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EXPLORATION ON TOOLS COATING IN MACHINING PROCESS PARAMETERS

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ABSTRACT

ORIGINAL RESEARCH ARTICLE

The effect of traditional machine process parameters is of absolute importance to improve productivity and reduce losses.Traditional machine process parameters were used on three types of equipment with different cutting conditions and tool characteristics. Inconel 718, a nickel-based super alloy, has been found in many industries because of its unique combination of properties such as high strength at high temperatures, resistance to chemical corrosion and high wear resistance.The ANOVA analysis procedure applied to these process parameters is taken as the cutting speed, feed, and type of equipment to obtain the critical of the reaction.

1. INTRODUCTION

Inconel 718 is a registered trademark of Special Metals Corporation which refers to a family of austenitic nickel-chromium-based super alloys. This material is commonly being used or operated in the aerospace industry, turbocharger rotors and seals such as high temperatures and extreme conditions. This research presents an experimental study of cutting force variation, surface roughness, tool life, and tool wear in the end milling INCONEL 718 [2].Higher feed rate will shorten the life of the equipment. However for the cutting condition, the situation is quite different where proper cutting speed will maintain the life of the tool and wear tool for the cutting tool. In addition, major producers apply differently surface coatings to increase their wear resistance and aesthetic appearance. Experimental study identifying innovative tool coatings is necessary to extend the life of the tool in the key-code cutting process [6].

2. BACKGROUND OF WORK: Quoted tools are also ranked by the Deposition technique. There are several methods of depositing the coating such as electro-plating, plasma coating, thermal spraying, and vapor deposition. The chemical reaction between the gaseous species and the substrate is called the CVD process which is usually in the high temperature range. Hoieret. al. [2] Identifying and characterizing the wear mechanism of SiC mustache-reinforced alumina when turning aged alloy conditions1 aged under different cutting conditions and when machining dries and turns with coolant. Secondary and backscatter electron microscopy with worn ion beam milling and EDX techniques were used for the analysis of the worn-out. Kamlesh et al. [3] deals with comparative analysis of whole quality, surface roughness and chip characteristics when drilling stainless steel with both uncoated and coated solid carbide drill bits with considering several responses. Suarez et. al. [6] demonstrated demands for higher productivity of machining require the use of higher cutting velocities and feed rates. Such machining naturally produces high cutting

temperatures, which not only shortens the life of the tool, but also disrupts the quality of the product. Thakur et al [7] present works on nickel-based super alloys with many Characteristics including superior mechanical and chemical properties at high temperatures and other properties. The surface integrity of nickel-based super alloys is an important aspect Impacts functional performance including fatigue life of the component. The main objective of this research work is to analyze the significant and predict the process parameters with coated tools during machining of Incoloy 718. Carbide tools without varying grades have been used with CVD and PVD techniques.

3. METHODS AND MATERIALS

It is particularly useful in sulfuric and phosphoric acids, sulfur-rich gases, sour gases and oil wells and sea water. PVD (physical vapor deposition) and CVD (chemical vapor deposition) are two techniques used to make a very thin layer of material in a substrate; commonly known as thin films on tool. Also one tool is uncoated is used to see the effect clarity in this work. These coatings are taken due to Incoloy is highly resistant to corrosion and has a high nickel content, sufficient to resist chloride ion stress corrosion cracking, and has a very stable austenite structure. Design of experiment is based on Taguchi design L9 OA and passes these experiments run in thrice and recorded each time of responses. Average of three responses is taken as final value is preceded for ANOVA analysis. Machining parameters are shown in table 1.

Table 1 Parameters and level

Level	Cutting Speed (S) m/rev	Feed F mm	Tools T
1	100	0.1	CVD
2	150	0.2	PVD
3	200	0.3	Uncoated

4. RESULT AND DISCUSSION

The cutting or tangential force acts downward at the tool tip allowing tilt upward of the workpiece. Experimental testing was conducted using coarse operations. Parameters used in all tests suggested by the manufacturer, the selected raw material are subjected to severe dry machining conditions. The performance of the tools is evaluated through the analysis of the parts cutting force and the tools wear behavior, and the vibration levels produced during the machining process, which is used to constant the progress of the tool degradation during the machining test. The average responses of the experiment run are shown in fig 1 and fig 2.

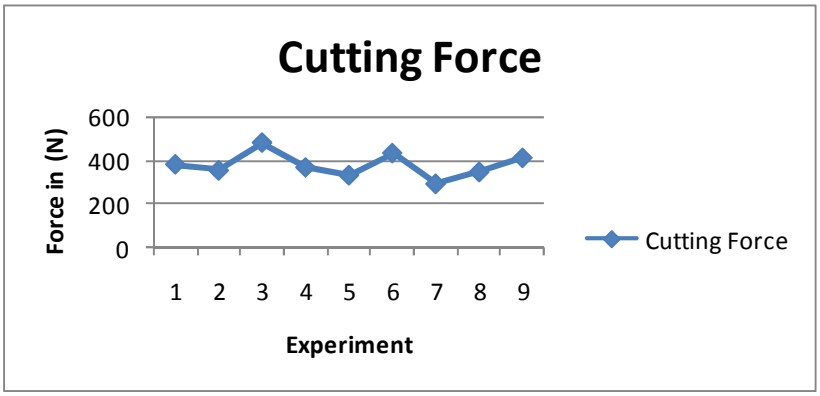

Fig. 1 Response of Cutting Force

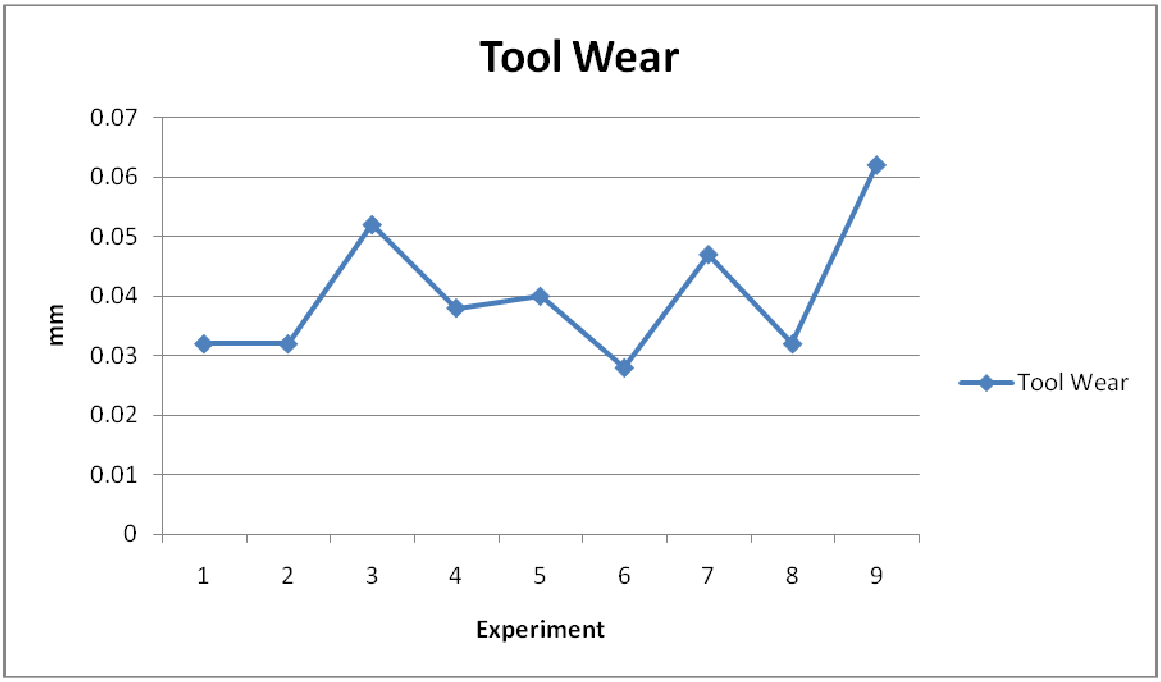

Fig. 2 Response of Tool Wear

ANOVA is a fundamental major statistical tool that aims to statistically quantify interactions between independent variables through their systematic modifications to determine their effect on predictor variables.The analysis of variance (ANOVA) of all three responses that is cutting force and Tool Wear are shown in table 2 and table 3 respectively was used to study the significance and effect of the cutting parameters on the response variables i.e. cutting force and Tool Wear. ANOVA analysis significant factor are depend on Probability Value is less than 5% significant.

Table 2 Analysis of Variance for Cutting force

Source	**DF**	**Seq SS**	**Adj SS**	**Adj MS**	**F**	**P**
S	2	17403	16403	74101.6	94.74	0.0690
F	2	19541	17541	8740.3	12.03	0.141
T	2	18618	16618	64709.1	53.29	0.032
Residual Error	20	17475	18475	576.8		
Total	26	263037				

Table 3 Analysis of Variance for Tool Wear

Source	**DF**	**Seq SS**	**Adj SS**	**Adj MS**	**F**	**P**
S	2	0.000556	0.000496	0.000498	36.31	0.0854
F	2	0.000139	0.000209	0.000155	8.09	0.254
T	2	0.001747	0.001557	0.000679	56.77	0.047
Residual Error	20	0.000247	0.000367	0.000213		
Total	26	0.003460				

The responses recorded which analysis in adequate as represented is where it is clear that tool is definitely a significant factor which is influenced in both responses. This table 2 indicates that tool coating is directly proportional to cutting forces; it is expected because coatings reduce the temperature which increases the tool durability. Cutting force usually decreases when coatings involve in tools whereas uncoated tools have higher cutting force due to high temperature developed. Similar effect also seen in table 3 tool wear is significant factor for above cutting operating followed as DOE. The lowest significant factor found in ANOVA analysis which is less than 5%, 0.047 P value shown in table 3. The main effect plot shown in fig 3 and fig 4 which depicts that cutting force CVD is the best parameters and tool wear is found maximum in uncoated tools.

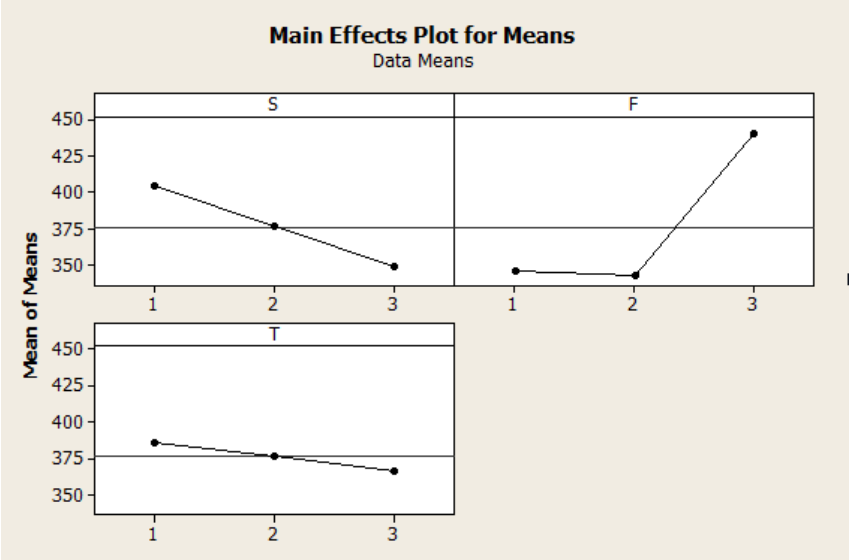

Fig 3 Optimum parameters for Cutting Force

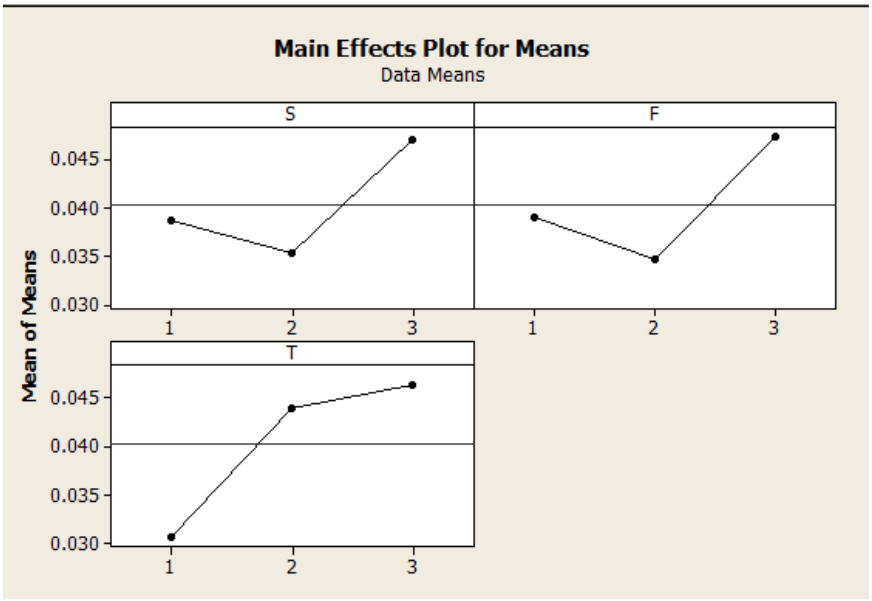

Fig 4 Optimum parameters for Tool Wear

5. CONCLUSION

Coatings of CVD and PVD deposited into the sintered ceramic tool got significant factor found in cutting process. Physical deposition from the gaseous phase (PVD) is estimated as one of the most important accomplishments of development of the service properties of ceramic cutting tools. Also the ANOVA analysis shows the optimum parameters for responses which also show the effects of coating tool against responses. Wear characteristics of investigated are compatible with wear model. Investigated ceramic tool inserts makes it possible to achieve the clear improvement of their tool life and also of the quality of the machined surfaces, reduction of machining costs and elimination of cutting fluids used in machining.

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