Study of Cutting Speed Effects on Lubricant Oil Film Thickness Under Minimum Quantity Lubrication

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Abstract:
In recent decades, there has been increasing interest in the study of Minimum Quantity Lubrication (MQL) due to its outstanding performance despite the minimal usage of cutting oil. However, study focusing on the behavior of oil mist during the MQL machining process is still scarcely reported. It is important to clarify this matter in detail as to explain how the lubricant oil mist can successfully reach the narrow cutting zone. The aim of this study was to investigate the cutting speed effects on the behavior of lubricant oil film by measuring its thickness accumulation on the workpiece after the MQL milling process. Measurement was conducted by using Laser Induced Fluorescence (LIF) method. Results showed that the average thickness of oil film generated at the center of milling path was approximately at 0.37 mm. Penetration ability of lubricant oil to reach the narrow cutting zone dropped with increasing cutting speed and subsequently leading to accumulation of thicker oil film at the cliffs of milling path. Further investigation is needed to clarify whether the nozzle position or the cutter flute may be the attributor of this phenomena. Moreover, it was found that the MQL machining must be conducted appropriately to ensure the oil mist can successfully lubricating the cutting zone on the entire workpiece.

Keywords: Minimum Quantity Lubrication; Lubricant oil behavior; Laser Induced Fluorescence.

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