Effect of welding parameters and cleaning with acetone on weldment quality cold rolled mild steel thin plate

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ABSTRACT – This paper investigates the effect of the acetone and welding parameters on the thin plate of cold rolled mild steel. The welding processes were conducted by Kuka KRC4 robotic gas metal arc welding (GMAW), whereby a jig was used to clamp the plate and a mild steel wire of ER70S-6 as the filler material. The results showed that with the current 39A, voltage 14 V, constant welding speed which is 0.4 mm/min and without cleaning the surface of thin plate with the acetone, the weld have holes on the surface after the welding process and with cleaning the surface with acetone on thin plate, it result to good weld.

1. INTRODUCTION

Thin plates are commonly used in automotive industry as car body panels. To have an outcome of high arc welding process is occupied as previous study [1]. Islam et al. [2] stated that arc welding is being applied in various manufacturing industries such as automotive and other industries. It is desirable in industries because they can cut the cost, increase the joint efficiency and strength. However, the welding parameter influences the quality of the welding. Benyounis et al [3] found that there are many common problem in which manufactures has faced especially on ways to control the parameter, reduce residual stress and distortion, avoid the cracks and holes rise during the welding process in order to get a good strength of welded joint. Acetone is used to chemically clean the surface as it effectively removes grease, dirt and staining from metals which allows for a stronger and better weld as on the previous study [4, 5].

2. METHODOLOGY

In this study, the cold rolled mild steel sheet have been chosen as material to be welded. American Society for Testing and Materials for this mild steel was ASTM A366. The dimension for the plate is 100X10 mm with the thickness 0.5 mm. Table 1 shows the material properties of cold rolled mild steel ASTM A366. The welding processes were performed using a jig and Kuka KRC4 robotic gas metal arc welding (GMAW) with different current and voltage but constant welding speed 0.4 mm/min. ER70S-6 mild steel filler wire with diameter 1.0 mm used in this experiment. The surface of the plate was clean using with acetone first then clamped in the jig as shown in Figure 2. The robot as in Figure 1 needs to be set up with the parameters first before the welding process started. Table 2 shows the welding parameters and variables for this experiment.

Table 1 Material properties

Ultimate tensile strength, psi	43,900-51,900
Yield strength, psi	26,100-34800
Elongation	42-48%
Iron (Fe)	99%
Carbon (C)	0.08%
Manganese (Mn)	0.6% max
Phosphorus (P)	0.035% max
Copper (Cu)	0.2% min
Sulphur (S)	0.04%

Figure 1 The Robotic Arm of Gas Metal Arc Welding KRC4 Type (GMAW) (FKP Welding Laboratory)

Figure 2 Jig for thin plate welding

Table 2 Welding parameters and variables

Parameters	Current (A)	Voltage (V)	Cleaning
Sample 1	39 A	14 V	yes
Sample 2	39 A	14 V	no

3. RESULTS AND DISCUSSION

Table 3 shows the results of the experiments. Based on Figure 3 (a) ,with the current was 39 A, voltage was 14 V, constant welding speed which was 0.4 mm/min and the surface was cleaned with acetone, the thin plate of cold rolled mild steel was weld good. However, it reveals that, with the same current, voltage and constant welding speed but no cleaning on the surface with the acetone, as shown in Figure 3 (b), the thin plate have two holes during the welding process. The holes on the plates might be influenced by the cleaning process by using acetone on the plate surface. This findings is in agreement as previous study [4, 5]. It stated that acetone can be used on surface of the workpiece to eliminate rust.

Table 3 Result of experiments

Parameters	Current (A)	Voltage (V)	Holes
Sample 1	39	14	no/good weld
Sample 2	39	14	yes/two holes

Figure 3 (a) sample 1, (b) sample 2

4. CONCLUSIONS

In conclusion, using acetone as a cleaning material on the surface plate and the parameter chosen play a big role to avoid the holes on the plate and have a good result during the welding process. From this study, the plate with the suitable parameter and cleaning the surface with the acetone on the plate surface before weld, has proven with no holes on the plate and have a. This experiment can be further studies on mechanical test like tensile and hardness test.

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