SPB1. Pulsing Parameter Effects on Weld Nugget Size and Apperance

Robert Huddleston, Darci Toussant and Mitchell Matheny, The Ohio State University

Introduction

Producers of automotive applications are switching from conventional GMAW to a pulsed GMAW in order to maximize efficiency, reduce rework and spatter. Problems occur in establishing pulsed power source settings due to lack of knowledge of how these affect nugget size and nugget appearance. The objectives of this work were:

- to determine how wire feed speed, arc trim, and travel speed affect both nugget size and appearance of the weld.
- To determine optimal parameters that will produce a weld in an acceptable nugget range (0.21 in2-0.27 in2) with a minimal amount of spatter.

Technical Approach & Results

The actual tubular joint was simulated using a linear horizontal lap joint. A Box-Behnken Design of Experiment was created in order to evaluate the effect of GMAW-P variables on weld size and appearance. A DOE was used to make welded samples using 409 stainless steel and a rating system was used to judge spatter (scale 1-30, 1-lowest, 30-highest). Welds were sectioned and weld area was measured. The response optimizer in Minitab was then used to determine parameters for optimal nugget area, and then determine optimal parameters based on amount of spatter. Wire frame surface plots were created based on linear regression analysis and were used to determine the variable's effects on nugget area and spatter. The following parameters produced an optimally sized nugget with minimal spatter, thus decreasing the amount of wasted material from unacceptable welds while maximizing production effeciency:

Wire Feed Speed = 425 ipm
Arc Trim = 1.00
Travel Speed = 45 ipm

Conclusions

- Wire feed speed, arc trim, and travel speed affect weld size in a similar fashion as the variables of a conventional power supply
- Higher wire feed speeds increase nugget area
- Higher arc trims increase nugget area, though not as effectively as high wire feed speeds
- Higher travel speeds decrease nugget area
- Lower arc trims lead to higher amounts of spatter
- No relationship between spatter and travel speed could be determined
- No relationship between travel speed could be determined