

Study on the Burr Formation Process in Micro Milling of High Aspect Ratio Structures

Xinlei Zhang

Ni Chen (✉ ni.chen@nuaa.edu.cn)

Nanjing University of Aeronautics and Astronautics <https://orcid.org/0000-0002-2036-0324>

Jinming Wu

Jiawei Wei

Bo Yan

Liang Li

Ning He

Research Article

Keywords: Micro-milling, Burr formation, High-aspect-ratio (HAR) micro-structures, Finite element method, Chip flow

DOI: <https://doi.org/10.21203/rs.3.rs-181429/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

High-aspect-ratio (HAR) micro-structures of harden steel (SKD11) are widely used in the national defense and electronic fields. Micro-milling is a suitable method for machining HAR micro structures, however the inevitable generation of burrs deteriorates the machined surface. Previous studies have mostly focused on the burr formation process of shallow grooves, but have ignored HAR grooves. This paper investigated the burr formation mechanism in HAR (2:1) grooves on harden steel (SKD11). Due to the fact that the burr formation process was difficult to be observed in the actual micro-milling process, a finite element model was established. A corresponding experimental research was conducted, which revealed a good consistency between simulation and experimental results. Moreover, a new burr type was formed on the sidewall of the HAR groove, which was transformed from top burrs and was named as side burr. The results demonstrated that the chip flow on the rake face of the micro-mill was hindered by the sidewall, which caused chip crumbling, chip accumulation, and surface scraping, seriously affecting the burr formation mechanism. This paper revealed the burr formation mechanism for HAR grooves, and provided research direction for improving the machining accuracy of HAR grooves.

Full Text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed. However, the latest manuscript can be downloaded and [accessed as a PDF](#).