Flank Wear Characterization in Aluminum Alloy (6061 T6) With Nanofluid Minimum Quantity Lubrication Environment Using an Uncoated Carbide Tool

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ABSTRACT

This study is focused on the categorical analysis of flank wear mechanisms in end milling of aluminum alloy AA6061 with minimum quantity lubrication (MQL) conditions using nanofluid. Wear mechanisms for the water-based TiO_2 nanofluid with a nanoparticle volume fraction of 1.5% are compared with conventional oil-based MQL (0.48 ml/min and 0.83 ml/min) using an uncoated cemented carbide insert. Micro-abrasion, micro-attrition, and adhesion wear leading to edge chipping are identified as the main wear mechanisms. Aluminum deposits on the tool flank surface are observed. Results show that the water-based nanofluid shows potential as a capable MQL cutting media, in terms of tool wear, replacing the conventional oil-based MQL.

KEYWORDS: MQL, nanofluid, wear, abrasion, attrition, adhesion

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