

Effect of cutting temperatures on the hole quality of a carbon-fiber composite

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Abstract. The drilling of composites project is aimed at minimizing delamination and reducing the fiber pull out, thereby improving the hole quality. The heat generated during drilling has an adverse effect on the hole quality. So it is important to analyze the effect of cutting temperatures on the dimensional accuracy of the drilled hole namely hole oversize and roundness and also its effect on the surface finish/roughness of the drilled hole. The drill bit will also be tested for the same parameters using a mist cooling system. These results will be compared with one another. Also the results of different drill bits will be compared with one another.

1. Introduction

Research and experiments conducted on drilling of composite materials have proved that as the cutting edges of the drill bit wear out, the heat generated and the thrust force produced increases and the dimensional accuracy of the hole decreases. Hence it is important to investigate the adverse effect of cutting temperatures on the hole quality. The objective of the experiment is to analyze, for a given drill bit/a set of drill bits, the effect of cutting temperatures on the dimensional accuracy of the drilled hole viz., hole oversize and roundness and also its effect on the surface finish/roughness of the drilled hole. The drill bit will also be tested for the same parameters using a mist cooling system. These results will be compared with one another. Also the results of different drill bits will be compared with one another. In this way we can say, for a given set of drill bits, which drill bit performs optimally in terms of producing a acceptable hole quality. In addition, it can be estimated as to which drill bit generates the maximum temperature and which drill bit generates the least. By estimating this, it is possible to analyze the extent to which the cutting temperatures adversely affect the hole quality.

2. Experiment, Results, Discussion, and Significance

There are two phases of this experiment. The first phase is dry drilling and the second phase is drilling using the mist cooling system. The temperature during the drilling process is measured using a high precision Infrared camera. We have started the first phase of the experiments and have finished one set of drilling operations. Initial analysis show that at low speeds and feeds, the temperature generated is high. This may be attributed to the fact that at low feeds the tool remains in contact with the workpiece for a longer duration of time. The geometry of the drill bit is one of the factors that influences the temperature distribution in the material. The heat generated during drilling affects the hole quality. This heat generation also affects the dimensional accuracy of the hole. Initial analysis point out that the dimensional accuracy of the hole decreases with increase in the heat generated during drilling.

3. Conclusions

There are more experiments that need to be conducted and hopefully we will be able to get enough results for inclusion in the symposium publication. As soon as we get these results, we will send these results to the GRASP editorial board/committee.

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