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Influence of MQL parameters on surface roughness and temperature in end milling of titanium alloy

[Jurnal Tribologi](#) • Article • 2025

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Abstract

This paper addresses the challenge of optimizing Minimum Quantity Lubrication (MQL) parameters in the end milling of titanium alloys, where improper lubrication can lead to increased friction, elevated temperatures, and poor surface quality. The study aims to enhance machining performance by systematically investigating the effects of lubrication flow rate, nozzle distance, and nozzle angle on key performance metrics such as surface roughness and cutting temperature. The Taguchi method was employed to design experiments and analyse the influence of these parameters, enabling the identification of optimal conditions. Results revealed that a flow rate of 10 m³/s, nozzle distance of 20 mm, and nozzle angle of 60° minimized surface roughness to 0.66 µm and a flow rate of 10 m³/s, nozzle distance of 10 mm, and nozzle angle of 30° reduced cutting temperature to 58°C, significantly improving machining efficiency. This research highlights the importance of precise

MQL parameter control and contributes to advancing sustainable manufacturing practices by reducing environmental impact and enhancing process efficiency. © 2025, Malaysian Tribology Society (Mytribos). All rights reserved.

Author keywords

End milling; Minimum Quantity Lubrication (MQL); Silicon dioxide; Taguchi method; Titanium alloy

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