

An experimental investigation of the effect of physical vapour deposition coating on carbide tools and uncoated carbide tools in turning Aluminium Alloy -6063

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ABSTRACT

The main focus of the work is to optimize cutting parameters, in order to achieve the lowest cutting force, the lowest surface roughness and the lowest temperature for both physical vapour deposition(PVD) coated carbide and uncoated carbide tool in turning aluminum alloy 6063 by Taguchi technique. The experimentation was carried out according to Taguchi technique. The array designed 9 experiments on each category of the tool materials on same work piece using L9 orthogonal array. To analyse the experimental values the analysis of variance (ANOVA) has been used. According to the ANOVA results, the influence of feed is more predominant on the surface roughness followed by speed and depth of cut respectively. The depth of cut has played significant role on cutting force. Similarly, speed has more significant effect on temperature. The experimental values compared with predicted values and it has been shown that, the cutting parameters responsible for producing optimum cutting force are A3, B2, C1; i.e. Cutting speed at 95 m/min, feed at 0.3 mm/rev and depth of cut at 0.5 mm. So from above optimal process parameter it gives less cutting force for effective machining of AA6063. The cutting parameters responsible for producing optimum surface roughness are A2, B1, C1; i.e. Cutting speed at 85 m/min, feed at 0.3 mm/rev and depth of cut at 0.5 mm and the cutting parameters responsible for generating optimum temperature are the A1, B1, C1; i.e. Cutting speed at 75 m/min, feed at 0.2 mm/rev and depth of cut

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at 0.5 mm. So from above optimal process parameter it gives less temperature. From the results it was observed that the PVD coated tools drastically reducing the surface roughness, cutting force and temperature. This work mainly contributed to enhance the machining of high strength materials with high value of tolerance and accuracy while turning process. The coated tools are able to produce high quality of machining surface as compare to the uncoated tools.

Key words: Physical vapour deposition (PVD) coated carbide; turning, aluminum alloy 6063; Taguchi method; L9 - orthogonal array; ANOVA method, grey relational analysis.