Analysis of the influence of geometric parameters of laser-produced texturing on carbide tools in Ti6Al4V turning

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Keywords: laser texturing, Ti6Al4V, tool texture optimization, cemented carbide, machining

Abstract

This research investigated the effect of laser-produced textures on the rake surface of carbide tools in Ti6Al4V turning with abundant fluid application. The machining cutting forces were considered as a comparison parameter between the textures and smooth tools. The input variables are direction, dimensions and distance from the cutting edge for the texture conditions and cutting speed and feed rate for the machining cutting conditions. The methodology consists of executing 3 stages of experiments, in which the results obtained seek to optimize the input variables for the next stage. First, experiments were carried out in which the texture variables and their respective values were selected based on the literature [1, 2]. Then, experiments were carried out a central composite design which, through a Response Surface Methodology, were able to define the optimum point for texturing. Finally, a series of experiments were carried out in order to validate the results and compare the optimum texture with a condition without texture. There were cases where the same type of texture produced results that were sometimes favorable and sometimes not, alternating according to the cutting speed range, indicating that the optimum texture may vary for a roughing or finishing operation. This effect is also correlated with the fact that the sensitivity of the texture response is relatively high for the cutting forces. Finally, texturing shows significant improvements in machining, depending on the cutting conditions.

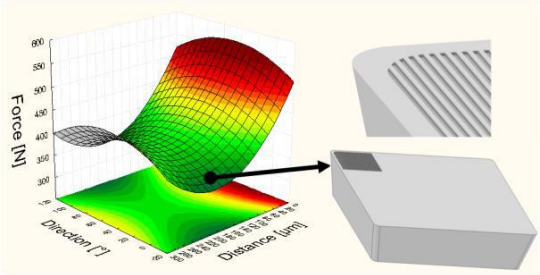

Figure 1. RSM indicating the optimum point for some texture parameters.

The Fig. 1 exemplifies an optimum point for texture variables through the combination of a RSM (Response Surface Methodology) and a CCD (Central Composite Design) planning. After experimenting by varying the texture geometry (depth, width, spacing, direction and distance from the cutting edge) under different turning conditions, an optimum texture was defined and later compared to a tool without texture

References

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