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RESEARCH ARTICLE

Finite Element Simulation on Machining of Aluminium Components

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ABSTRACT

The method of modeling and simulating the machining process attracts researchers to better apprehend the mechanism of chip formation, localized heat generation, the friction properties of the device and the pair, and the accuracy of the machine surface. . Predictions of physical parameters such as temperature distribution and stress play an important role in predicting the technological performance of the processing process. The geometry of the edge of the device is particularly important because of its effect in obtaining the most desired life of the device and the integrity of the surface is very large. Therefore, it is necessary to develop accurate and robust continuous models to study the effect of geometry, tool edges, tool wear mechanisms and shear conditions on residual stresses and surface accuracy on machine planes. The present work aims to analyze the FEM modeling studies that have been conducted inearlier and to employFEM models for the most satisfactory simulation of shear processes and the most reasonable forecasts of shear forces. Temperature and residual stresses on the treated surface of Aluminum Components.

Keywords: FEM, Surface Integrity, Simulation, Heat Affected Zone, Residual Stress.

INTRODUCTION

The engineering examination of mechanical systems is considered by obtaining differential equations related to variables through simple physical ethics such as equilibrium, energy conservation, mass conservation, thermodynamics, Maxwell's equations, and Newton's laws of motion. However, once established, solving the mathematical model obtained is impossible, especially when the obtained model is a non-linear partial differential equation. Only the simplest problems of correct geometry can be tracked, such as one rectangle with the modest boundary conditions.

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RESEARCH ARTICLE

Effect of Current and Pulse Time for Machining Alluminium, Brass, Stainless Steel, Mild Steel and En8 Byelectro Discharge Machinig

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ABSTRACT

Electric discharge machining (EDM) is one of the most efficient non-conventional manufacturing technologiesused in highly accurate processing of all electrically conductive materials irrespective of theirmechanical properties. It is a non-contact thermal energy process applied to a wide range ofapplications, such as in the aerospace, automotive, tools, molds and dies, and surgical implements,especially for the hard-to-cut materials with simple or complex shapes and geometries.This present work represents the variation of machining parameters (current, pulse on time, pulse off time and machining time) in EDM on machining performance (MRR and surface roughness) of aluminum, brass, mild steel (MS), stainless steel (SS) and EN8. The result provides a better comparative conclusion among the parameters on their performances in EDM.

Key words: EDM, Pulse on Time, Pulse off Time, MRR, Surface Roughness.

INTRODUCTION

In recent years, rapid developments in aerospace, medical instruments, transportation, and many other industrial sectors increased the need for new materials with favorable characteristics. In additionto unique characteristics, most modern materials need special manufacturing processes to enable themto be machined with ease [1,2]. Most of these materials are usually difficult to cut by conventionalmanufacturing processes [3–5]. The unique characteristics of these hard-to-cut materials increase theirapplications, which further drive manufacturers to explore new machining processes with reasonablecost and high precision [6]. Electric discharge machining (EDM) is one of the most advanced manufacturing methods used to successfully machine conductive hard-to-cut materials [7-9]. EDM is the

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Experimental Examination of Process Parameters During Fabrication and Machining of Powder Metallurgy Aluminum Component

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Abstract: ***The present study aims at investigating the effect of process characteristics during fabrication and machining of powder metallurgy (PM) Aluminium cylindrical components. The application of the machining process as an alternate manufacturing process to fabricate the PM Aluminium components for industrial use with desired shape and size is explored. The PM Aluminium cylindrical components were fabricated by compacting the Aluminium metal powder within the compaction dies under various values of compaction load, sintering temperature and sintering time. These PM components were then machined under different standard cutting velocity and tangential cutting velocity, surface roughness data were analyzed. After the investigation it was concluded that, higher values of compaction load, sintering time and sintering temperature leads to higher values of relative density and relative hardness of the sintered Aluminum component. Again from machining results it can be stated that, higher values of fabricating parameters have a higher significance on performance parameters.***

Keywords : Powder Metallurgy (PM), Sintering, Relative Density, Relative Hardness, Cutting Force, Surface Roughness.

I. INTRODUCTION

Powder Metallurgy (PM) is one of the advanced manufacturing technologies by the help of which highly reliable shaped parts of both ferrous and non-ferrous materials can be produced from their respective metal or alloy powders. PM parts are developed by blending alloy and/or elemental powder, compacting the blend in a closed die and then heating (sintering) within a controlled atmospheric furnace to diffuse and bind the particles metallurgically together[1]. PM process is capable of generating parts with good dimensional accuracy, near-net shape and complex geometry[2]. Profound studies have been devoted to chemical and electrochemical methods for preparing fine and ultrafine metal and non-metal powders. Whether it is by optimizing the chemistry or by controlling the porosity to provide improved longevity in wear parts, PM process provide feasible solutions for all intricate manufacturing process route including difficult to handle materials [3].

Now-a-days, Aluminum has increased demand in the field of domestic and engineering because of its light weight, less fabrication cost, neat shaped component manufacturing and less energy consumption during machining. In addition, Powder Metallurgy Aluminum recommends parts with excellent fatigue and mechanical properties, exceptional machinability, low density, high electrical and thermal conductivity, better response to finishing processes and good corrosion resistance [4]. Moreover, Powder Metallurgy Aluminum components can be easily further processed to minimize porosity and enhance yielding properties as compared to traditional wrought aluminum components. PM parts are becoming increasingly popular in many applications due to their applications and advantages over traditional cast and forged parts and it allows for the production of complex shapes from a wide variety of alloy systems with very little material waste. As a result, PM parts can drastically reduce the amount of secondary processing, such as machining, that is required for definite applications. However, in certain instances, additional machining can be necessary to reach required very high dimensional tolerances or from features that are impossible to create during compaction such as, threads and undercuts.

Gokce and Findik[5] studied the mechanical and physical properties of sintered Aluminum powder and stated that, an increased compaction pressure increases the density of sintered Aluminum part. Morgan and Sands[6] have studied the isostatic metal powder compaction process and investigated the effect of die speed on compacting pressure, green density, green strength and hardness of metal powder compacts. From their study they concluded that, isostatic compaction cannot produce components with high dimensional accuracy. Hwang[7] the powder metal compaction process and concluded that the density variation within the compact depends on compact geometry and frictional condition between compact and dies. Lewis and Khoei [8] have investigated the compression of aluminum powders and formulated the slip-line field and plasticity upper-bound theories for sintered aluminum powder. It was found that yielding of sintered materials is sensitive to hydrostatic stresses component imposed, as yield surface closes on the hydrostatic stress axis. Mamedov and Mamedov [9] presented a new fabrication method for the manufacturing of increased density powder metallurgy components using single press cold sintering technique. Using SEM images they estimated the compact green density of samples and explored the influence of the processing conditions on the density.

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Experimental Study of Mechanical Properties of Carbon Black Particulate Composite Material when Treated with Commercial Oils

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Abstract

Now-a-days, in several engineering fields composites are extensively used where they may be explored to different corrosion conditions. It has been noted that, only limited published work exists on mechanical properties investigation of composite material when subjected to different commercial oils. Hence, it is imperative to understand the influence of such corrosive conditions in the working performance of composite. Therefore, in this present study particle reinforced composites made of carbon black particles in epoxy matrix (fly ash as filler) were fabricated and immersed in an universal multi grade engine-oil (20W-50) and a hydraulic brake oil (DOT 3) for 15 days, 30 days and 45 days and to examine the influence of oil absorption on hardness and impact strength of particulate composite, charpy impact test and hardness test were carried out. The results are compared for the composites before immersion and after immersion in the liquid. The result showed a significant change in mechanical properties of composite material when treated with commercial oils.

***Keywords:** Carbon Black Particulate Composite, Commercial oils, Mechanical Properties, Charpy Impact Test, Hardness Test.*

1. Introduction

All composite materials have wide applications in the field of engineering, because of their extensive properties like

good resistance to corrosion, high specific stiffness and strength, dimensional stability, high fatigue life and cost effective fabrication. In this present study, the mechanical properties which are significantly plagued by different environmental settings are studied. It has been noted that, only limited published work exists on mechanical properties investigation of composite material when subjected to different commercial oil. Amaro et al. [1] studied the mechanical properties of Glass fibre-epoxy composite immersing in multi-grade engine (15W-40) and in DOT 4 hydraulic brake fluid. After experimentation he stated that, brake fluid has less significance on mechanical properties compared to engine oil.

Banna et al. [2] proposed that the type of resin used has a great influence on the mechanical properties of composite material when exposed to vigorous solutions. They also concluded that, material microstructure degrades more rapidly in polyster material than the bisphenol in higher temperature and acidic environments. Mortas et al. [3] investigated the affect of aggressive solutions on impact strength of carbon/epoxy composite and alkaline solutions has more

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