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MEASUREMENT OF FERRITE CONTENT ANALYSIS OF FLUX CORED ARC WELDING (FCAW) WITH VARIOUS VOLTAGE INPU T

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ABSTRACT

Flux Core Arc Welding (FCAW) is an arc welding process that using continuous flux-cored filler wire. The flux is used as a welding protection from the atmosphere environment. This project is study about the effect of FCAW process on different parameters by using robotic welding with the variables in welding current, speed and arc voltage. The effects are on welding penetration, micro structural and hardness measurement. Mild steel with 6mm thickness is used in this study as a base metal. For all experiments, the welding currents were chosen are 90A, 150A and 210A and the arc voltage is 22V, 26V and 30V respectively. 20, 40 and 60 cm/min were chosen for the welding speed. The effect will studied and measured on the penetration, microstructure and hardness for all specimens after FCAW process. From the study, the result shown increasing welding current will influenced the value depth of penetration increased. Other than that, the factors that can influence the value of depth of penetration are arc voltage and welding speed.

Keywords: FCAW, Welding penetration, arc voltage, welding speed

1. INTRODUCTION

It is very important to understand and control the metallurgical behavior of the stainless steel claddings and to establish sound cladding procedure, which determines its suitability for intended service. It has become essential to control two important aspects of the stainless steel cladding: 1. clad bead geometry (already has been dealt in chapter 3) and 2. Delta ferrite content and its morphology. Detailed metallurgical studies were made in this chapter which includes the following aspects.

The application of design of experiments to study the effect of process parameters on macro hardness, ferrite content and heat input in the weld claddings has also been analyzed and the models have been developed. The direct and interaction effects of cladding process parameters

on macro hardness, ferrite content and heat input have also been discussed. Analysis of microstructures of the claddings are also presented.

2. EXPERIMENTAL METHODOLOGY

In cladding, the amount of heat input involved plays a major role in achieving the desired clad bead geometry and its metallurgical properties which in turn affect the mechanical properties. Hence, control of heat input is necessary to achieve the desirable clad properties which necessitate a detailed study to investigate the effect of the cladding process parameters on heat input. Experiments were conducted using design of experiments to explore the interdependence of these parameters. The welding current and the arc voltage were recorded for 32 runs and heat input (HI) was calculated using the Equation (4.1) (Radaj 1992, Rajasekaran et al 1998, Subramaniam 1999, Rajasekaran 1999). The calculated HI using equation 4.1 is given in Table 4.1.

$$HI=\frac{60\ IV\eta}{1000\ S} \quad (4.1)$$

where, HI = Heat Input, kJ/cm

I = Welding current, Ampere

V = Voltage, Volt

S = Welding speed, cm/min

η = Arc efficiency accounting for heat dissipation to the surrounding as a result of convection and radiation = 0.85 (Poorhaydari et al 2005)

2.1. Measurement of Delta Ferrite Content

The claddings were deposited as per the design matrix described in Chapter 3. The specimens prepared for ferrite measurements were ground to form a flat surface and polished to a depth of 0.5 mm as shown in Fig. 4.1. It was reported that the linear traverse of the Ferritescope on austenite weld deposits gave a better representation of the variability of the delta ferrite content along the welding direction, than a random measurement (Prasad Rao and Prasanna Kumar 1984). Delta ferrite contents were measured at 6 different locations on the top surface along the center line of the clad bead for each cladding using a Ferritescope shown in Fig. 4.2 and average of six readings were taken for each clad and recorded. The observed values of delta ferrite content (F) in percent volume (Fe %) are presented in Table 4.1. The observed values of volume percent ferrite (Fe %) are subsequently used to develop a mathematical model to predict the delta ferrite content. Subsequently the main and interaction effects of the cladding process parameters on delta ferrite contents (F) are discussed.

Figure 1 Welded Specimens

3. RESULTS AND DISCUSSION

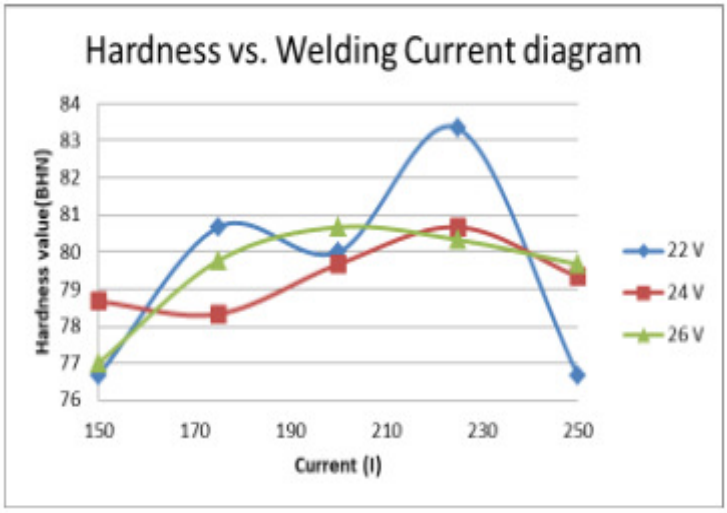

Figure 2 Comparison of Welding Current Vs Hardness

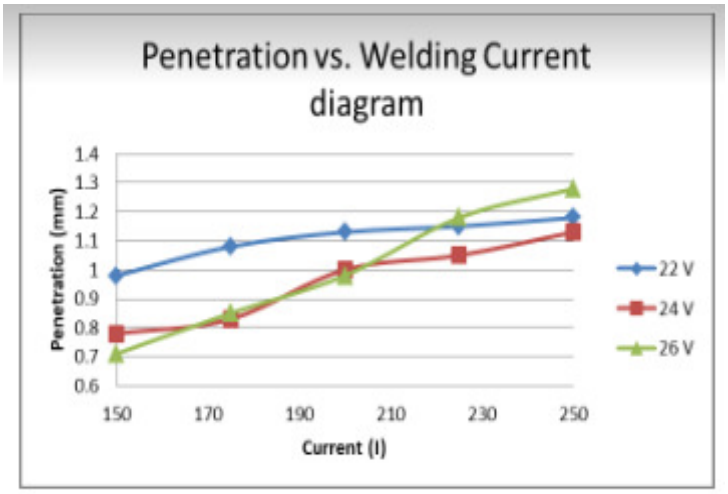

Figure 3 Comparison of welding current Vs penetration

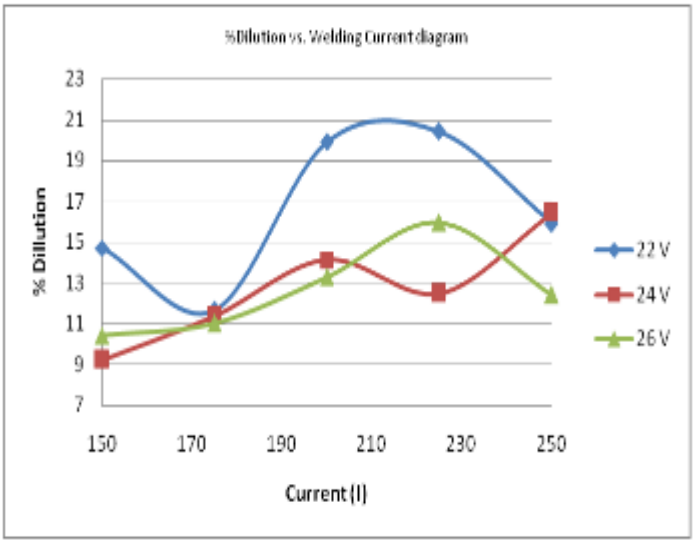

Figure 4 Comparison of % Dilution vs. Welding Current

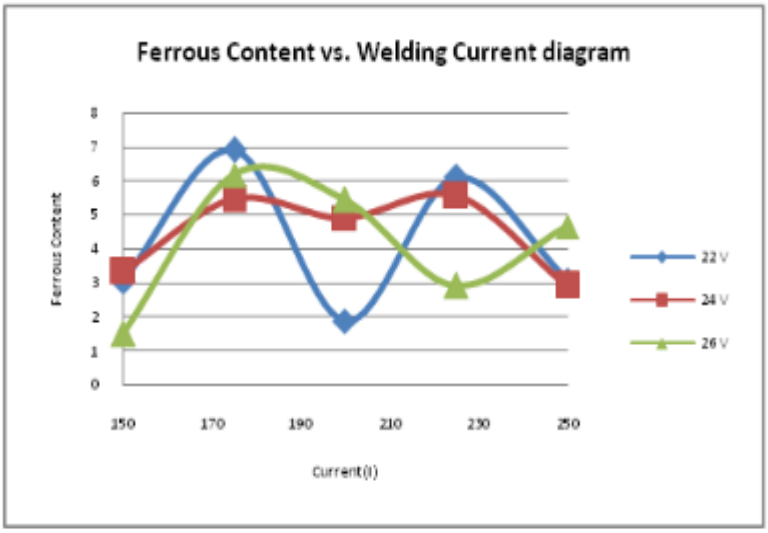

Figure 5 Comparison of Ferrous Content Vs Welding Current

4. CONCLUSION

From the analysis of Flux Core arc welding for the steel materials with the various voltage of 22V, 24V and 26V with the current value is varied from 150 A to 250 A, for this current and voltage conditions Hardness value, Penetration, % dilution and Ferrous content analysis also done from the analysis 24V only give the better performance value of all other current values

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