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Experimental Investigation of Process Parameters on Machining Force, MRR and Power in Turning of AISI 316 Steel

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ABSTRACT

A machining process involves many process parameters which directly or indirectly influence the surface quality of the product. A precise knowledge of these optimum parameters facilitate reduce the machining costs and improve product quality. Current investigation aims to investigate the effect of process parameters; cutting speed, feed and depth of cut in turning of SS-316 which is widely used in automobile industries, each varying in three levels. The response characteristics considered for study were machining force, material removal rate and power. Experiments were planned according to Taguchi full factorial design using L_{27} orthogonal array. The machining was carried out using cemented carbide cutting tool and various forces acting on the cutting tool were measured using lathe tool dynamometer. Results indicated that cutting speed and tool feed rate have a significant effect than that of depth of cut on the quality characteristics.

Keywords: *Cutting forces, machining force, MRR, power*

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INTRODUCTION

Austenitic stainless steel is one of the most important engineering materials with wide variety of applications. Superior resistance to corrosion and compatibility in high temperature and high vacuum has particularly made it an attractive choice. Grade 316 is the standard molybdenum-bearing grade. Molybdenum gives 316 better corrosion resistance properties than crevice corrosion in chloride environment. It has excellent forming and welding characteristics.

As P 30 grade of cemented carbide would provide excellent balance of hardness, wear resistance and toughness, the same grade has been chosen for machining of stainless steel as cutting tool. Also effect of cutting speed, feed, and depth of cut on various characteristics during machining of austenitic stainless steel was studied. According to Ciftci (2005)[1] AISI 316 resulted in higher forces at all cutting speeds employed than AISI 304. Zhuang et al. (2010)[2] studied on two steels, free cutting austenitic stainless steel and austenite stainless steel 1Crl8Ni9Ti at various cutting speeds; they find that the cutting forces generally decreased with the increase of cutting speed in the range 10 – 80 m/min. They reached 418 N and 336 N at 10 m/min cutting speed for steel A and B respectively and at cutting speed of 80

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Electrochemical Etching on Copper Surfaces to Achieve Superhydrophobicity

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ABSTRACT

In the present study, an attempt has been made to create superhydrophobicity on copper substrate by etching the surface at different parameters (current density and time). Etching time was varied from 30 to 240 minutes. Untreated copper surface exhibited contact angle of 91.4°. The best etched surface exhibited a maximum contact angle of 142.1° for a current density of 0.01A/cm^2 and etching time of 60 minutes. The structure–property relationship of etched copper surface has been discussed by interpreting atomic force microscope results with contact angle.

Keywords: *contact angle, copper plate, etching, superhydrophobic surfaces, surface roughness*

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INTRODUCTION

Wetting is one of the most important properties of liquid/fluids to spread over a solid substrate. Wetting a solid by liquid is of great technological importance. Some applications require a good wetting between liquid and substrate surface such as soldering, printing, whereas some others demand poor wetting (or repellence) such as painting and solar panels. Contact angle is a measure of the degree of wetting or wettability of a surface by a liquid [1].

A surface is classified as either hydrophilic (loving water) or hydrophobic (scared of water) by how it interacts, or sticks to water drops. Usually, if the contact angle of water is smaller than 90° (or significantly low), the surface is regarded as hydrophilic. A surface which exhibits liquid drop with a contact angle over 90° is considered as hydrophobic. However, few surfaces are repellent to water droplet , i.e., extremely difficult to wet. A superhydrophobic surface is one that repels water to such an extent that the contact angles obtained are extremely high; they are generally defined as surfaces with water contact angles above 150°, but it has also been less commonly adopted as 140° [2]. This is also referred to as the lotus effect.

Superhydrophobic surfaces were first observed on plants and animals [3]. Such surfaces have received interest in many fields such as water-repellent, self-cleaning, contamination-inhibiting and anti-icing. Superhydrophobic surfaces are generally produced by roughening or by

Effect of Casting Moulds on Tribological Properties of Al-Sn Alloy

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***Abstract*: In the present study, an effect of casting mould on tribological properties of Al–15%Sn was investigated. Liquid Al–Sn (740°C) alloy was poured into moulds of aluminium and wood. Al–Sn alloy solidified in aluminium mould exhibited higher cooling rate compared to wood mould. Size of Sn grains/particles became finer and distributed uniformly in the matrix of alloy solidified in Al mould than in wood mould. An effect of surface wear on Al–Sn alloy cooled in different moulds was also assessed. Alloy cooled in Al mould exhibited less worn surface (692.3μm) than alloy cooled in wood (2045.6μm).**

***Keywords*: Al–Sn, Moulds, Microstructure, Mechanical properties.**

Introduction

Al–Sn is an immiscible alloy and it is called as soft tribological alloy. Al–Sn based alloys are broadly utilized as sliding bearing materials in car and shipbuilding industry due to their great compatibility, wear resistance and sliding properties [1]. Al-Sn alloys have good mechanical and tribological behaviours [2]. Excellent tribological properties can be achieved in Al-Sn alloys when the soft Sn-rich phase is dispersed homogeneously into the Al matrix. However due to the low density of the aluminium alloys, in engineering applications especially where it has to perform in friction environment it is necessary to improve its mechanical and tribological properties to support different loads and provide expected performance to the alloys [3,4]. Hence, in the present study an attempt has been made to improve the tribological properties of Al–Sn alloys by solidifying in aluminium and wood moulds.

Experimental

Al–15Sn alloy ingot was purchased in the dimensions of 350mm in length, 10mm width and 40mm of height as shown in Figure 1. Aluminium, and wood moulds were prepared in cylindrical dimension of 120 mm length, 30 mm inner diameter and 87 mm outer diameter as shown in Figure 2.

Figure 1: Al-15Sn Ingots

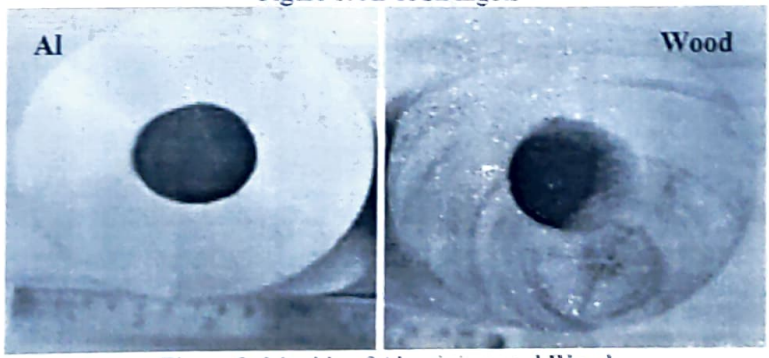

Figure 2: Moulds of Aluminium and Wood