An experimental study to evaluate the flank wear interaction with process parameters during machining of aluminium alloy under minimum quantity lubrication with TiO2 nanofluid

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Abstract:
This paper presents an experimental study to evaluate the flank wear interaction with process parameters during machining of aluminium alloy under minimum quantity lubrication with TiO2 nanofluid. The cutting speed, feed rate, depth of cut, MQL flow rate and % volume fraction of nanofluid are developed for end milling experiments for aluminium alloy AA6061-T6 in order to correlate the performance measures with minimum quantity lubrication technique using uncoated tungsten carbide. Response surface methodology with central composite design approach is used for the design of experiments. The accuracy of the model is verified through confirmation tests with different sets of parameters. Nanofluid-MQL exhibits superior performance compared to conventional MQL in terms of tool wear. Flank wear decreases up till a certain % of nano-particles which is 2.5% in this research. Beyond this value, flank wear increases with the increasing % volume fraction of nano-particles. This increase in flank wear may presumably be attributed to the higher viscosity of the nanofluid as well as some agglomeration. The cooling effect results in reduced adhesion of work material and lower heat in the cutting zone thus leading to lower flank wear due to softening effect of the tool with increasing temperature.

Keywords: . The cutting speed; feed rate; TiO2 nanofluid

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