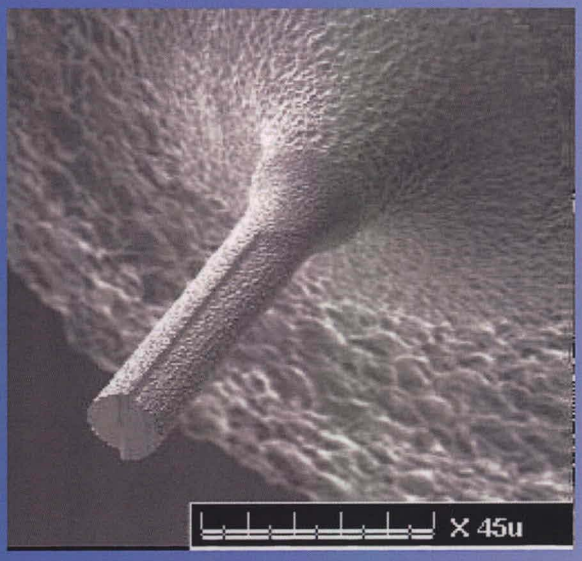
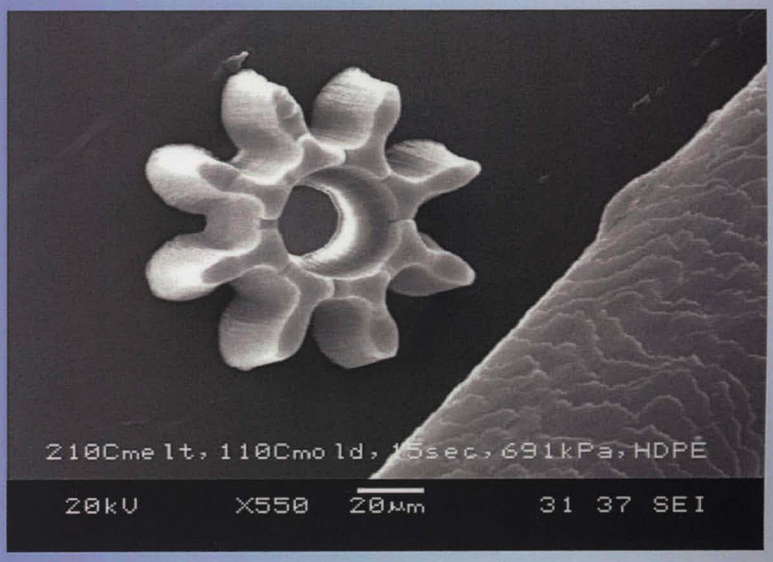
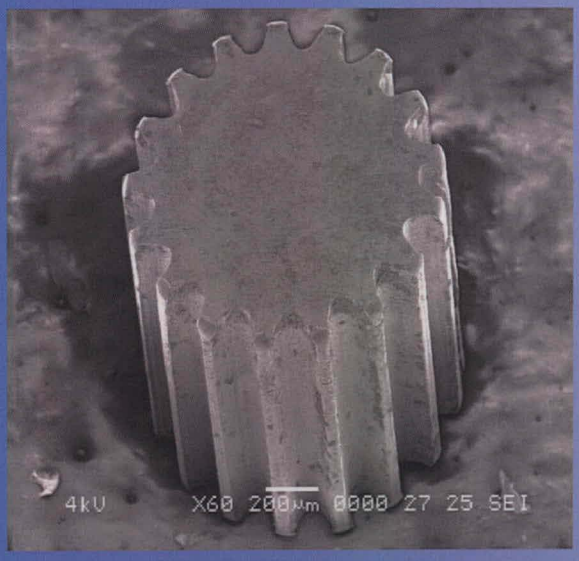
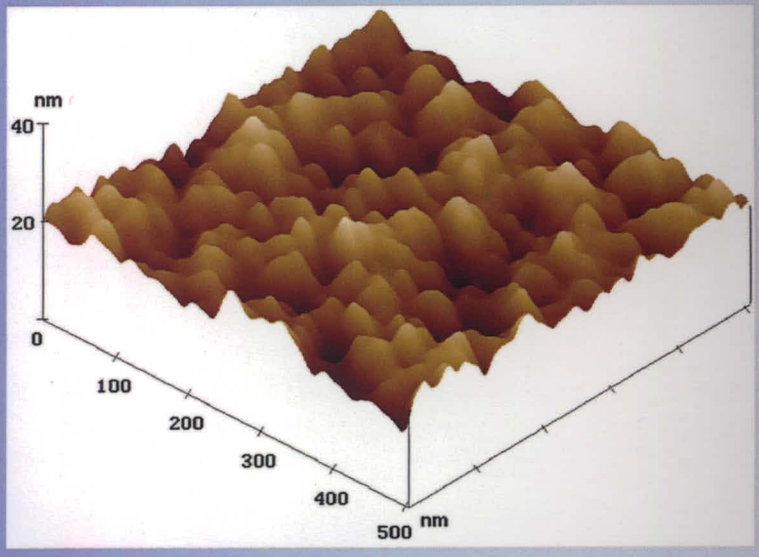
Advanced Machining Process









Editors
Mohammad Yeakub Ali
AKM Nurul Amin
Erry Yulian Triblas Adesta

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Erry Yulian Triblas Adesta

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Tel: +603-6188 1542 / 44 / 45 Fax: +603-6188 1543
EMAIL: iiumprinting@yahoo.com

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Table of Contents

Chapter 3

Role of Current, Voltage and Spark on-time on Electrode Material Migration during EDM

Ahsan Ali Khan , Nurul Shima Mohd Noh
Faculty of Engineering - International Islamic University Malaysia
: aakhan@iium.edu.my

Keywords: EDM, Material migration, Current, Voltage, Spark on-time

Abstract. In the present work the influence of current, voltage and spark on-time on electrode material migration to the workpiece has been investigated. It was found that when the current or voltage is high, a spark with higher energy is produced and mote electrode material is melted and migrated to the work surface. When spark on-time is higher, more time is available for the copper electrode to be melted and migrated to the workpiece.

Introduction

Electrical discharge machining (EDM) is a thermoelectric process that removes material from the workpiece by a series of discrete sparks between a work and tool electrode immersed in a liquid dielectric medium. Due to electrical sparks temperature may rise from 8000^0C to 20,0000 C. This high temperature is sufficient to melt and vaporize material from the workpiece. The molten material is ejected and flushed away by the dielectric leaving a very small crater on the electrode surface.

Only a few authors have studied the migration of material during EDM in the past. A number of authors have reported that the surfaces of the eroded electrodes are of the material which considerably differs from the initial one by its chemical composition and the properties. The surface consists of the dielectric pyrolysis products and of the alloy between the matrix and the opposite electrode. The material of the workpiece can diffuse into the tool surface and influence its wear resistance which can have even a negative effect. Several others such as Roethel, et.al [1] have noticed the presence of a considerable quantity of opposite electrode material in the surface treated and debris produced by EDM. Roethel has investigated the mechanism of mass transfer of electrode material and determined the changes in the zone of thermal influence. Pandey and Jilani [2] presented a thermal model on plasma channel growth and thermally damaged surface layer.

However, one of the research was done by J. S. Soni and G. Chakraverti [3] which done on investigation on migration of material during EDM of die steel (T215 Cr 12). This paper presents the scanning electron microscopic (SEM) investigation on changes in chemical composition of resolidified layers of the tools and the workpieces as well as debris. In the present work the influence of current, voltage and on-time on migration of materials has been studied during EDM of stainless steel with copper electrode.

Influence of Process Parameters on Electrode Migration

The EDS of the work surface is shown in Fig.1. The percentage composition of a few elements on the work surface before EDM is shown in Table 1.