THE EFFECT OF EDM DIE-SINKING PARAMETERS ON SURFACE INTEGRITY FOR ALUMINIUM COMPOSITE USING COPPER ELECTRODE

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ABSTRACT

This paper investigates the performance of copper electrode on the surface integrity of aluminium alloy LM6 (Al-Sil2) in the electrical discharge machine (EDM) die sinking.The relationship between the machining parameters which is pulse-on time, pulse-off time, peak current and voltage on surface integrity was study.Copper tool of diameter 10mm was chosen as an electrode. Scanning electrone microscope (SEM) was used to observe the microstructure of LM6 after machining process and the average of recast layer (R_L). It is found that the current and pulse on time was significantly affected the recast layer while pulse off time and voltage are less significant factor that affected the responses. Result shows that increasing the pulse duration has increased the recast layer.Thus, it shows that copper having capability to cut aluminium alloy LM6

KEYWORDS: EDM Die-Sinking, Aluminium alloy LM6, Recast Layer, Surface Integrity

1.0 INTRODUCTION

Electrical discharge machine (EDM) die-sinking is one of the best alternative process for machining high strength and good resistance material where usually found in application in mold industries [1]. EDM machining utilizes rapid, repetitive spark discharges from a pulsating direct-current power supply between the workpiece and electrode submerged into the dielectric fluid.

It is known that LM6 which aluminium containing 12% silicon has good resistance to corrosion and excellent cast ability. It is widely used in many fabrication devices due to its characteristics properties such as applications for motor housings, manifolds, marine components and pumping cases. Further, LM6 is also appropriate where sometimes castings require to be welded [2,3]. Aluminium LM6 castings have excellent resistance to corrosion in marine environments, possess excellent ductility, but is of medium strength and is not heat treated. Its strength falls off rapidly at high temperatures. Its elastic limit is low and it is fairly difficult to machine. Some researcher have using aluminium alloy LM6 as the main workpiece by using copper tungsten [4] and graphite [5] as their electrode and they found a good result in term of material removal and surface roughness.

2.0 EXPERIMENTAL

This project used EDM die-sinking Sodick AQ35L series. The metal matrix material used was aluminium having reinforced agents of 12% silicon which is known as aluminium LM6. The dielectric fluid used in this project was Kerosene. Further, the selected factors for maching parameters having three levels is shown in Table 1.

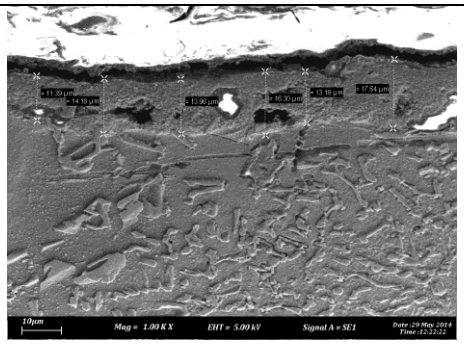
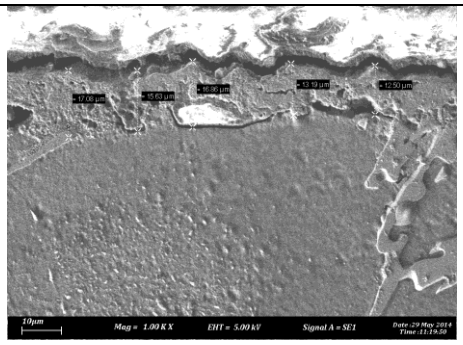
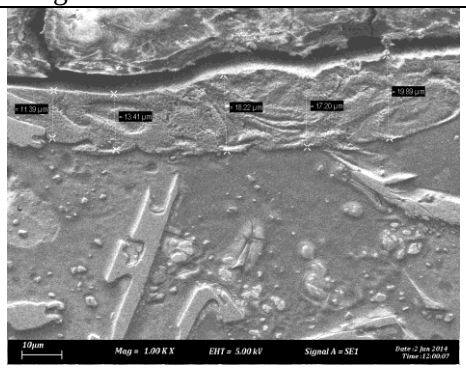
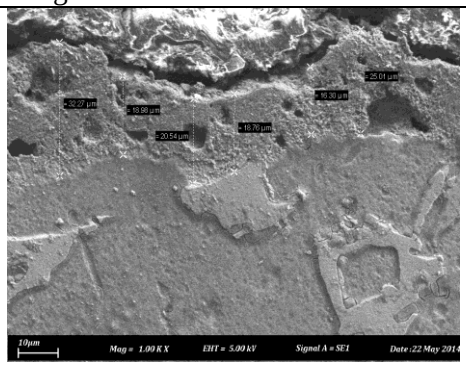
Table 1: Factors and levels for the experiment

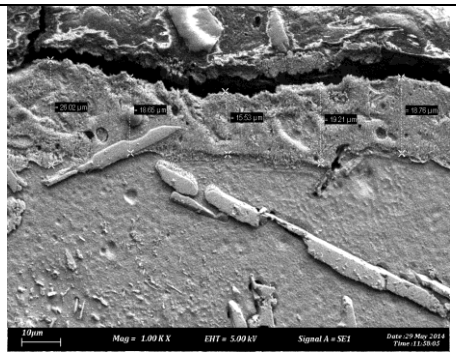
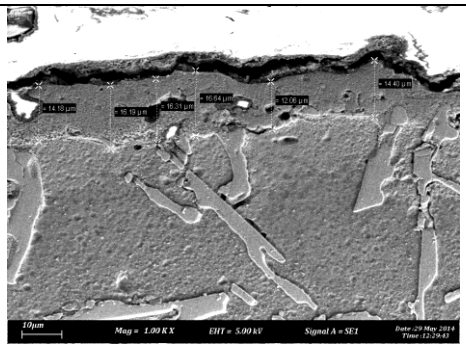
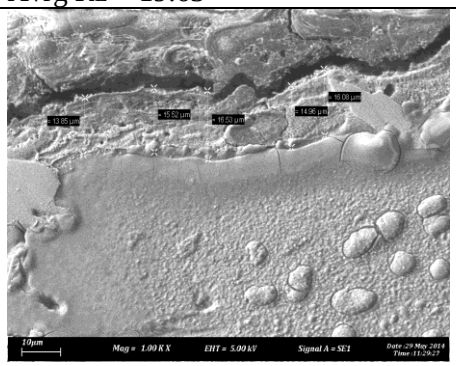
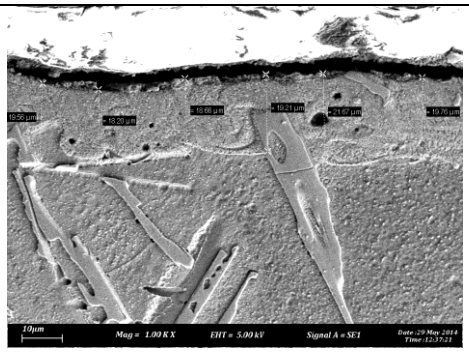
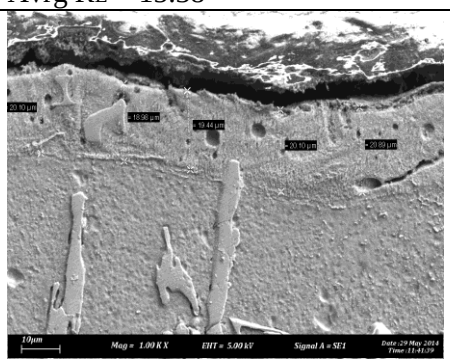
Factors	Input Parameters	Level		
		Low (-1)	Medium (0)	High (+1)
A	Peak Current (A)	2	15	30
B	Voltage (V)	21	25	30
C	Pulse on Time (µs)	1	200	400
D	Pulse off Time (µs)	1	5	9

2.1 Result and Discussion

Explanation of the result analysis is described by the observation and calculated length of the recast layer.. Average of recast layer for every sample after analyzed using SEM is show in Table 3.

Table 3: SEM image of recast layer with 1.0K magnification

Run No.	**SEM Image with 1.0K Magnification**	**Run No.**	**SEM Image with 1.0K Magnification**
1.	 Avrg R_L = 14.44	6.	 Avrg R_L = 15.05
2.	 Avrg R_L = 16.02	7.	 Avrg R_L = 21.97

3.	 Avrg R_L = 19.63	8.	 Avrg R_L = 14.96
4.	 Avrg R_L = 15.38	9.	 Avrg R_L = 19.51
5.	 Avrg R_L = 19.90		

3.0 CONCLUSION

The effect of EDM die sinking parameters on surface integrity for aluminum composite using copper electrode was investigate. Length of recast layer from the peak until the bottom was measure and the average was calculated. It can be concluded that pulse on time and peak current are the significant factors that can affect the recast layer. Other factor, voltage and pulse off time just show less affected to the responses i.e, recast layer. Thus, it shows that increasing the pulse on time will be increased the recast layer thickness.

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