CLEMEX

Image Analysis Report

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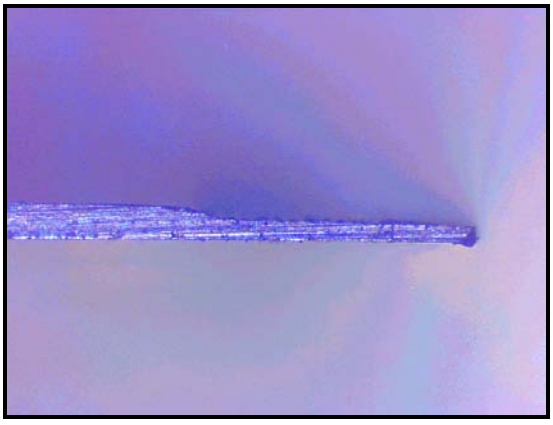

Cutting Blade Characterization

Sample Description

One sample of cutting blade.

Purpose of Analysis

Demonstrate the ability of the Clemex Vision image analyzer to measure:

- blade thickness
- edge thickness
- edge width
- attacking angle

Apparatus

Image Analysis System:	Clemex Vision 2.2 software
Microscope:	Nikon Optiphot-2 (40X) with reflected light
Camera:	Sony DXC 950P, Color (or B&W)

Procedures

The entire analysis was performed at the same magnification (40x). The corresponding calibration factor was 3.04 µm/pixel

The original image is shown on the front page. An *Average Grab* instruction allowed to work in gray levels. Figure 1 shows the result of the *Oriented Edge* gray instruction that gave a good contrast to the image. The blade was entirely binarized in blue by *Gray Thresholding*.

Artifacts were removed from the blue bitplane by using some binary instructions (*Trap*, *Fill*, *Chord Size*, *Closing*, *Opening*). A *Pause Edit* allowed the operator to identify the limit between the edge and the rest of the blade. Figure 2 shows the edge isolated in bitplane red (*Transfer*). The edge width measurement was performed at this point.

The bitplanes representing the blade and the edge were transformed into measuring lines as shown in Figure 3 (*Square Grid*, *Booleans*, *Pruning*).

Ferets measurements were performed on the green lines (blade thickness) and on the pink lines (edge thickness). An orientation measurement was performed on the cyan bitplane to get the attacking angle of the blade. A distribution of the blade thickness appears in Figure 4. Results are summarized in the next section.

The most significant image[1] modifications and final results are as follows:

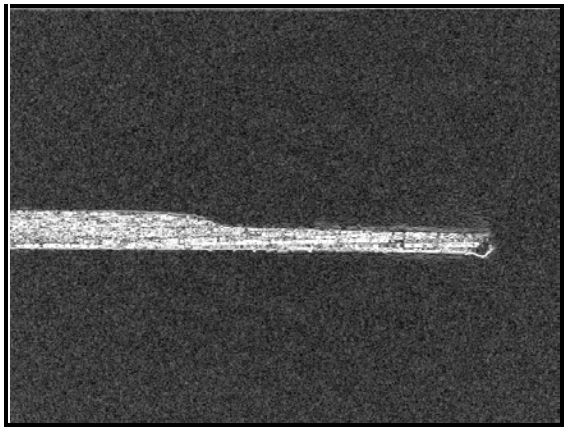

Figure 1: An *Oriented Edge* gray instruction allowed to obtain a contrasted gray image.

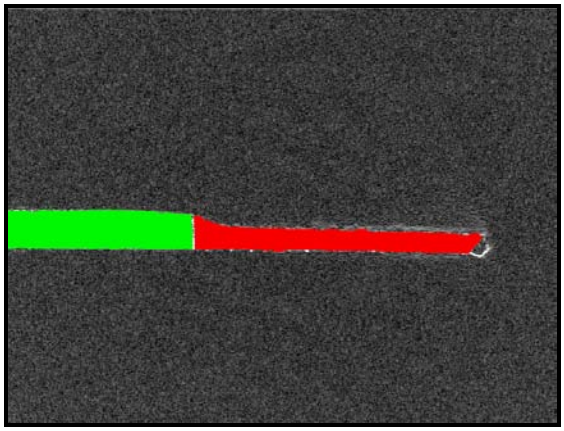

Figure 2: The edge was isolated from the rest of the blade (red bitplane). The edge width measurement was then performed.

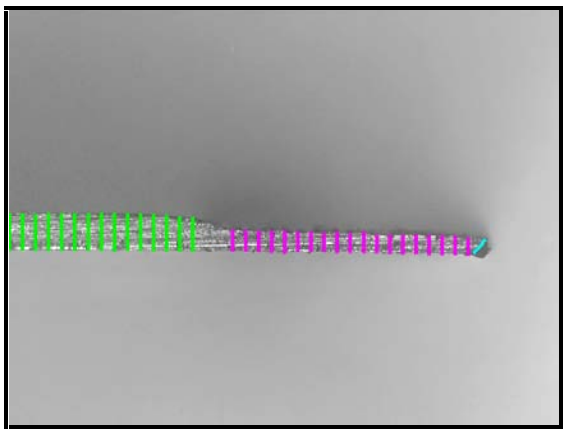

Figure 3: Measuring lines of the blade (green), edge (pink) and attacking angle (cyan) overlaid against the original gray image.

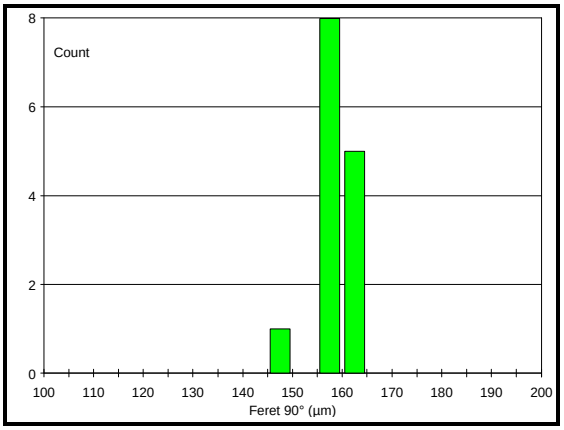

Figure 4: Thickness distribution of the blade.

[1]Note that some image characteristics may not be visible due to printing resolution.

Result Summary[2]

	Blade Thickness (mm)	Edge Thickness (mm)	Edge Width (mm)	Attacking Angle (°)
Minimum	149.7	79.4	1218.8	56.25
Maximum	165.0	110.0	1218.8	56.25
Average	158.8	88.9	1218.8	56.25
Standard Deviation	3.8	7.1	0	0

Discussion

The Clemex Vision image analysis system can perform the requested measurements accurately and efficiently.

The analysis required the operator assistance to precisely identify the frontier between the edge and the other part of the blade. The rest of the routine is completely automatic.

The bitplanes representing the edge and the blade were transformed into measuring lines to produce a distribution of the thickness. A unique step was sufficient to obtain a precise measurement of the edge width and attacking angle.

Results are reproducible.

[2] It is possible to transfer all the results to Microsoft Excel format. Excel offers many valuable statistical tools and substantial graphical versatility.