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

Edited by:
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IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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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
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Chapter 28

Comparison of Machinability of Ceramic Insert in Room Temperature and Cryogenic Cooling Conditions during End Milling Inconel 718

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1.0 INTRODUCTION

Nickel based super alloy or Inconel 718 is known as heat resistant alloys which they are primarily used in gas turbine, steam turbine component and aircraft engine component construction [1]. Inconel 718 attained several unique combinations of properties like strength at elevated temperature, resistance to chemical degradation and wear resistance [2]. However, their ability to maintain these properties at elevated temperatures severely deters the machinability of the alloy, thus it is generally regard to as difficult to machine alloy [3]. The properties of nickel based alloys that contributes to the difficulties in their machining are summarized as follows: (i) major part of its strength is maintained during machining due to high temperature properties; (ii) work hardening occurs rapidly during machining which an ultimate input to notch wear at the tool nose; (iii) cutting tools suffer from high abrasive wear due to the presence of hard abrasive carbides particles in the material; (iv) chemical reaction occurs at high cutting temperatures when machining with normal cutting tool materials, which leads to a high diffusion wear rate; (v) adhesion of nickel alloys onto the cutting tool frequently occur during machining which causing severe notching on the tool rake face due to consequent pull-out of the tool materials; (vi) production of a tough and continuous chip which is difficult to control during machining thus contributing to the degradation of the cutting tool by seizure and cratering; and (vii) poor thermal conductivity of nickel based alloys frequently generates high temperature at the tool tip as well as high thermal gradients in the cutting tool [4]. Due to deprived machinability factors mentioned above, tool life attained when machining nickel based alloys are severely insufficient [5]. Most of main key parameters such as choice of tool materials, tool geometry, machining method, cutting variables and conditions become the causes to achieve sufficient tool life during machining [6]. Several studies on the machining of nickel based alloys had been performed with the use of different tool materials that will contribute to improve machinability and ensure of longer tool life and better surfaced integrity of machined components.

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