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RESEARCH NOTE

Analysis of Milling Process Parameters and their Influence on Glass Fiber Reinforced Polymer Composites

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ABSTRACT

Milling of fiber reinforced polymer composites is of great importance for integrated composites with other mating parts. Improper selection of cutting process parameters, excessive cutting forces and other machining conditions would result in rejection of components. Therefore, machining conditions are optimized to reduce the machining forces and damages. This work reports practical experiments in milling, to study the effect of machining conditions on cutting force, surface roughness and damage factor of Glass Fiber Reinforced Polymer (GFRP) composites. The experiments were carried out with a designed carbide end mill tool by a random set of milling process parameters. The results showed that machined surface integrity was highly influenced by the spindle speed followed by the feed rate. The results of the experiments were illustrated and analyzed by interaction plots and Scanning Electron Microscope (SEM) images.

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1. INTRODUCTION[1]

Nowadays Glass Fiber Reinforced Polymer (GFRP) composites are alternative products for metals due to their superior characteristics like high specific stiffness, corrosion resistance, fatigue resistance and less weight to strength ratio. Therefore GFRP composites are widely used in automobile, aerospace and other industrial applications. However, composite materials have distinct mechanical behavior compared with other conventional engineering materials. Jahanmir et al. [1] stated that milling is one of the machining operations to produce closed dimensional accuracy with fewer damages on mating parts. The surface finish is an important measure that would be indication for surface quality of machined composites. In this regard Ramulu et al. [2] focused on determination of optimum machining processes to obtain the desirable surface quality. The mechanistic modeling approach is used for predicting cutting forces in the milling process of fiber reinforced polymer composites. The machining force plays a key role in getting desirable machinability indices. Hence, Janarthan and Jeyapaul [3] proposed a specific energy function and it was determined by regression analysis of experimental data and a machining model. The model predictions were concluded to be in good agreement with experimental results. Srinivasulu [4] conducted the experiments by drilling operation using a Taguchi technique with prefixed cutting parameters on GFRP workpiece and the confirmation test was concluded with the analysis of variance (ANOVA). Many researchers conducted turning operations to minimize the machined damages on FRP composites. Kumat and Satsangi [5] developed a procedure to evaluate and optimize the selected input factors to achieve the minimum surface damage. Gopalakannan and Senthilvelan [6] considered that EDM is one of the optimistic machining operations to study the process parameters; conduction of experiments was based on the central composite design and desirability approach. The research papers on milling of composites are few as compared with metals. In order to understand the damage mechanisms in

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