GMAW (solid wire) vs. FCAW (flux-cored wire)

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There are many different welding processes and wires so it can be confusing knowing which one will fit your application the best? We are going to examine the differences between GMAW (solid wire) vs. FCAW (flux-cored wire). These processes are both very popular and have some similarities but also some big differences. To determine what process you should use you need to look at some important variables. Some of the variables would be the thickness of the material, shielding gas, wire feed speed, voltage settings, location of the work site and weld appearance. There is no one size fits all welding solution and all of the above variables listed will affect the operators decision to use solid wire or flux cored wire.

Gas metal arc welding (GMAW) is identified by the American Welding Society, is also popularly known as MIG (Metal Inert Gas) and uses a continuous solid wire electrode for filler metal and an externally supplied gas (typically from a high-pressure cylinder) for shielding. The wire is usually mild steel, typically copper coated to protect it from rusting, improve electrical conductivity, increase contact tip life and generally improve arc performance.

The welder must be setup for DC + (direct current reverse polarity). The shielding gas is usually a mixture of argon and carbon dioxide or straight carbon dioxide. The purpose of the shielding gas is to protect the molten metal from reacting with the atmosphere. Shielding gas flows through the gun and cable assembly and out the gun nozzle with the welding wire to shield and protect the molten weld pool. Molten metal is very reactive to oxygen, nitrogen and hydrogen from the atmosphere, if exposed to it. MIG welding is usually only performed indoors where you have proper protection from wind because a slight breeze can blow the shielding away and cause porosity, therefore welding outdoors is usually avoided unless you have proper windscreens.

Flux-cored arc welding (FCAW) is identified by the American Welding Society, or also referred to as flux-cored, is different in that it uses a wire which contains a flux material in its core that when burned by the heat of the arc, produce shielding gases and fluxing agents to help produce a sound weld. There are two types of flux cored wires: gas shielded and self shielded.

Gas shielded flux cored wires require external shielding gas and the slag is easy to remove. The shielding gases most commonly used is very similar to GMAW in that you can use straight Co2 or an argon/Co2 blend. The operator may want to consider using gas shielded flux cored wires when welding on thicker metals or in out-of-position applications. Gas shielded flux cored wires have a flux coating that solidifies more quickly than the molten weld material. As a result, it creates a "shelf" to hold the molten pool when welding overhead or vertically up. Just like GMAW, gas shielding flux cored should be run on DC + (direct current reverse polarity)

Self shielding flux cored wire does not require external shielding gas. The weld pool is protected by gas generated when flux from the wire is burned. A "drag" or pull angle for the gun is specified which improves operator visibility. Self-shielded wire is different from gas shielded wire in that it must operate on DC – (direct current straight polarity). Self shielding flux cored wire is very portable because it does not require an external shielding gas. The shielding flux is very efficient and can endure a strong breeze. Self shielded wire is often used in the construction industry where welding outdoors is very common. It is a perfect fit for them because they don't need to worry about lugging a cylinder around and trying to have the proper windscreens. This process is much more efficient than the manual process of Shielded metal arc welding (SMAW) or also referred to as stick welding because you have a wire feeder which makes this a semi-automatic process. Farmers have also found self shielded wire to help out because they can make quick fix by repairing a broken machine out in the middle of the field in record time. A downfall is that there is more slag in this process than gas shielded flux cored and it can be messy to chip and clean.

In summary there are many advantages and disadvantages to both GMAW & FCAW processes. Some advantages to GMAW is there is lower spatter and no slag which saves time on chipping off and overall cleaning time. Cosmetically your weld appearance may appear nicer due to lower spatter levels than flux-cored. The arc is softer and less likely to burn through thin material.

The GMAW process is the easiest type of welding to learn and tends to be more forgiving if the operator is somewhat erratic in holding arc length or providing a steady travel speed. If you are skilled and get specific proper guns, shielding gas, liners, drive rolls, and electrode, GMAW can weld a wider range of material including thinner materials and different materials such as stainless, nickel alloys or aluminum.

Some disadvantages in GMAW process is that it requires an external shielding gas which is not cheap. In most cases you must rent or lease a cylinder from a gas supplier and then pay the cost to get it filled. When using a shielding gas it also requires additional equipment, such as a hose, regulator, solenoid (electric valve) in the wire feeder and flow meter. GMAW is not the most practical choice if you are looking for a quick fix with out additional cost or if you're looking for portability and convenience. GMAW can be used for out-of-position welding but it much slower than flux cored wires because usually it is limited to short-circuit transfer, which is restricted by many welding codes due to the tendency for lack-of-fusion. It also requires the steel you are welding on must be very clean

Some advantages of self-shielded wire are that it's optimal for outdoor procedures since the flux is built into the wire for positive shielding even in windy conditions. An external shielding gas and additional equipment are not needed, so it is much cheaper and quicker to start welding. This process is most suited for applications with thicker materials. Some advantages to gas shielded flux cored wire is that the slag is very fast freezing which helps provide higher deposition rates especially in the vertical-up position. Some disadvantages to the flux-cored process is the clean up. With self-shielded

wire having all of the shielding in the flux the slag can be very tough to clean and chip out. This could be very labor intensive causing higher labor costs.

In conclusion you cannot have tunnel vision and a one process fixes it all mindset. Many factors will determine what process you should use. Some variables that I mentioned before will help determine the process such as, the thickness of the material, shielding gas, wire feed speed, voltage settings, location of the work site and weld appearance. Both GMAW and FCAW have its advantages and disadvantages so it very important to be educated on what will work the best for you.