ScienceDirect

Materials Today: Proceedings

Volume 81, Part 2, 2023, Pages 454-458

Experimental investigation on sensitiveness WEDM parameters for12X18H10T – Stainless steel

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https://doi.org/10.1016/j.matpr.2021.03.612

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Referred to by IVCSM 2K20 – EXPRESSION OF CONCERN – PART 4

Materials Today: Proceedings, Volume 81, Part 2, 2023, Pages 90

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Abstract

The unconventional machining processes are popular in machining the difficult to cut type complex contour/ profile. The key parameters are to be machined with care as they directly affects the function and non key dimensions are machined with other than consideration of functional aspect, like design, passage. That means accuracy is less important in those dimensions but finish is to be good. So the machining of engineering materials does not always require optimizing parameters based on multiple responses. This investigation focuses on the sensitiveness of Wire EDM of 12X18H10T - Stainless Steel and identifying the parameters contribution and establish mathematical model to predict values without trial. An austenitic alloy 12X18H10T - Stainless Steel exhibits its inherent mechanical properties

even when it expose to extremely high temperature. Ithas potential application in aerospace engine components manufacturing. This investigation utilized the Taguchi L9 experiential Design with factors of Pulse off Time, Wire Tension, Pulse on Time, and Wire Feed Rate. This study aims to examine Maximize the rate of machining with Taguchi approach in the process of Wire EDM of 12X18H10T - Stainless Steel and establish a mathematical model to predict the highly influencing parameter(s) for desired rate of machining.

Introduction

Space engine components are exposed in the elevated temperature must exhibit their mechanical properties as well at its all geometrical features of the components. The research on machining of toughest materials is widely popular. The study also the motivation on machining of material which demands high precision on finish and where their precision causes a serious issue is focused. Super alloys are one of such kind of materials which needs high accuracy. Because their applications are; high speed gas turbines and aerospace components [1]. The complex contours like bio implants are difficult machine in the conventional machining practices [2]. Not only the component profile but also the material toughness and its hardness, strength to with stand with its inherent mechanical properties also one of the reason to study the machining parameters optimization in the unconventional machining like WEDM [3] e.g., components of aerospace engine, guide vanes and blades of the gas turbine rotors, turbocharger impellers etc [4]. The nickel based cast alloy of IN713 Cisa γ′ precipitation hardened can withstand up to 800°C with excellent mechanical properties. Its physical properties are helps to cast it well [5], [6]. Though it has wide application, it is mainly preferred for components of Turbochargers which operates at 1, 50,000rpm at 760°C [7]. The influence of nano-powder mix in the electrolyte in surface quality was studied by [8], [9]. [10] Investigated and reported the feasibility of machining of 12X18H10T - Stainless Steel in Electrical Discharge Machining. This study investigates with the aim of optimizing process parameters of wire cut EDM to minimize the maximum height of the profile,

Section snippets

Materials and methods

This investigation on on-Traditional Machining process, with a target of optimizing the process parameterson WEDM of 12X18H10T - Stainless Steel. The machining sensitiveness is measure of how alter the process parameters to control the rate of removal of material [11]. Even though some studies reported in the literature this study is unique by work material focus for aero space application which is employed in elevated temperature [12]. The machine-ability of material is measured in terms of

Experimental design

Taguchi L9 orthogonal array (Shown in the Table 4) was preferred for experimental design. The level of each parameter fixed with trail experiments and manufacture guidelines. Nine different 5 mm thick square specimens of side 10 mm were prepared and used for investigation. The machining quantity is measured in terms of the material removed in unit time. The Material Removal rate is computed in Volume of material removed per minute (mm^3/min). That is change in volume per minute of machining. The

Results and discussion

In the MINITAB 17 software, for computing the signal to noise ratio, it was set that the maximum Machining rate $\mathbf{M_R}$is must be preferred so 'Higher the Better' option for maximum profile peak height measure of the Machining rate $\mathbf{M_R}$ (Fig. 4).

Conclusion

As miniaturization and design integration most complicated components profiles are in is unavoidable as per application requirements. Hence the Precise manufacturing is preferred like space vehicle engine components as they are exposed in elevated temperature and they possess complex profile features. The machining sensitivity investigated to establish control over the machining rate. The wire electro chemical machining of 12X18H10T - Stainless Steel work material machining characters studied

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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