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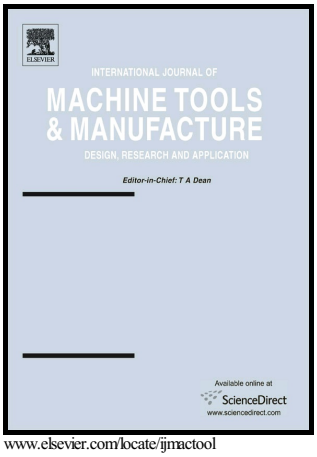

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PII: S0890-6955(16)30405-9
DOI: http://dx.doi.org/10.1016/j.ijmachtools.2016.12.001
Reference: MTM3213

To appear in: *International Journal of Machine Tools and Manufacture*

Received date: 17 October 2016
Revised date: 1 December 2016
Accepted date: 2 December 2016

Cite this article as: Chenwei Dai, Wenfeng Ding, Jiuhua Xu, Yucan Fu and Tianyu Yu, Influence of grain wear on material removal behavior during grinding nickel-based superalloy with a single diamond grain, *International Journal of Machine Tools and Manufacture* http://dx.doi.org/10.1016/j.ijmachtools.2016.12.001

Influence of grain wear on material removal behavior during grinding nickel-based superalloy with a single diamond grain

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Abstract

In order to explore the effect of grain wear on material removal behavior during grinding nickel-based superalloy Inconel 718, the grinding experiment with a single diamond grain was carried out. The variations of grain wear, grinding force and force ratio, and pile-up ratio were investigated under the conditions of undeformed chip thickness (UCT) ranging from 0.2 to 1 μm. The results show that a critical UCT value, such as 0.3 μm, could be determined according to the pile-up ratio and could also be used to quantify the material removal process. The wear behavior of a diamond grain shows four types, such as crescent depression on the rake face, abrasion on the flank face, grain micro-fracture, and grain macro-fracture. Furthermore, these classifications were determined by the dwell time of rubbing, ploughing and cutting at different UCT values applied. The grinding force ratio increased with increasing of the negative rake angle of a diamond grain. In the rubbing and ploughing stages, the material removal efficiency is proportional to the wear width on the rake face. However, in the cutting stage, the material removal efficiency is diminished in the absence process of crescent depression.

Keywords: Single diamond grain; Material removal; Grinding force; Wear; Pile-up.