

Influence of Vegetable Oil-Based Controlled Cutting Fluid Impinging Supply System on Micro Hardness in Machining of Ti-6Al-4V

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Abstract : A controlled cutting fluid impinging supply system (CUT-LIST) was developed to deliver an accurate amount of cutting fluid into the machining zone via well-positioned coherent nozzles based on a calculation of the heat generated. The performance of the CUT-LIST was evaluated against a conventional flood cutting fluid supply system during step shoulder milling of Ti-6Al-4V using vegetable oil-based cutting fluid. In this paper, the micro-hardness of the machined surface was used as the main criterion to compare the two systems. CUT-LIST provided significant reductions in cutting fluid consumption (up to 42%). Both systems caused increased micro-hardness value at 100 μm from the machined surface, whereas a slight reduction in micro-hardness of 4.5% was measured when using CUL-LIST. It was noted that the first 50 μm is the soft sub-surface promoted by thermal softening, whereas down to 100 μm is the hard sub-surface caused by the cyclic internal work hardening and then gradually decreased until it reached the base material nominal hardness. It can be concluded that the CUT-LIST has always given lower micro-hardness values near the machined surfaces in all conditions investigated.

Keywords : impinging supply system, micro-hardness, shoulder milling, Ti-6Al-4V, vegetable oil-based cutting fluid

Conference Title : ICMFMP 2017 : International Conference on Metal Forming and Machining Processes

Conference Location : Zurich, Switzerland

Conference Dates : April 20-21, 2017