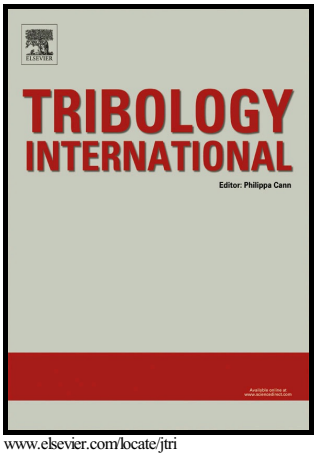
Prediction of the Erosive Footprint in the Abrasive Jet Micro-machining of Flat and Curved Glass

K. Kowsari, A. Nouhi, V. Hadavi, J.K. Spelt, M. Papini



www.elsevier.com/locate/jtri

PII: S0301-679X(16)30404-2
DOI: http://dx.doi.org/10.1016/j.triboint.2016.10.038
Reference: JTRI4428

To appear in: *Tribiology International*

Received date: 13 July 2016
Revised date: 28 September 2016
Accepted date: 26 October 2016

Cite this article as: K. Kowsari, A. Nouhi, V. Hadavi, J.K. Spelt and M. Papini, Prediction of the Erosive Footprint in the Abrasive Jet Micro-machining of Fla and Curved Glass, *Tribiology International* http://dx.doi.org/10.1016/j.triboint.2016.10.038

Prediction of the Erosive Footprint in the Abrasive Jet Micro-machining of Flat and Curved Glass

K. Kowsari[a], A. Nouhi[b], V. Hadavi[b], J.K. Spelt[a,b*] M. Papini[b,a*],

[a]Department of Mechanical and Industrial Engineering, University of Toronto, 5 King's College Road, Toronto, ON, Canada M5S 3G8, Canada
[b]Department of Mechanical and Industrial Engineering, Ryerson University, 350 Victoria Street, Toronto, Ontario, M5B 2K3, Canada
spelt@mie.utoronto.ca,
mpapini@ryerson.ca,
*corresponding authors: Tel.: +1 (416) 978-5435, Fax: +1 (416) 978-7753
*corresponding authors: Tel.: +1 (416) 979-5000 X7655, Fax: +1 (416) 979-5265

Abstract

A computational fluid dynamics (CFD) procedure is presented for the prediction of the erosive footprint size in abrasive jet micro-machining (AJM). The CFD-obtained footprints were in good agreement with those measured experimentally. The footprint was found to be due to both primary particle impacts in the conical plume emanating from the nozzle, and secondary particle impacts driven by the flow. The footprint depended on target curvature because the spread in lateral particle rebounds differed, depending on the target radius. It thus follows that footprints obtained from shallow channels machined on flat targets cannot be used to predict channel shape on curved surfaces. Since the footprint must consider secondary impacts, this has important implications for surface profile modeling of curved surfaces.

Keywords: abrasive particle; air jet; footprint; computational fluid dynamics.