CLEMEX **intelligent** microscopy

Engineered Wood *Analysis*

Engineered Wood Report – Introduction

Meeting performance requirements and standards in the composite wood industry requires solutions that are precise and easy to replicate. Strength and stress tests are only one part of the process. When it comes to analyzing the boards' glue to wood ratio, Clemex's Vision PE image analysis system is the preferred solution.

Wood is one of the mainstays of the world's economy. One of its primary uses is as fuel, but for millennia wood has been used as a construction material. From the paper we write on to the houses we live in, wood is the number one recyclable resource in the world. Not only is wood the single major renewable building material, it also requires less energy to manufacture than any other building material. Wood is strong, lightweight and easy to manufacture into new products such as engineered wood.

Typically, engineered wood products are made from hardwoods and softwoods: whole logs are usually used for veneers, like plywood, while sawmill scraps and other wood waste are used for particle boards or Oriented Strand Boards (OSB), like aspenite.

As its name implies, aspenite is an OSB made out of the wood strands of the aspen poplar, a fast growing softwood. The strands are compressed and bonded together with wax and resin adhesives. The layers are then placed in a thermal press and compressed to a standard 15 mm panel thickness. This process sets and hardens the glue. All aspects of this entire process must be carefully controlled to ensure the correct size, density and consistency of the board (95% wood and 5% wax, resin and/or glue). The finished product has similar properties to plywood, but is uniform and cheaper. It is primarily used as sheathing in walls, floors, and roofs.

OSB and waferboards are manufactured to meet performance requirements and standards such as CSA 0325 for Construction Sheathing, or PS 2, Performance Standard for Wood-Based Structural-Use Panels in the US. For our report, Clemex was given a sample of aspenite to determine if the wood to glue ratio complied with industry standards.

Sample Description

One sample of aspenite showing glue spots was submitted for analysis.

Purpose of Analysis

To demonstrate that the Clemex Vision image analysis system can isolate and measure the glue (dark phase) and compare it to the aspenite.

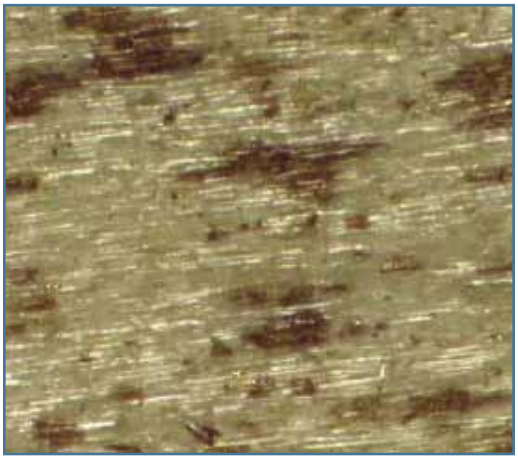


Figure 1: Part of the original image (5.72 microns/pixel).

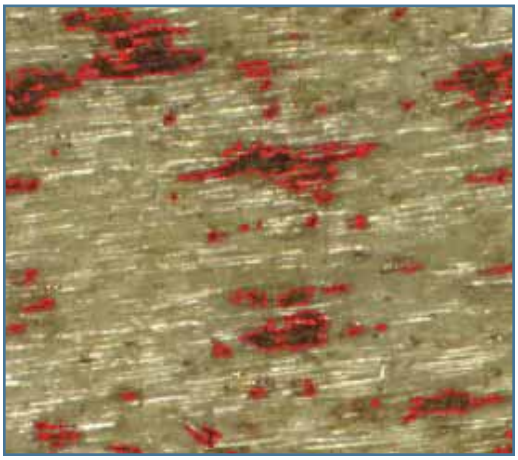


Figure 2: Outline view of detected glue phase as measured.

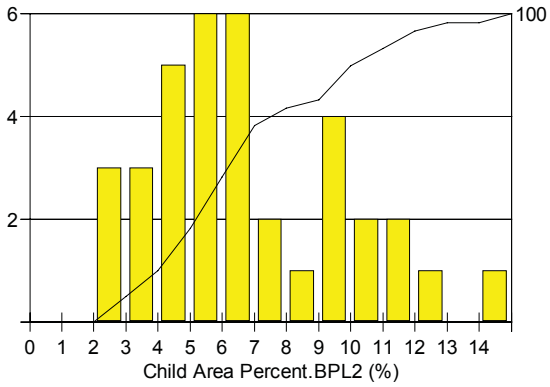
Procedure[1]

The glue was binarized into the red bitplane. Some small artifacts were eliminated and some small holes were filled in.

In a second step, the aspenite was binarized into the yellow bitplaned, filled and cleaned from artifacts that could have been detected from the background (outside of the sample).

Results[2]

Area measurements of the glue spots and the area percentage of these same spots over the aspenite were performed. Automated statistics and graph were generated and were cumulated for the whole sample. Final results could be printed directly from Clemex Vision and were saved for further use. A customized report was built using the Report Generator module. Raw data is linked to their respective objects for validation purposes. Raw data could also be exported in Excel format.



Minimum:	2.43 %
Maximum:	14.11 %
Mean:	6.84 %
Std Dev.:	3.00 %

Figure 3: Area percentage of glue per aspenite section.

Equipment

Image Analysis System:	Clemex Vision PE
Additional Module:	Report Generator
Microscope:	Stereoscope Leica
Objective/Magnification:	3.2x / 32x
Illumination:	Reflected Light
Calibration:	5.7189540 microns/pixel
Camera:	Clemex L 1.4 C
Motorized Stage:	Marzhauser EK32IM 75x50mm
Stage Controller:	Clemex ST-2000

Discussion

The main concern in this analysis was to compare the glue area to the aspenite area only, even when the sample was not covering the whole field area. The problem was easily overcome by calculating the ratio of the glue over the wood instead of over the field.

1 *Images taken during the procedure are available in appendix A*

2 *Complete results are available in appendix B.*

Image Analysis Steps

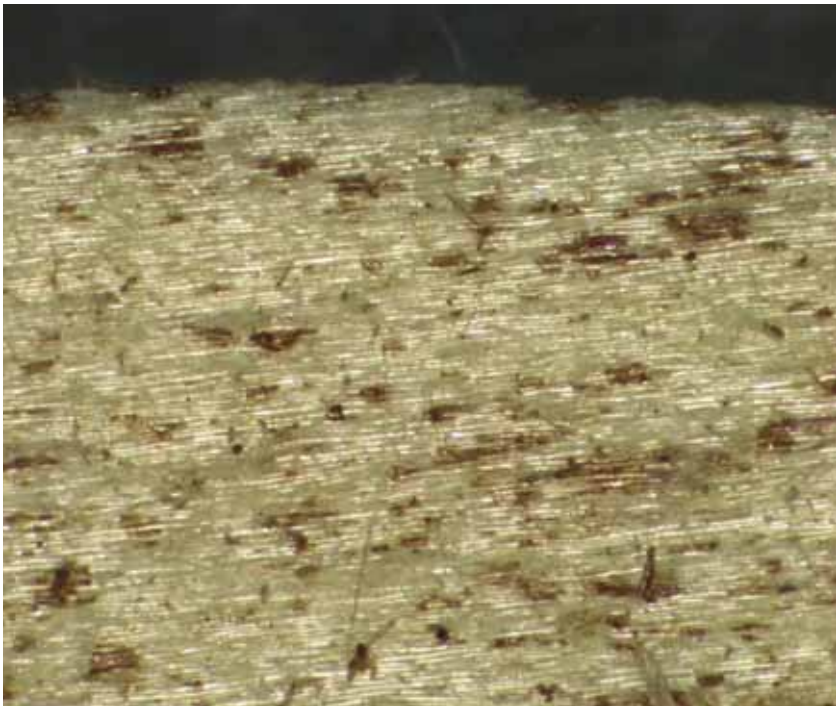


Image 1: Original image at 16x (5.72 microns/pixel)

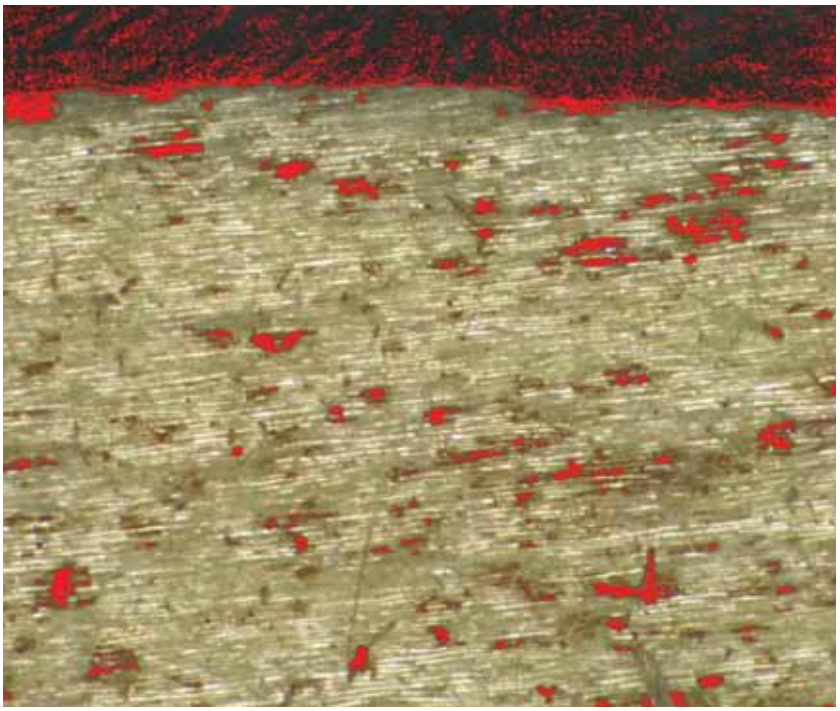


Image 2: Dark features detected in red using Color Threshold.

Image Analysis Steps

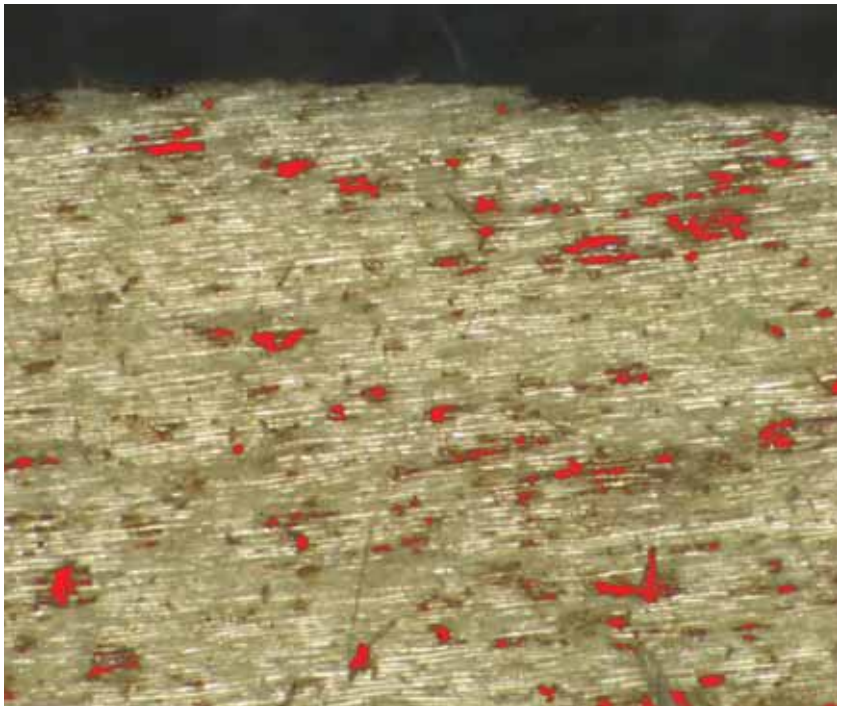


Image 3: Artifacts were eliminated and remaining features were considered as glue.

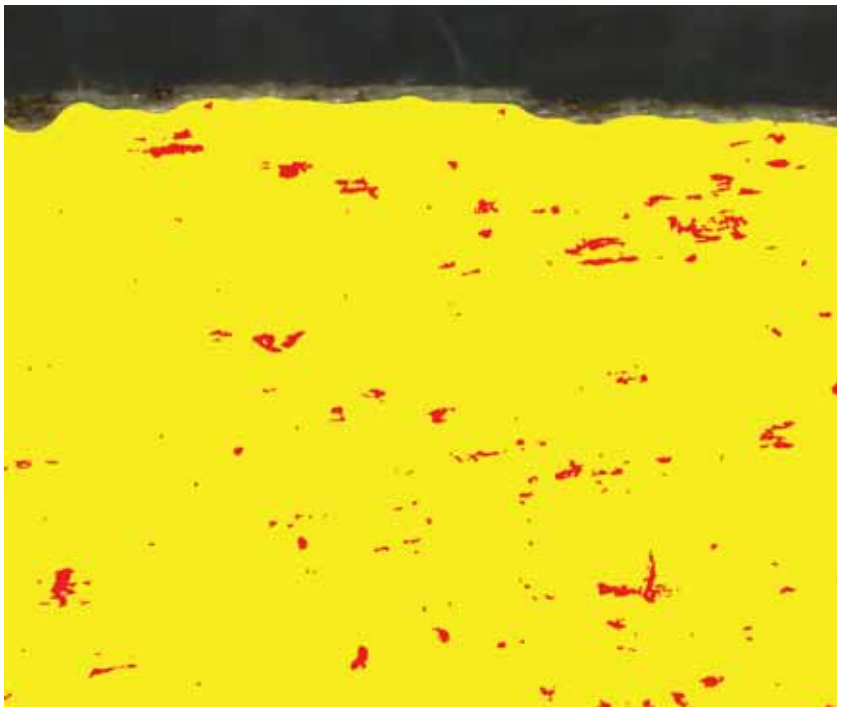
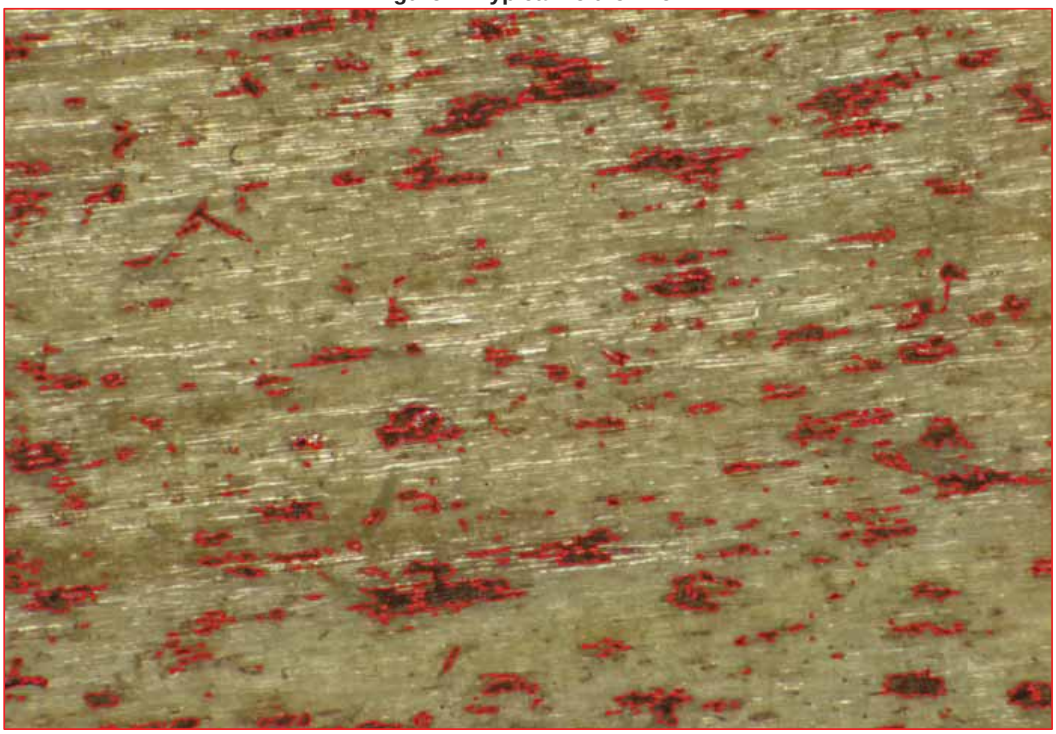


Image 4: Aspenite detected in yellow (fuzzy edges were eliminated), as measured.

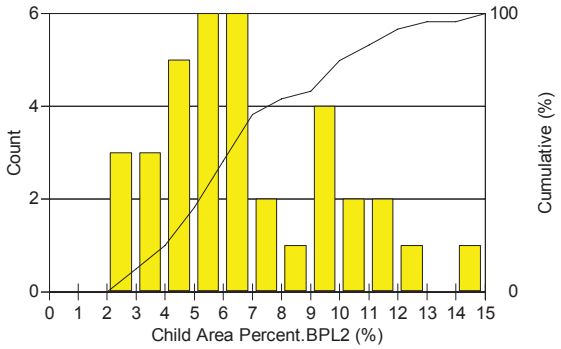
Phase Area Percent Analysis

Date:	2006-Nov-16, 5:03:08 PM -05'00'	**Magnification:**	32x
Company:	Clemex Technologies	**Calibration:**	5.7190 µm/pixel
Department:	Laboratory	**Units:**	microns
User Name:	Myriam	**# Fields:**	40
Sample ID:	Sample 1		

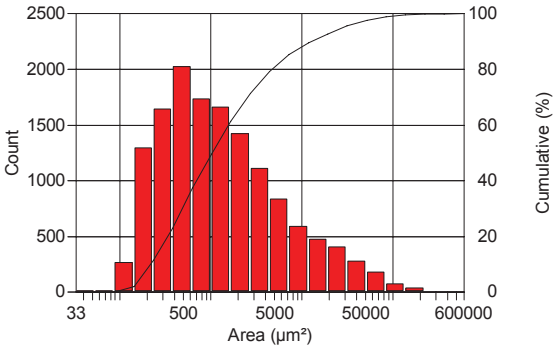
Figure 1: Typical field of view.



Distribution of glue area % per field



Area distribution of glue spots



Count:	36	wood portions		14099	glue spots
Min:	2.43	%		32.71	micron 2
Max.:	14.11	%		527881.88	micron 2
Mean:	6.84	%		6006.06	micron 2
Std. Dev.:	3.00	%		20104.51	micron 2
Whole analysis:	6.68	%		84679382.69	micron 2

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