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Mr. Eric Fritsche
Director of Operations
The Material Works, Ltd.
101 South Main Street
Red Bud, IL 62278

Dear Eric,

Steve Bosworth of IMEC and myself have conducted the weld testing of the SCS material that you are producing. We were able to produce the same spatter difficulties that some of your end users have been experiencing. We compared the weldability of the hot rolled sheet with the SCS processed sheet. The welding information that was received from your end users was collated into a set of parameters that appeared to be somewhat universal between each facility. Most of the responses indicated that the shielding gas of choice was 90% Argon-10% CO2. All flow rates were comparable. While most users indicated that they were welding in the Short-Arc mode, based upon the wire feed speeds and voltages specified, each was in the globular transfer mode. All filler metal diameters were 0.035" with most using ER70S-6 filler metal.

We ran samples with the 90% Argon-10% CO2 and a high wire feed speed (600 IPM). The weld bead that was deposited on the SCS material produced a large amount of spatter along with an irregular bead shape. There was also poor wetability along the edges of the weld bead. Based upon our observations, the wire is being over driven in an effort to increase welding speed. The welder must travel rapidly with a short contact tip to work distance. This can also increase the possibility of spatter if the tip to work distance is not held constant.

A change in shielding gas was then performed. The new gas was a mix of 95% Argon-5% Oxygen. As soon as the new gas was tried, the stability of the arc drastically improved and the spatter was reduced to a minimal amount. The spatter that was produced could easily be removed. Argon-Oxygen mixes are suitable for true spray arc welding. The oxygen addition provides good arc stability. The arc is now a true spray with excellent weld metal transfer. Other advantages of the oxygen addition include minimal undercutting, a fluid weld puddle, better controllability and a uniform bead appearance.

The Argon-Oxygen mix can vary between 3 and 5 per cent to give the operating characteristics that we were looking for. Additionally, based upon one gas suppliers' quote, the Argon-Oxygen mix is 5% cheaper than the Argon-10% CO2 gas. Finally, the smoke and fume also appear to be decreased.

Welding travel speed is always an issue. I think that your clients were overdriving the filler metal to increase welding travel speed. With the change to the Argon-5% Oxygen mix, you now have a true spray transfer that gives better penetration at the same travel speeds that were previously used along with a better bead appearance. I think that they will also find that there will be less filler metal required for a given weld joint since the bead will be more uniform. There should not be any excess reinforcement unless the welder is traveling too slowly. Any weld bead produced by the globular or spray transfer mode must have a high travel speed.

The only disadvantage to using an oxygen mix is the filler metal must have sufficient oxidizers to overcome any potential porosity problems. The ER70S-6 filler metal has a high manganese content and we experienced no problems with porosity during our testing. It would be my recommended filler metal.

The following parameters were tested and found to work very well:

1. Wire feed speed 400 IPM with 24 Volts
2. Wire feed speed 430 IPM with 24 Volts
3. Wire feed speed 460 IPM with 25 Volts
4. Wire feed speed 500 IPM with 26 Volts

The filler metal was 0.035" ER70S-6 with a gas flow of 25-30 CFH. The base materials ranged from 0.079" to 0.101"with no surface preparation being performed before welding.

Based upon this testing, I feel that an acceptable reasonably spatter free weld can be performed on SCS material using the parameters included in this report.

Barry Heuer
Chief Welding Engineer and Metallurgist
Optimum Engineering Solutions, Inc.