Analysis and optimum machining parameters on surface roughness and material removal rate for titanium alloy in milling machining with MQL

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ABSTRACT

Proper cutting parameters are needed to produce lower surface roughness of titanium alloy machined material. The high temperature in the cutting zone is always happened due to high friction between the tool and the workpiece and will cause dimensional error and poor surface roughness. Therefore, the main objectives of this research were to investigate and compare the surface roughness and material removal rate (MRR) of Ti-6AL-4 V alloy under the dry and minimum quantity lubrication (MQL) technique. The effect of cutting parameters towards surface roughness was investigated and the optimum cutting parameters was studied to obtain lower surface roughness and higher MRR. From ANOVA, spindle speed has been identified as the most significant parameter that affects the surface roughness and MRR. In t his paper, the optimum cutting parameters that give the low surface roughness and high MRR was 1500 rpm (spindle speed), 0.4 mm/tooth (feed per tooth), and 0.4 mm (depth of cut). From this study, it can be concluded that in this milling of Ti-6Al-4 V alloy, higher spindle speed, feed per tooth, and depth of cut are preferable to achieve the better surface quality of Ti-6Al-4 V alloy.

KEYWORDS

MQL; MRR; Optimization; Surface roughness; Titanium alloy

REFERENCES

Kumar, U., Senthil, P.
A comparative machinability study on titanium alloy Ti-6Al-4V during dry turning by cryogenic treated and untreated condition of uncoated WC inserts (2019) *Mater Today: Proc*, 27 (3), pp. 2324-2328.
Abbasi, S.A., Pingfa, F.
Evaluating the effectiveness of various coating layers applied on k-grade cemented carbide cutting tools on machinability of titanium alloy Ti-6Al-4V in high speed end milling
(2015) *Proceedings of 2015 12Th International Bhurban Conference on Applied Sciences and Technology, IBCAST*, 2015, pp. 14-19.
Du, Q., Chen, X., Zhang, K.
Study on high speed cutting machinability of medical titanium alloy Ti-6Al-4V (2006) *IET Conference Publications*, 524, pp. 263-266.
Rao, P.N., Srikant, R.R.
(2015) *Sustainable Machining Utilizing Vegetable Oil Based Nanofluids. May*, pp. 664672. Hegab, H., Kishawy, H.A., Darras, B.
Sustainable cooling and lubrication strategies in machining processes: A comparative study
(2019) *Proc Manuf*, 33, pp. 786-793.