Int. J. Chem. Sci.: 14(4), 2016, 3113-3118
ISSN 0972-768X
www.sadgurupublications.com

EXPERIMENTAL INVESTIGATION OF MILLING OPERATION ON ALUMINUM ALLOY 6063 BY MQL TECHNIQUE

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ABSTRACT

This report presents an experimental investigation on the change of output parameters especially surface roughness during machining aluminum alloy 6063 using minimum quantity lubricant (MQL) technique. The minimum quantity of lubrication technique is becoming familiar due to environmental safety. The input parameters such as cutting speed, depth of cut, feed rate and MQL flow rate This experiment aims to develop a model of process optimization based on the response surface roughness.

Key words: Milling operation, Aluminium alloy, MQL technique.

INTRODUCTION

Conventional machining operations like turning, milling, boring, tapping, sawing etc. are easily performed on aluminum and aluminium alloys. The machines that are used for machining of aluminium is used for steel also, however optimum machining conditions such as machining speeds and feed rate can only be achieved on machines designed for machining aluminum alloys. It is observed that the effect of coolant feed rate makes a huge impact on the surface finish on the work piece

The specific properties of aluminum alloys 6063 is –

(a) Its density allows high speeds of rotation and translation because of the inertia of aluminum alloy swarf of AA 6063 is less compared to steel

(b) Its youngs modulus is - one third of steel-requires specific chucking and clamping arrangements to neglect deformation and distortion

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(c) Their thermal conductivity assists heat dissipation. Because of the higher rate of chip removal, the heat generated during machining is carried away with the swarf without giving time to diffuse into the metal

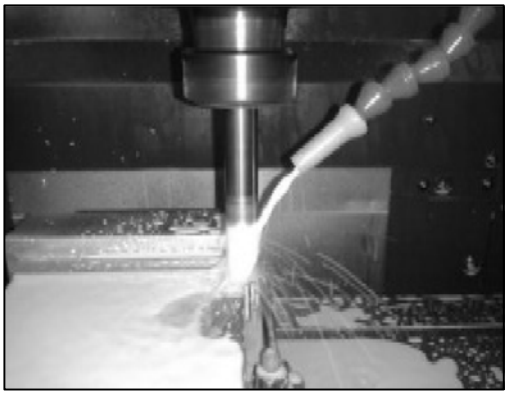
EXPERIMENTAL

The main objective the experimental is to investigate the Minimum Quantity Lubricant (MQL) in machining process of AA 6063.The main objective of the experiment is to find the effect of surface roughness with the change in lubrication conditions. The other three parameters considered in the study is

- Feed rate (FR)
- Depth of cut (DOC)
- Cutting speed (CS).

Experimental setup

The MQL machining technique requires a very small amount of coolant compared to the wet lubricant technique which requires a higher amount of coolant. Fig. shows the condition of wet machining. The coolant feed rate is altered by adjusting the coolant valve.



Wet machining

Mql

(MQL) machining is an another machining technique for dry or wet lubricating system It mainly aims on reducing the amount of lubricant to reduce the environmental, economical and mechanical process performance concerns The AA6063 alloy billet of 16

mm thickness were cut into 2 section of 10 X 10 mm square step projection. The specimen is prepared from the plate by MQL process.

Design of experiments

After identifying the quantity of factors and level, orthogonal array methods are used for the experiment to find the total of experiment. The total No of experiments should be find by two ways, (i) using a table (ii) MINITAB software. In this investigation L9 is used which is suggested by orthogonal array based on the three factors and four levels. The total number experiment has been conducted

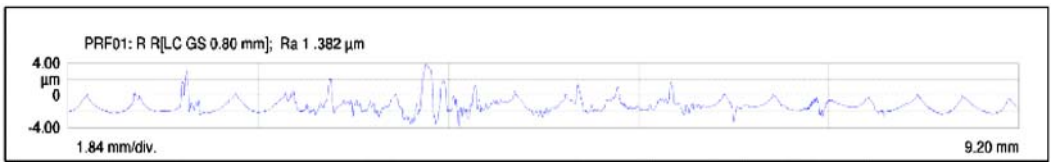
Result of surface roughness

The process parameters of end milling process on aluminium alloy work pieces with MQL by Taguchi technique, L-16 series of experiments were conducted and optimization is carried out by Minitab 16.0, optimization software

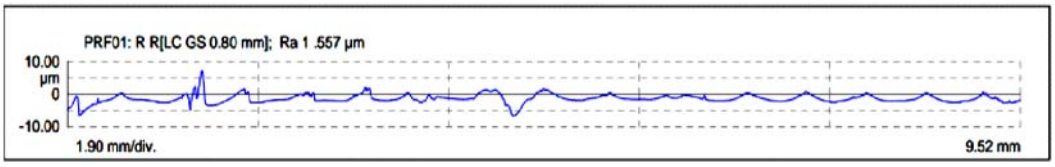
S. No	CS (rpm)	DOC (mm)	FR (mm/min)	Coolant Feed (lit/kg)	Surface roughness (Ra) (Ra)
1	4000	0.4	500	5	1.382 µm
2	4000	0.6	600	3.5	1 .557 µm
3	4000	0.8	700	2	1 .249 µm
4	5000	0.4	600	2	1 .317 µm
5	5000	0.6	700	5	1 .578 µm
6	5000	0.8	500	3.5	1 .265 µm
7	6000	0.4	700	3.5	1 .276 µm
8	6000	0.6	500	2	1 .242 µm
9	6000	0.8	600	5	0 .602 µm

The results of the experiments is as follows:

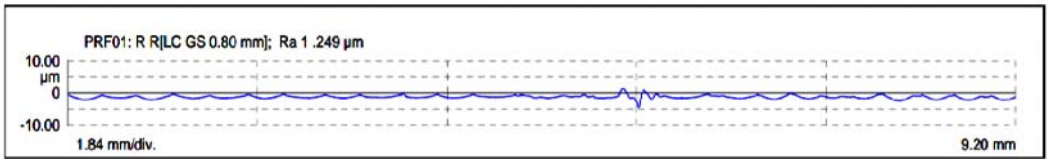
Milling No. 1



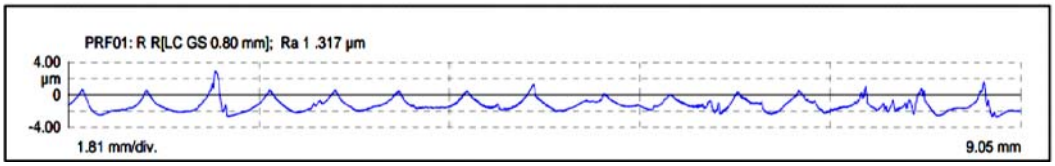
Milling No. 2



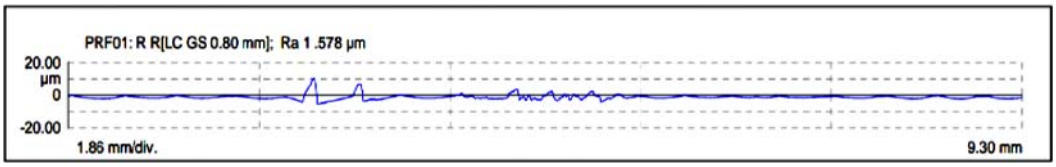
Milling No. 3



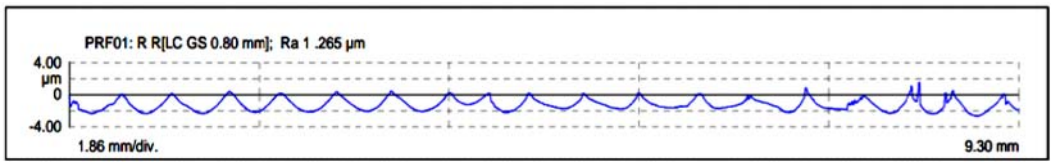
Milling No. 4



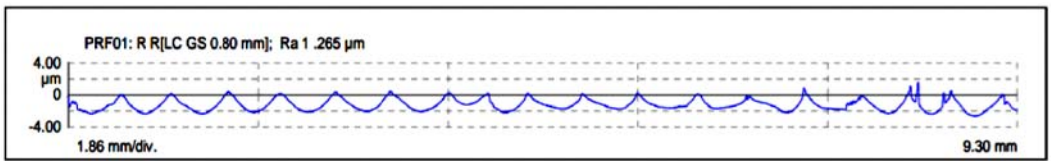
Milling No. 5



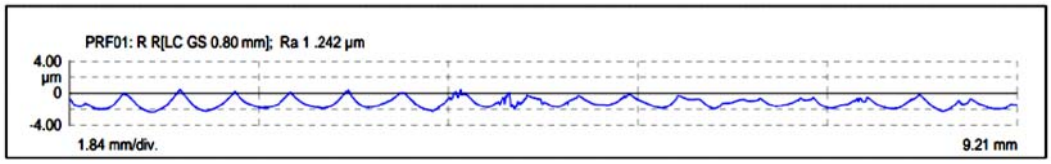
Milling No. 6



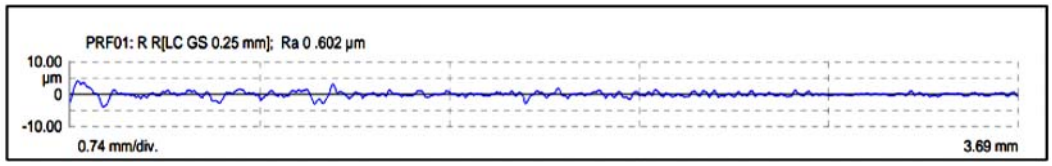
Milling No. 7



Milling No. 8



Milling No. 9



From the above graph reading the surface finish for milling No 9 is seem to be good i.e. surface finishing with 40% lubricant with three parameter speed of cut 6000 rpm, Depth of cut 0.8 mm, feed rate of 700 mm have the better surface finishing of Ra = 0.602 µm.

CONCLUSION

According to the experiment result, Surfaces roughness is better in 40% lubricant by using minimum quantity lubricant techniques rather than using of 100% Coolant by wet techniques .Due to MQL method , they electricity required to pump the remaining 60% of coolant can be saved. Due to MQL method, they quantity of lubricant Used can also be reduced in machining with result in reduction in economical and environmental factors.

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Accepted : 31.10.2016