

COATING CHARACTERIZATION OF STEEL

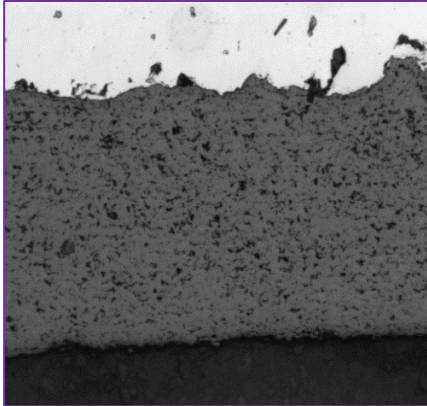


Figure 1: Original image.

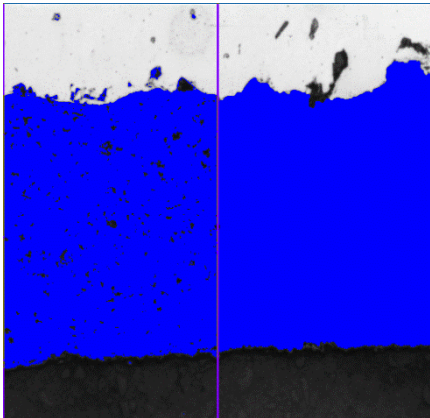


Figure 2a: Binarization of the original image.

Figure 2b: Binary operations are used to remove artifacts, holes and inclusions from the coating.

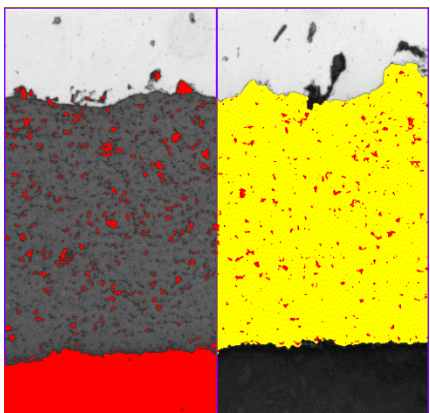


Figure 3a: The porosity, the mount and some inclusions are detected in red.

Figure 3b: Porosity in red and coating in yellow.

Sample Description

Two pieces of steel with a thin ceramic coating (in a single mount).

Purpose of Analysis

Demonstrate the ability of the Clemex Vision image analysis system and coating thickness module to perform the following analyses:

- Thickness distribution of the coating
- Porosity percentage of the coating
- Hardness of the coating

Procedure

Figure 1 shows the original image. The coating is binarized into blue and several binary operations are combined to remove artifacts and holes from the coating as shown in Figure 2a and 2b. The porosity, the mounting and some inclusions are detected and assigned to red bitplane in Figure 3a. Whereas, the coating is isolated by yellow in Figure 3b. Vertical lines are created in the green bitplane to measure the coating thickness. Measurements are performed on these lines to obtain a distribution of the coating thickness as can be seen in Figure 4.

Equipment

Image Analysis System:	Clemex Vision CORE
Microscope:	Nikon Optiphot-2
Camera:	Sony XC-77CE B&W
Magnification:	100X
Stage:	Marzhauser EK8B-S1
Hardness tester:	Mitutoyo MVK-HO

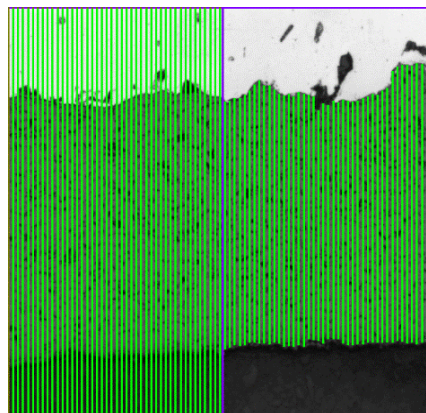


Figure 4a: Vertical lines are created in the green bitplane.

Figure 4b: The coating is converted to measuring lines between the coating and the grid.

Results

	Coating Thickness (microns)		Coating Hardness (Vickers)	
	<i>Coat. A</i>	<i>Coat. B</i>	<i>Coat. A</i>	<i>Coat. B</i>
Sample				
Minimum	132.5	288.6	1123.61	1183.53
Maximum	462.9	460.2	1381.92	1464.00
Average	393.7	407.9	1223.51	1322.28
Standard Deviation	60.3	27.2	112.06	124.91

	Coating Porosity (%)	
Sample	<i>Coat. A</i>	<i>Coat. B</i>
Total	2.33	3.41

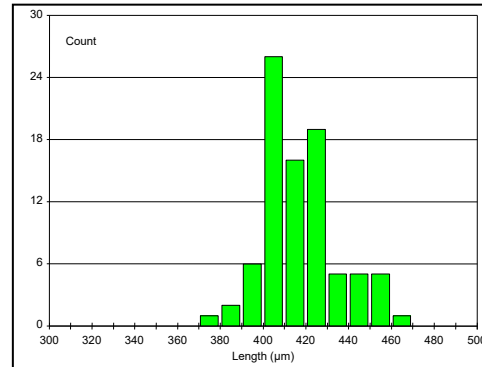


Figure 5: Coating thickness distribution.