

Optimization of Drilling Parameters for Composite Materials using Taguchi Method

**Sumit Ganguly, Deepak Kumar Mahto, Dipu Kumar Gope, Ankit Kumar Mahato,
Sujal Chaurasiya, Aman Gupta, Ajay Pandit**

Department of Mechanical Engineering
K. K. Polytechnic, Govindpur, Dhanbad

Abstract: *Composite materials' heterogeneous and anisotropic nature renders drilling them very challenging and may lead to defects such as delamination, pull-out of fibers, and non-uniform surface finish. To improve hole quality and process performance, the present work addresses how drilling parameters for composite laminates can be optimized using the Taguchi approach. Spindle speed, feed rate, drill diameter, and percentage of fiber reinforcement are the key process parameters considered. An L9 orthogonal array is employed to evaluate each of these parameters at three levels. The "smaller-the-better" signal-to-noise (S/N) ratio criterion is applied to evaluate the performance metrics like thrust force, torque, surface roughness, and delamination factor.*

Results indicate that although drill diameter and reinforcing content contribute a secondary effect on thrust force and delamination, feed rate and spindle speed have a prominent effect. The predominance of feed rate in minimizing drilling-induced damage is substantiated through ANOVA analysis. Under ideal conditions, the confirmation experiment exhibits a perceptible improvement in surface finish and hole quality. This paper demonstrates that the Taguchi approach gives a direct, efficient, and statistically valid way of optimizing drilling parameters in the machining of composite materials..

Keywords: *Composite materials'*

