Applications of Confocal Microscopes on Toolmark Analysis

Eden Amin, Samantha Springer, Nate Simon, Dr. Jeff Salyards, Dr. Heike Hofmann
Iowa State University

Introduction

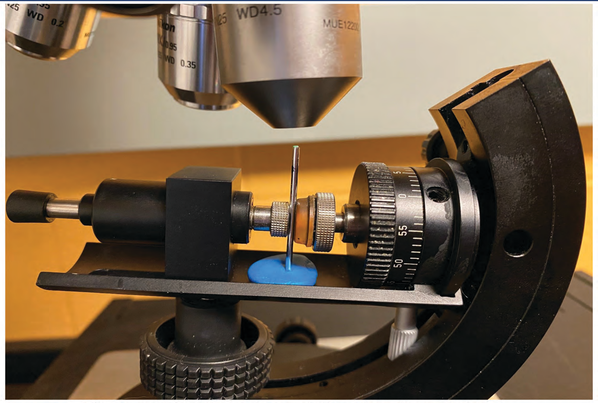
We lack published articles demonstrating the potential of wire cutter tool mark comparisons. This study involves creating test cuts with aluminum wire using Kaiweets wire cutters. Our preliminary findings show that test cuts have a small area of no striations, or "smush", before leaving any striae. In the next steps, we will create a program to extract three-dimensional data, or a signature, from the test cuts, ultimately determining accuracy as a function of the area of the cut.

Goals

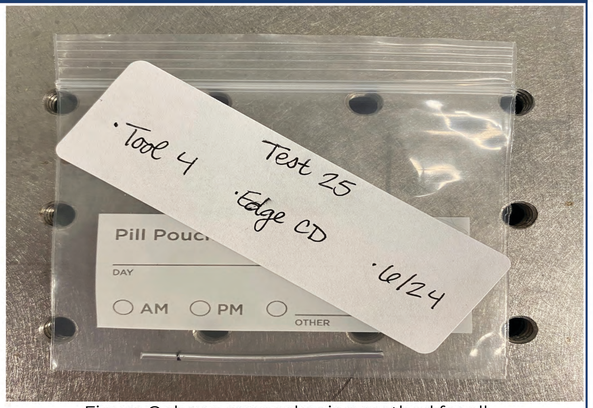
- Standardization across the field of toolmark evidence
- Finding accuracy as a function of area of the test cut
- Utilizing machine learning to make accurate statistical comparisons
- To develop a method for toolmark comparisons (specifically wire cutters)
- To be able to replicate results found on this study

Methods Images

A Figure A shows an example of how we would get a test cut. For this image we are using pair 4 of our pliers making an AB test cut

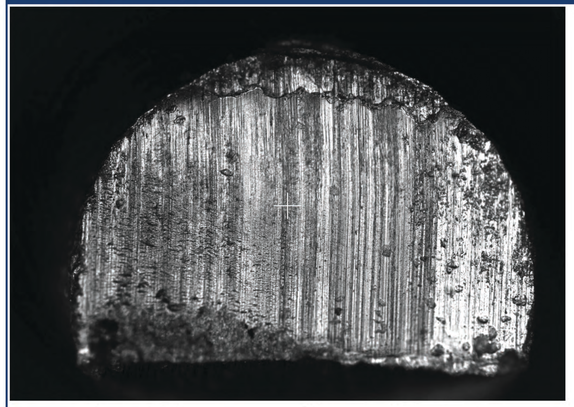


B Figure B shows a piece of the aluminum wire sitting in the stage of the microscope. We utilize sticky tac to help keep it in place while scanning.

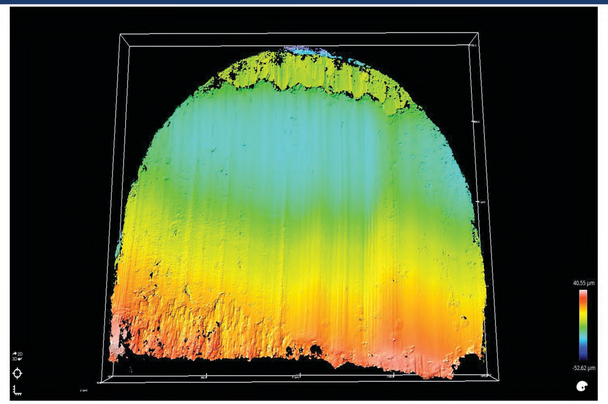


C Figure C shows our packaging method for all test cuts. On the Ziploc we label the test number, tool, edge side, and date.

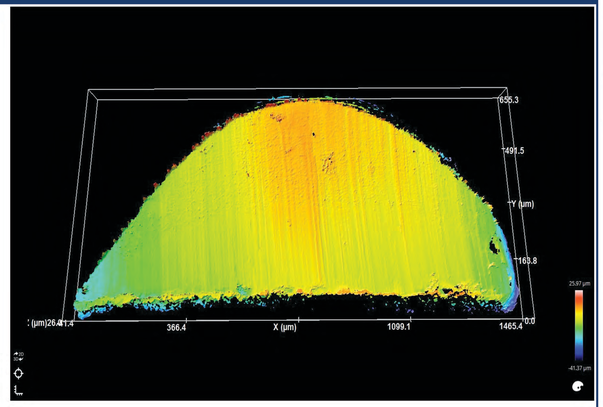
Results Images



D Figure D shows an overall image of a test cut scan under the 10x optic lens on our confocal microscope.



E Figure E shows an in-depth scan of the large side of a test cut, or side A. Here you can see good striations as well as the smush.



F Figure F shows an in-depth scan of the small side of a test cut, or side B.

Methods

For this study we have created a method for achieving reliable scans of the aluminum wire on a confocal microscope. Our initial data collection, which consisted of four wires cut per wire cutter at three separate locations (inner, middle, and outer), has shown there is some variance between the location of the test cut on the wire cutters and the scan itself. Each packaged wire has a corresponding file within an organized folder system in order to easily relocate and compare for future analysis.

Next Steps

For our next steps we hope to scan the wire cutters themselves to start matching test cuts to unknown samples. We also have started testing cuts on aluminum sheets to view the entire cutting surface. In addition, we plan to create a program to implement machine learning to make accurate comparisons.

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