Flank Wear Characterization in Aluminum Alloy (6061 T6) with Nanofluid MQL Environment using Uncoated Carbide Tool

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ABSTRACT

This study is focused on categorical analysis of flank wear mechanisms in end milling of aluminum alloy AA6061 with minimum quantity lubrication condition using nanofluid. Wear mechanisms for the water-based TiO2 nanofluid with a nano-particles volume fraction of 1.5% are compared with conventional oil-based minimum quantity lubrication (0.48 ml/min and 0.83 ml/min) using uncoated cemented carbide insert. Micro-abrasion, micro-attrition and adhesion wear leading to edge chipping are identified as the main wear mechanisms. Aluminum deposit on the tool flank surface is observed. Results show that the potentials of water-based nanofluid as a capable MQL cutting media, in terms of tool wear, replacing the conventional oil-based MQL. Especially the tool edge integrity and adhesion losses are reduced with the use of nanofluid applications.

KEYWORDS: Wear; Aluminum alloys; Nanofluids; Water; Lubrication; Adhesion; Aluminum; Nanoparticles; Abrasion; Cutting

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