TRIZ approach for machining process innovation in cryogenic environment

By: Ghani, JA (Ghani, Jaharah A.)[1]; Natasha, AR (Natasha, A. R.)[1,2]; Hassan, CHC (Hassan, C. H. Che)[1]; Syarif, J (Syarif, J.)[3]

INTERNATIONAL JOURNAL OF MATERIALS & PRODUCT TECHNOLOGY
Volume: 53 **Issue:** 3-4 **Pages:** 286-297 **Special Issue:** SI
DOI: 10.1504/IJMPT.2016.079200
Published: 2016
Document Type: Article
View Journal Impact

Abstract

This paper presents the utilisation of TRIZ approach in machining process of AISI 4340 in cryogenic environment which lead to product improvement in turning process. The machining study is carried out in two stages; FEM simulation for finding the optimum condition and machining experiment to visualise the product improvement that involved plastic deformation. The simulation result revealed that at moderate to high cutting speed, high feed rate and high depth of cut will result in high temperature that enable for the change in phase of AISI 4340 from retained austenite to fully martensite. A sample from machining experiment at optimum cutting condition found that the microstructure changes beneath the machined until at the depth of similar to 7 mu m with high hardness to 8,500 N/mm(2) Martens hardness at the machined surface. This hardness is equivalent to the hardness obtained in conventional case hardening process that is required after the machining of AISI 4340 in their application as automotive engine parts in order to enhance these parts in their service lives. This study reveals that the TRIZ approach helps to systematically analyse the various outcomes in this study started with process limitation, problem identification, axiomatic and Su-field analysis.

Keywords

Author Keywords: TRIZ; machining process for product improvement; cryogenic turning; high hardness
KeyWords Plus: CUTTING FORCES; ALLOY; TOOL

Author Information

Reprint Address: Ghani, JA (reprint author)

+ Univ Kebangsaan Malaysia, Fac Engn & Built Environm, Dept Mech & Mat Engn, Bangi 43600, Malaysia.

Addresses:

+ [1] Univ Kebangsaan Malaysia, Fac Engn & Built Environm, Dept Mech & Mat Engn, Bangi 43600, Malaysia

+ [2] Int Islamic Univ Malaysia, Fac Engn, Dept Mfg & Mat, POB 10, Kuala Lumpur, Malaysia

+ [3] Univ Sharjah, Coll Engn, Dept Mech Engn, POB 27272, Sharjah, U Arab Emirates

E-mail Addresses: jaharahaghani@ukm.edu.my; tasha0812@gmail.com; chase@ukm.edu.my; sjunaidi@sharjah.ac.ae

Publisher
INDERSCIENCE ENTERPRISES LTD, WORLD TRADE CENTER BLDG, 29 ROUTE DE PRE-BOIS, CASE POSTALE 856, CH-1215 GENEVA, SWITZERLAND

Journal Information
Impact Factor: Journal Citation Reports

Categories / Classification
Research Areas: Materials Science
Web of Science Categories: Materials Science, Multidisciplinary

See more data fields

1 of 1

Cited References: 17

Showing 17 of 17 **View All in Cited References page** *(from Web of Science Core Collection)*

1. Title: [not available] **Times Cited: 117**
By: Altshuller, G. S.
Creativity as an exact science: The theory of inventive problem solving Published: 1988
Publisher: Gordon and Breach, New York, NY

2. **Influence of case hardening on wear resistance of a sintered low alloy steel** **Times Cited: 5**
By: Askari, M.; Khorsand, H.; Aghamiri, S. M. Seyyed
JOURNAL OF ALLOYS AND COMPOUNDS Volume: 509 Issue: 24 Pages: 6800-6805 Published: JUN 16 2011

3. Title: [not available] **Times Cited: 1**
Group Author(s): ASM International
ASM HDB PROP SEL IR Volume: 1 Published: 2001
online
Publisher: The Materials Information Company

4. Title: [not available] **Times Cited: 1**
By: Groover, M.P.
Fundamentals of Modern Manufacturing Pages: 491-504 Published: 2007
Publisher: John Wiley & Sons, Inc, USA

5. **Design and manufacturing of a 3-D dynamometer** **Times Cited: 4**
By: Korkut, I; Donertas, MA; Seker, U.
Zonguldak Karaelmas University, Karabuk Faculty of Technical Education, J Technol Volume: 2 Pages: 115-129 Published: 1999

6. RETRACTED: **Applying TRIZ and Fuzzy AHP to develop innovative design for automated manufacturing systems (Retracted article. See vol. 42, pg. 5402, 2015)** **Times Cited: 55**
By: Li, Te-Sheng; Huang, Hsing-Hsin
EXPERT SYSTEMS WITH APPLICATIONS Volume: 36 Issue: 4 Pages: 8302-8312 Published: MAY 2009

7. **A TRIZ Inventive Product Design Method without Contradiction Information.** **Times Cited: 10**
By: Liu, C.-C.; Chen, J. L.
The TRIZ Journal Published: 2001