Data in Brief 22 (2019) 574–577

Contents lists available at ScienceDirect

Data in Brief

journal homepage: www.elsevier.com/locate/dib

Data Article

Wear data for trials machining brass, titanium grade 2 and Hastelloy in order to characterize wear of micro-tools

L.L. Alhadeff*, M.B. Marshall, T. Slatter

Department of Mechanical Engineering, University of Sheffield, Mappin St, Sheffield, S1 3JD, UK

A R T I C L E I N F O

Article history:
Received 23 November 2018
Received in revised form
12 December 2018
Accepted 13 December 2018
Available online 18 December 2018

A B S T R A C T

This data article presents data on machining trials that were carried out using 0.5 mm micro-end-mills with different coatings to characterize their wear. The data take the following forms: Tabulated wear measurements, cutting force measurements and graphs of wear against sliding distance. Three materials were machined: titanium grade 2, Hastelloy and Brass (CuZn37). Wear is measured on the flank, rake face and outside edge of the tools.

Two coatings were used for each material, with wear data plotted for each material.

For further information on experimental methods please refer to “Protocol for Tool Wear Measurement in Micro-milling” (Alhadeff et al., 2018).

Specifications table

Subject area	*Mechanical engineering*
More specific subject area	*Tribology of machine tools*
Type of data	*Tables, graphs, text*

DOI of original article: https://doi.org/10.1016/j.wear.2018.11.018
* Corresponding author.
E-mail address: lalhadeff1@sheffield.ac.uk (L.L. Alhadeff).

https://doi.org/10.1016/j.dib.2018.12.051

How data were acquired	*SEM (Hitachi TM 3030 tabletop SEM)* *Kistler Dynamometer (Type 9317C)*
Data format	*Raw wear distance measurements in micro meters, in tabulated format. Tabulated cutting forces processed to produce an average force over a single cut.*
Experimental factors	*Samples were washed; examined using SEM and then wear scars were measured.*
Experimental features	*Tools were used to machine and then removed from the spindle to be measured with an SEM every n cuts. Cutting forces were measured using a force cell on the bed of the machine.*
Data source location	George Porter Building, University of Sheffield, Sheffield, UK. 53°23′00″N, 1°28′44″W
Data accessibility	*Data Included in this article.*
Related research article	L. Alhadeff, M.B. Marshall, T. Slatter, Protocol for Tool Wear Measurement in Micro-milling, Wear, 2018.

Value of the data

- Micro-milling tool wear studies often contain insufficient data points to identify wear curves. The data provide wear measurements that can be plotted to examine the evolution of wear curves for a number of tool coatings and materials.
- The use of sliding distance for these data will allow it to be compared with existing data so that a large scale comparison for a number of tool coatings and materials can take place to compare relative performance of tools.
- Force data allow a comparison between wear and cutting forces to be made both within this data and also in comparison with other datasets.

1. Data

The data included in this article primarily takes the form of tabulated tool wear data, considering tool wear over different parts of the tool: tool flank, rake face and outside edge.

Data on cutting forces is also provided post-analysis, due to the extremely high volume of wear data. Analysis is a simple averaging process described below.

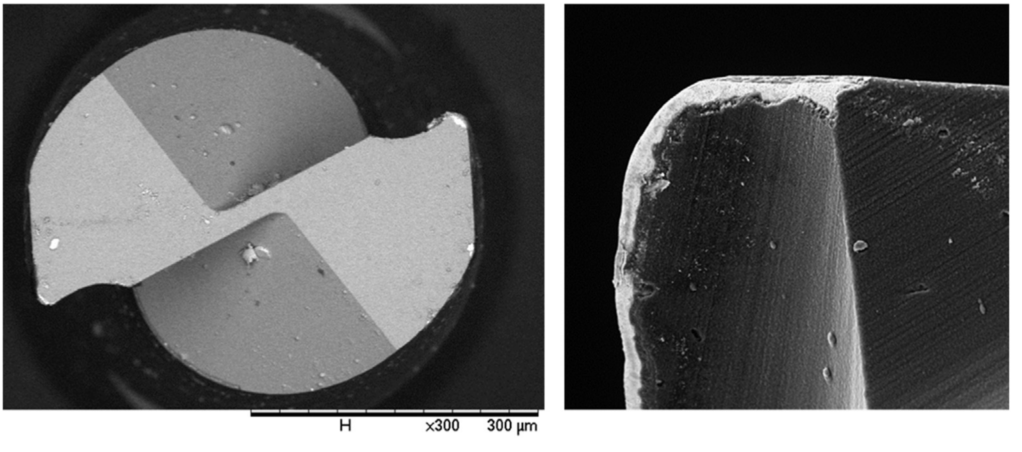

Fig. 1. Measurement orientations of tools [1].

2. Experimental design, materials and methods

Once an acceptable wear testing protocol had been established [1], machining trials were designed to test the pertinence and consistency of the method. Tools were set up and measured in two orientations (Fig. 1).

The trials took place on a KERN Evo micro-milling machine with a maximum spindle speed of 50,000 RPM. The tools used were commercially available 0.5 mm AlTiN coated tungsten carbide end mills (SGS SER M2SM 0.5 × 3 × 0.8 × 38). Straight slots of 25 mm in length were milled to a depth of 0.2 mm. The workpiece and tool were flooded continuously throughout the cutting process using synthetic Hocut 768. The machining parameters are given in Table 1.

The different cutting speeds and feed rates used for each material can be accounted for through the use of sliding distance as the independent variable in reporting the results. The workpiece was mounted onto a 3-component force link (Kistler 9317C) (Fig. 2) capable of measuring cutting forces in three dimensions (*x*, *y*, *z*) aligned with the major axes of the cutting process. This was connected to a National Instruments data acquisition system (DAQ) and. Kistler software was used to analyse the recorded data. After each cut was completed, the tools were imaged (by SEM) to measure the wear. This was then tabulated. Raw Kistler dated was analysed to find an average cutting force, feed force and normal force, and also to approximate the force signals to the second term of the Fourier transform. The transformed data are provided here.

Table 1
Parameters used in machining. Only one parameter changed: radial depth of cut. For each set of parameters the test was repeated twice [1].

	Titanium grade 2	Hastelloy C276
Spindle speed (rpm)	25,205	6786
Feed (m/min)	69	11
F z (mm)	0.00136	0.00080
Radial depth of cut (mm)	0.5	0.5
Axial depth of cut (mm)	0.2	0.2
Sliding distance per 25 mm length	14.06	23.75

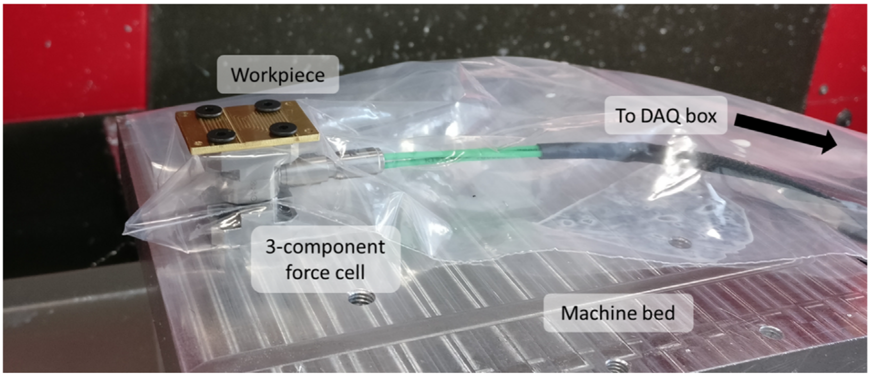

Fig. 2. Force measurement setup.

Acknowledgements

The authors wish to acknowledge the contribution of tools and expertise from Steve Neale at KYOCERA SGS Precision Tools Europe Ltd, UK; and the financial support of the EPSRC (EP/L016257/1) in this work.

Transparency document. Supporting information

Transparency document associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2018.12.051.

Reference

[1] L. Alhadeff, M.B. Marshall, T. Slatter, Protocol for tool wear measurement in micro-milling, Wear (2018).