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REVIEW OF GAS METAL ARC WELDING AND ITS EFFECT

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ABSTRACT
Gas metal arc welding is a fusion welding process having wide applications in industry. Productivity of weldment. Results from this research work show that wire feed rate (W),arc voltage (V) have increasing effect while nozzle-to-plate distance (N) and welding speed. Practical implications: Monitoring of gas metal arc welding is a good tool for evaluation of the quality of weld. All introduced, artificial disturbances of the welding process destabilize the welding arc and produce changes in the instant values of the welding parameters.

INTRODUCTION
The GMAW has got wide applications in industries due to the advantages such as high reliability, all position capability,low cost, high productivity, high deposition Castner has provided what may be the most comprehensive study of a single system using the standard AWS fume chamber. Although a comparison of steady- and pulsed-current fume rates rate, ease of use, absence of fluxes, cleanliness and ease of mechanization. This process establishes an electric arc between a continuous filler metal electrode and the weld pool, with shielding from an externally supplied gas, which may be an inert gas, an active gas or a mixture. The most important gases which have (S) decreasing effect on the dilution whereas gas.The GMAW has got wide application. Welding process emits sound, light and electromagnetic radiation to surrounded space. Sound emission and light emission were exploit as a source of information about the process [1] but till now welding parameters are counted as a main source of data for welding process monitoring which can be essential part of online evaluation of weld quality [2]. Parameters of welding are controlled by electronic control units but their modulation by welding process can be exploited for monitoring of welding process. The design of the monitoring system should predict the high electromagnetic interferences during the welding process on the microprocessor-controlled system [3].

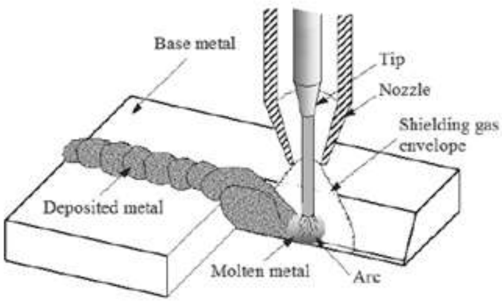

Fig1.1. GMAW process

Disturbance the gas metal arc welding (GMAW) is increasingly employed for fabrication in is versatile, since it can be applied for all position welding; it can easily be integrated into the robotized production canters. [4] The effect of main variables such as wire feed rate, welding voltage, nozzle-to- plate distance and welding speed on dilution in GMAW process, and showed that the most significant factor on dilution are wire feed rate and welding voltage .Dilution will increase with the increase in wire feed rate and welding voltage, and decrease with the increase in welding speed and nozzle-to- plate distance. [5] Analyzed defects in GMAW process using Taguchi method. GMAW-S is a very dynamic process. A major problem occurring during GMAW-S is unstable process behavior accompanied by the formation of spatter.

EFFECT
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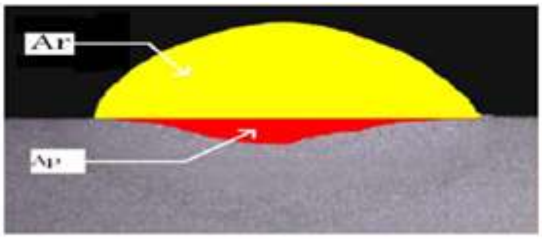

Fig.2.1.Dilution of bead- on- plate weld

DESIGN OF EXPERIMENT

Test pieces of size 200×100×6 mm were cut from ST-37 plates and their surfaces were ground to remove oxide scale and dirt and moreover, consumable electrode of 0.8 mm diameter was used for depositing the weld beads on the base metal Shielding of the gas puddle and molten metal droplets from the electrode was carried out by a gas mixture oturef 80% argon and 20% CO_2. Current and wire feed speed were continuously measured. The closed-loop Hall Effect current sensor Model CLN-500 was used to measure the welding current. This sensor provides electrical isolation between the current carrying conductor and the output of the sensor. The voltage was measured by a directly in the output of power supply resistance bridge Signals from the welding circuit were recorded on the PC through the data acquisition card NI DAQ 6036E.

Fig.3.1.The experimental setup

EXPERIMENTAL EQUIPMENT

Figure.4.1. is a photograph of the experimental power source. This power source has been constructed and used for previous research [6]. It incorporates all the circuit features required for optimised control of the short-circuiting GMAW process. It has a peak current output capacity of 600A, and a current turnoff capability of 20,000 A/ms. The mean current output is thermally restricted to 330A at 60% duty cycle. For experiments having a lower duty cycle, higher mean currents can be supplied for short period.

(a) (b)

Fig.4.1. Reversing wire feed unit (b) Advanced experimental power source short periods experimental power source short periods.

EXPERIMENT

The aim of the research was to examine the possibility of detecting welding imperfections by recording the instant values of welding parameters. Disturbances were implemented in three areas 25 mm in length. These areas were separated by clean areas 50 mm in length. The beginning and the end of weld were also free of disturbances. To disturb the MMA welding process three types of disturbances were introduced a layer of paint, a layer of grease and a layer of oil. A lack of shielding gas was introduced as the forth disturbance during MAG welding. Experiments were carried out on an automated GMAW A simple schematic of the experimental setup with data flow is shown in Fig. 5.1 During trials, an Olympus i-SPEED high speed camera was used to image and record the metal transfer process for later analysis. The camera direction was perpendicular to the welding direction. The torch was moved while the work-piece was in a fixed position such that camera was stationary in relation to the work-piece. The high speed camera used a sampling speed of 3000 frame per second (fps). In addition to an aperture of 11 and a shutter of 1, a narrowband filter (central wavelength 940 nm, bandwidth 20 nm) was used to reduce the arc brightness in order to image the metal transfer.

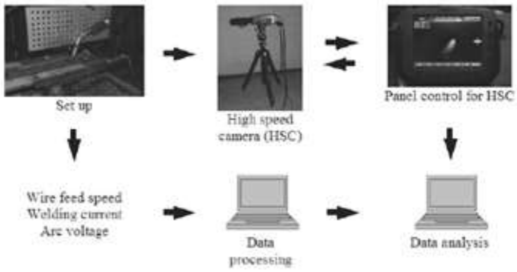

Fig.5.1Experimental setup with flow of data

CONTROL METHODOLOGY

The control method to be initially tested will use a controlled current waveform to regulate the instantaneous melting rate of the electrode. The instantaneous wire feed rate is adjusted in response to events in the process, as signaled by the voltage feedback. Typical reference waveforms for current and wire feed rate, as well as welding voltage, are shown in Figure6.1. The shape of the voltage waveform is based on observed behavior in preliminary tests. The figure depicts one complete metal transfer cycle in the process. The process is considered to proceed in several distinct stages. Stages 2, 3 and 4 constitute the short-circuiting period, when the droplet forms a bridge connecting the electrode tip to the weld pool. Stages 5, 6 and 1 constitute the arcing period, when the droplet is formed at the tip of the electrode, and the arc

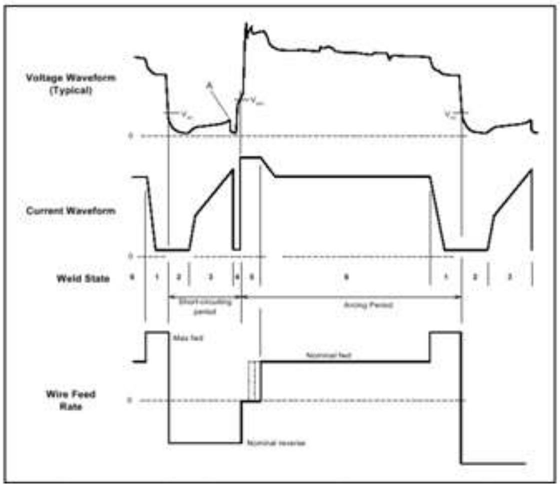

Fig.6.1.Typical waveforms for current,wire feed speed and welding voltage

contributes to work piece heating. Short circuit period is typically 3 to 5 milliseconds in duration, while the arcing period lasts typically 10 to 50 milliseconds. There are three types of welding process disturbances.

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RESULT

The first influences the stability of welding arc, the second influences welding parameters and the third influences the metallurgical reaction in the arc and welding pool. It seems that three applied disturbances affect weld metal in the same way; all of them are able to produce gas pores. It is necessary to note that welding arc deliquesces grease and oil and blow them out from the welding area. Only a part of fumes and vapors is absorbed by the arc column. A layer of paint burns in the welding arc and most of products of its disintegration are absorbed by arc.

CONCLUSION

The measuring system for arc welding processes has a modern easy to expand structure. It measures and records the most important welding parameters. It enables online evaluation of welding data and a detailed post-weld analysis of data on a PC Tests of the device performed during manual metal arc welding and gas metal active welding revealed that the occurrence of some welding imperfections is followed by changes of the welding parameters. In this case they can be revealed by the analysis of the instant values of the welding parameters. Experiments show that monitoring gas metal arc welding is a good tool for evaluation of the quality of weld. All introduced, artificial disturbances of the welding process destabilize the welding arc burning and produce changes in the instant values of the welding parameters. In the case of manual metal arc welding changes of instant values of the welding parameters are barely noticeable and can be missed during online study. The measurements of metal transfer are presented in the GMAW process in the range of welding wire speed from 150 inch/min to 240 inch/min. The measurement system is based on a high speed camera and it can measure the metal transfer at 3000 frames per second.

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