Ar/2$O_2$ [5] |
| Stainless Steel | 100% Ar | 100% $CO_2$ or 75Ar/25$CO_2$ | Short Circuit | 90He/7.5Ar /2.5$CO_2$ | N/A |
| | | | Spray / Pulse | 98Ar/2$O_2$ [6] | 98Ar/2$O_2$ [6] |
| Aluminum | 100% Ar [2] | N/A | Spray / Pulse | 100% Ar [2] | N/A |
| Nickel Alloys | 100% Ar | N/A | Short Circuit | 100% Ar | N/A |
| | | | Spray / Pulse | 100% Ar or 75Ar/25He | |
| Copper Alloys | 100% Ar [2] | N/A | Spray / Pulse | 100% Ar or 75Ar/25He | N/A |

Notes:

1) While it is possible to operate metal cored electrodes in a short circuit transfer, arc performance is poor. They operate at their best in a spray arc or pulse spray arc metal transfer mode.

2) On thicker plates, 100% He or an Ar /He mix may be used for more radiated heat into the plate.

3) Other Ar/$CO_2$ blends may be used, with a minimum of 82% Ar (sometimes 80Ar/20$CO_2$ blends are used).

4) 100% $CO_2$ shielding gas may also be used.

5) Other gas mixes that may be commonly used include 95Ar/5$CO_2$ and 90Ar/10$CO_2$

6) Other gas mix may be 98Ar/2$CO_2$

There literally are hundreds of shielding gas mixes. Slightly playing with the percentages of each component can in some cases provide a very desirable effect. Some mixes will have components, such as nitrogen, in the parts per million range, yet it will create a significant effect.

This video shows the difference between 100% CO2 and 75% argon 25% CO2.
https://www.youtube.com/watch?v=J87Z4NRvTn0

Article excerpted from: http://weldinganswers.com/effects-of-shielding-gases-in-gmaw/