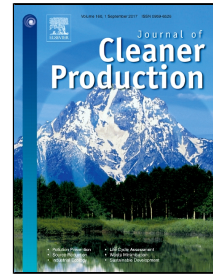


# Accepted Manuscript

Sustainable machining: Process energy optimisation of wire electrodischarge machining of Inconel and Titanium superalloys

Janaka R. Gamage, Anjali K.M. DeSilva, Dimitrios Chantzis, Mohammad Antar



PII: S0959-6526(17)31356-2  
DOI: 10.1016/j.jclepro.2017.06.186  
Reference: JCLP 9936  
To appear in: *Journal of Cleaner Production*  
Received Date: 04 January 2017  
Revised Date: 20 June 2017  
Accepted Date: 20 June 2017

Please cite this article as: Janaka R. Gamage, Anjali K.M. DeSilva, Dimitrios Chantzis, Mohammad Antar, Sustainable machining: Process energy optimisation of wire electrodischarge machining of Inconel and Titanium superalloys, *Journal of Cleaner Production* (2017), doi: 10.1016/j.jclepro.2017.06.186

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Word count: 6718

Sustainable machining: Process energy optimisation of wire electrodischarge machining of Inconel and Titanium superalloys

Janaka R. Gamage<sup>a</sup>, Anjali K.M. DeSilva<sup>a,\*</sup>, Dimitrios Chantzis<sup>b</sup>, Mohammad Antar<sup>b</sup>

<sup>a</sup>School of Engineering and Built Environment, Glasgow Caledonian University, Glasgow, Scotland, UK

<sup>b</sup>The Manufacturing Technology Centre, Coventry, UK

\* Corresponding author. Tel.: +44-141-331-3522; fax: + 44-141-331-3005. E-mail address: [ade@gcu.ac.uk](mailto:ade@gcu.ac.uk)

## Abstract

Process energy optimisation is vital in view of the environmental performance of electrodischarge machining (EDM). This research is focused on identifying the significant parameters that optimise the process energy consumption of wire EDM (WEDM) of superalloys: Inconel-718 and Ti64Al4V. **Four general parameters: workpiece material, workpiece thickness, wire material, and wire diameter; and four discharge parameters: gap voltage, peak current, pulse-ON time, and pulse-OFF time were tested against specific energy consumption (SEC) and surface quality of the cut.** Taguchi design of experiments and analysis of variance (ANOVA) methods were used for experimentation and analysis. **The Green House Gas Protocol is used to analyse potential reductions in carbon emissions. The results indicate that preferred parameters to minimise the specific energy consumption are workpiece thickness, wire material, wire diameter, and pulse-OFF time in the order of significance. It is found that 2/3<sup>rd</sup> of the total energy was consumed during non-working hours which can potentially be saved. Further, the reduction of carbon emissions corresponds to non-working energy consumption of the machines is also presented.**

**Keywords:** Sustainable machining; WEDM; Process energy, Superalloys

## 1 Introduction

### Glossary of terms

HB	Higher-the-Better
LB	Lower-the-Better
MRR	Material Removal Rate (mm <sup>3</sup> /min)
P-OFF	Pulse Off time (μs)
P-ON	Pulse On time (μs)
R <sub>a</sub>	Average Surface Roughness (μm)
SEC	Specific Energy Consumption(kJ/mm <sup>3</sup> )

Download English Version:

<https://daneshyari.com/en/article/5480476>

Download Persian Version:

<https://daneshyari.com/article/5480476>

[Daneshyari.com](https://daneshyari.com)