

Accepted Manuscript

Investigation of machinability in turning of difficult-to-cut materials using a new cryogenic cooling approach

Amin Bagherzadeh, Erhan Budak

PII: S0301-679X(17)30547-9

DOI: [10.1016/j.triboint.2017.11.033](https://doi.org/10.1016/j.triboint.2017.11.033)

Reference: JTRI 4973

To appear in: *Tribology International*

Received Date: 9 August 2017

Revised Date: 18 November 2017

Accepted Date: 18 November 2017

Please cite this article as: Bagherzadeh A, Budak E, Investigation of machinability in turning of difficult-to-cut materials using a new cryogenic cooling approach, *Tribology International* (2017), doi: 10.1016/j.triboint.2017.11.033.

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1 Investigation of machinability in turning of difficult-to-cut
2 materials using a new cryogenic cooling approach

3 Amin Bagherzadeh and Erhan Budak
4 Manufacturing Research Laboratory
5 Sabanci University, 34956, Istanbul, Turkey
6

7 Corresponding author (E. Budak): Tel: +90-216-4839519, Fax: +90-216-4839550

8 Email address: ebudak@sabanciuniv.edu

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10 **Abstract**

11 A new cooling technique is proposed to improve effectiveness of the minimum quantity
12 lubrication (MQL) and cryogenic carbon dioxide (CO₂) cooling in high performance
13 machining of hard-to-cut materials. The combination of minimum quantity carbon dioxide
14 and oil (CMQL) supplied from the rake face are compared with CO₂ and MQL supplied from
15 rake and flank faces, respectively, as well as only CO₂ supplied from rake face, in turning of
16 Ti6Al4V and Inconel 718. Tool wear, surface roughness and temperature measurements
17 were performed to quantify the cooling impact of the various methods. Based on the
18 systematical test results, CMQL was identified as the most favorable cooling method
19 considering environmental impact, tool wear, surface finish, chip formation and cutting
20 forces.

21 *Keywords:* Cryogenic machining, Tool wear, Surface finish, Cutting temperature
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