

Taguchi design optimization of machining parameters on the CNC end milling process of halloysite nanotube with aluminium reinforced epoxy matrix (HNT/Al/Ep) hybrid composite

ABSTRACT

This paper introduces the application of Taguchi optimization methodology in optimizing the cutting parameters of end-milling process for machining the halloysite nanotubes (HNTs) with aluminium reinforced epoxy hybrid composite material under dry condition. The machining parameters which are chosen to be evaluated in this study are the depth of cut (d), cutting speed (S) and feed rate (f). While, the response factors to be measured are the surface roughness of the machined composite surface and the cutting force. An orthogonal array of the Taguchi method was set-up and used to analyse the effect of the milling parameters on the surface roughness and cutting force. The result from this study shows that the application of the Taguchi method can determine the best combination of machining parameters that can provide the optimal machining response conditions which are the lowest surface roughness and lowest cutting force value. For the best surface finish, A16B36C3 ($d = 0.4$ mm, $S = 1500$ rpm, $f = 60$ mm/pm) is found to be the optimized combination of levels for all the three control factors from the analysis. Meanwhile, the optimized combination of levels for all the three control factors from the analysis which provides the lowest cutting force was found to be A26B26C2 ($d = 0.6$ mm, $S = 1000$ rpm, $f = 40$ mm/pm).

Keyword: Taguchi method; Hybrid composite; Halloysite nanotubes; Composite machining