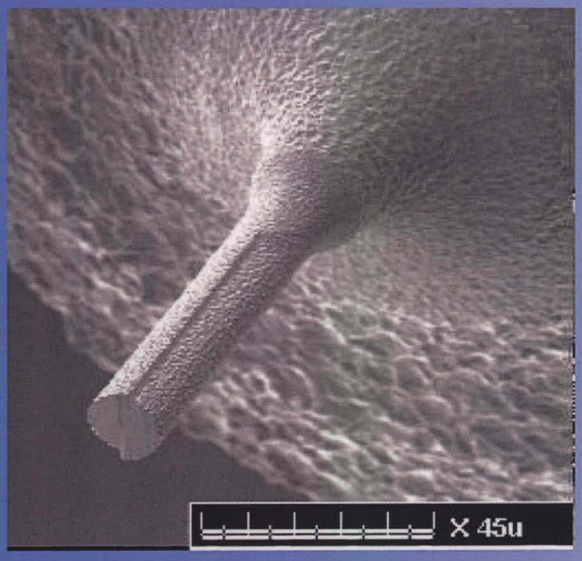
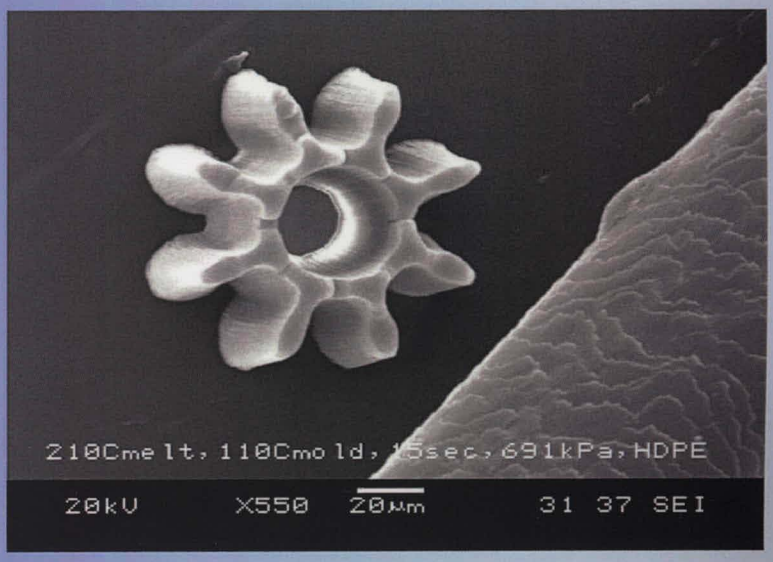
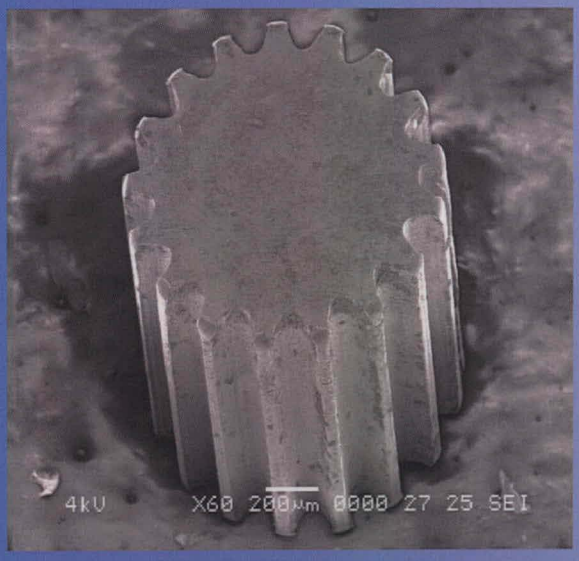
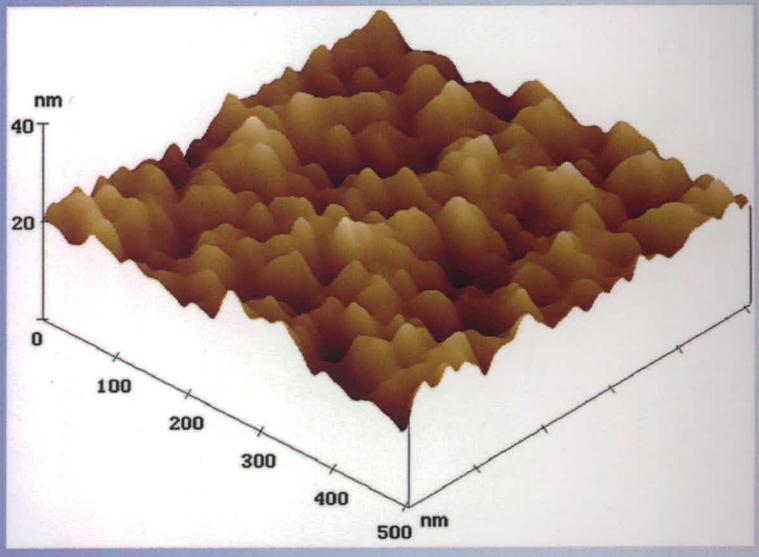
Advanced Machining Process









Editors
Mohammad Yeakub Ali
AKM Nurul Amin
Erry Yulian Triblas Adesta

IIUM PRESS
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

Advanced Machining Process

Editors

Mohammad Yeakub Ali
AKM Nurul Amin
Erry Yulian Triblas Adesta

IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Mohammad Yeakub Ali, AKM Nurul Amin & Erry Yulian Triblas Adesta: Advanced Machining Process

ISBN: 978-967-418-162-8

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed By:
IIUM PRINTING SDN.BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
68100 Batu Caves
Selangor Darul Ehsan
Tel: +603-6188 1542 / 44 / 45 Fax: +603-6188 1543
EMAIL: iiumprinting@yahoo.com

Advanced Machining Process

Table of Contents

Chapter 9

Formation of Micro-cracks and Recast Layer during EDM of Mild Steel using Copper Electrodes

Ahsan Ali Khan[1], Erry Y.T. Adesta and Mohammad Yeakub Ali[3]
Faculty of Engineering – International Islamic University Malaysia
[1]: aakhan@iium.edu.my

Keywords: EDM; Micro-crack; recast layer; mild steel; Copper electrode

Abstract. The present paper reports on the influence of process parameters on formation of micro-cracks and recast layer on mild steel during EDM using a copper electrode. Surface quality was evaluated on the basis of work surface roughness, micro cracks and thickness of the recast layer. Current, pulse-on time, pulse-off time and voltage were the variable parameters for the present investigation. Micro cracks were found on the surface due to rapid heating and cooling of the surface during EDM. Micro cracks reduced in number and size when the surface was EDMed with a low current and a short pulse-on time. A layer of recast layer on the work surface was observed after EDM. The thickness of the recast layer was higher while a higher current together with a higher pulse-on time were used. It was concluded that in order to have a high quality surface it should be machined with lower values of current, pulse-on time and voltage.

Introduction

Electrical discharge machining (EDM) is the most common machining technique to produce molds and dies of difficult to machine materials. Since its introduction to manufacturing industry in late 1940s, EDM became a well-known machining method [1]. High quality surface of dies and molds is the prime requirement in order to produce parts with high precision. Surface quality of EDMed parts are evaluated by work surface finish (R_a), micro-cracks and thickness of the recast layer on the machined surface. The parameters influencing on the performance of EDM are current (I), voltage (V), pulse-on time (t_{on}) and pulse-off time (t_{off}). Machining process parameters have an important effect on the surface quality [2]. Efforts have been done by many researchers to draw the relationship of the machining parameters on the performance of EDM. Soo Hiong et al. [3] observed a damaged layer on the workpiece surface with cracks during EDM of tungsten carbide. They concluded that high peak current and t_{on} produce more cracks. Attempts were made to quantify the depth of white (or damaged) layer with respect to the process parameters after EDM. It is found that with a fixed dielectric and flushing condition, the damaged layer correlates well with the pulse energy irrespective of the workpiece material [6,7]. During machining martensitic steel Rebelo et al. found that the dimensions of random overlapping surface craters increase with machining pulse energy [8]. According to their observation, the density and penetration depth of the cracks in the recast layer increases with the machining pulse energy. In another development Y.H. Guu et al. [9] found that the depth of micro-cracks, micro voids and machine damage increase with an increase in the amount of A and t_{on}. The above discussions reveal that efforts have been done to correlate machining parameters with machined surface