ADVANCED MACHINING TOWARDS IMPROVED MACHINABILITY OF DIFFICULT-TO-CUT MATERIALS

Edited by:
A.K.M. Nurul Amin (Chief Editor)
Dr. Erry Yulian Triblas Adesta
Dr. Mohammad Yeakub Ali

IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

ADVANCED MACHINING

TOWARDS IMPROVED MACHINABILITY OF DIFFICULT-TO-CUT MATERIALS

Edited by:
A.K.M. Nurul Amin (Chief Editor)
Dr. Erry Yulian Triblas Adesta
Dr. Mohammad Yeakub Ali

IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Advanced Machining Towards Improved Machinability of Difficult-To-Cut Materials: A.K.M. Nurul Amin, Erry Yulian Triblas Adesta & Mohammad Yeakub Ali

ISBN: 978-967-418-175-8

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

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Advanced Machining Towards Improved Machinability of Difficult-To-Cut Materials: A.K.M. Nurul Amin, Erry Yulian Triblas Adesta & Mohammad Yeakub Ali

ISBN: 978-967-418-175-8

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

List of Contents

Chapter 2

Machinability Improvement in End of Milling Titanium Alloy Ti-6Al-4V Through Preheating

A.K.M. Nurul Amin[1], Turnad L. Ginta[1],
[1]Department of Manufacturing and Materials Engineering, International Islamic University Malaysia, PO. Box 10 50728 Kuala Lumpur Malaysia

e-mail address of corresponding author: *akamin@iium.edu.my*

1.0 INTRODUCTION

Titanium alloys are used widely in the aerospace, chemical and ship building industry because of their superior mechanical properties, heat resistance and corrosion resistance. Titanium alloys, however, are materials that are extremely difficult to machine. During the machining of titanium alloy, tool wear progresses rapidly because of the high cutting temperature and strong adhesion between the tool and the work material, owing to their low thermal conductivity and high chemical reactivity [1,2]. However, by properly selecting the tool material and cutting conditions an acceptable rate of tool wear may be achieved and thus lowering the total machining cost [3]. The performance of a cutting tool is normally assessed in terms of its life. Mostly, flank wear is considered, since it largely affects the stability of the cutting wedge and consequently the dimensional tolerance of the machined work surface [4].

The use of workpiece preheating (hot machining) as a technique for improving machining operations has been under consideration since the late 19th century. This was informed by understanding that metals tend to deform more easily when heated, thus enhancing machining. The principle behind hot machining is increasing difference in hardness of the cutting tool and workpiece, leading to reduction in the component forces, improved surface finish and longer tool life [5]. Amin and Talantov [6] studied the influence of the furnace method of preheating of workpiece on machinability of titanium alloy BT6 (Russian Standard) and found that the vertical cutting force component decreases with the increase in the preheating temperature but the radial and the axial components sharply increase to their peak values at a particular temperature. Ozler et al [7] used gas flame heating to improve the machinability of austenitic manganese steel. Wang et al [8] performed LAM using YAG continuous solid laser on Al_2O_3 particle reinforced aluminum matrix composite (Al_2O_3p/Al). The result of their study showed that in machining of Al_2O_3p/Al composite the cutting force was reduced by 30-50 %, tool wear was reduced by 20-30 % in laser assisted machining as compared with conventional cutting. Tosun and Ozler [9] studied hot machining in turning high manganese steels using liquid