The Case For Metal-Cored Wire

Introduction
Since their introduction to the welding industry approximately 25 years ago, and especially over the last 5 years, metal-cored wire has seen significant gains in popularity at the expense of both flux-cored and MIG (solid) wire. The reasons are many, but lie primarily in the high quality of metal-cored wires now being produced by various manufacturers combined with a much clearer understanding of the productivity benefits associated with them. While metal-cored wires are available for mild steel, low alloy and stainless applications, this article will use a mild steel wire to make its case. Furthermore, the discussion will primarily compare and contrast metal-cored wire to MIG wire in the spray transfer – the transfer to which metal-cored wires are best suited.

What is a metal-cored (MC) wire?
Metal-cored wire is a tubular wire that, unlike flux-cored wire, is filled with iron powder as opposed to a slag producing non deposited flux. However, because MC wire exhibits many MIG performance characteristics, like high efficiency and multiple transfer mode capability (including short circuit), it is classified by the American Welding Society as a MIG wire (A 5.18-93). So, to simplify, MC wire can be viewed as a “hybrid” of a flux-cored wire from a manufacturing perspective and a MIG wire from an operational perspective.

Advantages of MC wire over MIG wire
First and foremost, MC wire offers greater productivity based on both deposition rate (lbs/hr) and travel speed (in/min) analysis, two factor critical to high productivity, low cost fabrication. Because the iron powder core of MC wire is non-conductive and the entire cross section of solid MIG wire is conductive, MC wire requires less current to melt it than MIG wire. Therefore, at a given current, the MC wire will require a higher wire feed speed which translates into more pounds of weld metal deposited.

EXAMPLE: Comparing an .045” diameter MC wire to an .045” MIG wire, in a spray transfer at 280A under 90% argon/10% CO2 shielding gas, MC wire deposition rate is 10.7 lbs/hr (450 in/min wire feed speed) vs. MIG’s 9.2 lbs/hr (350 in/min wire feed speed). This 16% increase in deposition rate, assuming similar electrode efficiency (which is almost identical), will require an equivalent increase in travel speed to deposit the same size weld bead. The fluidity of the MC arc makes the required travel speed increase easy to attain. In semi-automatic, non-automated applications, it should be noted that a deposition rate should take into account that a welder can only move so fast, consistently, from point A to point B. If the deposition rate is too high, the welder may over-weld, a costly problem. Many MC demos performed over the years tell me that the above procedures are aggressive but within the capability of a good welder. As you may have guessed, MC wires are especially well suited for automation where deposition rates and travel speeds can double when the human factor is removed from the equation.
Another advantage of MC wire is that at a given wire feed speed (deposition rate), MIG wire requires a higher voltage which is strongly associated with undercut, an unacceptable weld discontinuity in structural applications. When undercut halts productivity due to its required removal and repair, labor costs rise.

Other advantages of MC wire over MIG wire (at a given deposition rate), when applied in a spray transfer, include reduced heat input and, thus, distortion, less fume generation, superior arc wetting/bead appearance and greater tolerance to base plate surface contamination. Additionally, silicon (a required deoxidizer that appears on a weld surface in the form of glass) “islands” in newer MC formulations tend to migrate to the center of the weld and, thus, aren’t apt to “lock” into the toes of the weld. Thus, silicon islands are much easier to remove (they often pop off on their own), an important improvement especially if the welded part will require a paint job.

Conclusion
This article is not meant to suggest that MC wire is always the right choice. Welding can be as complicated and nuanced as the applications it’s performed on. But if you are a job shop or manufacturer that welds 12 gauge or heavier plate and puts a high premium on quality and productivity, the benefits are many and MC wire may be worth investigating.

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