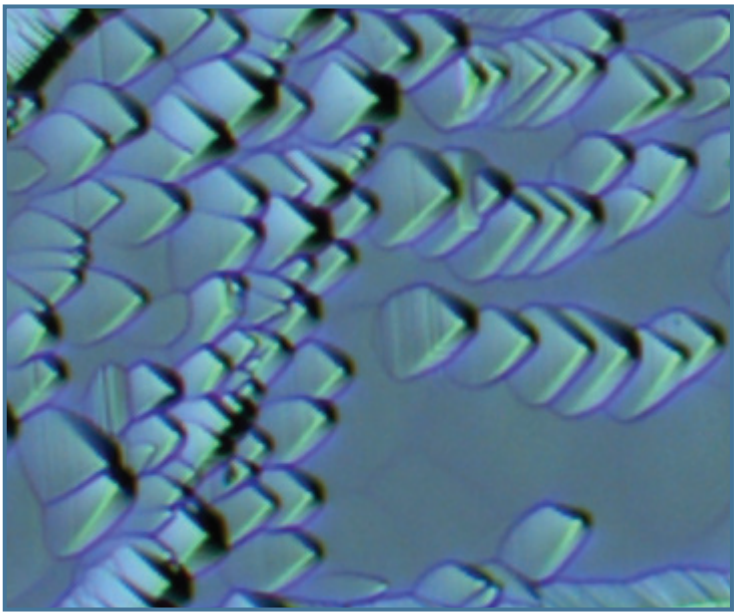
CLEMEX

Image Analysis Report

698

Crystals Analysis



Prepared by
Clemex Technologies Inc.

Crystals Analysis

Image Analysis Report # 698

Sample Description

One image showing crystals was submitted for analysis.

Purpose of Analysis

To demonstrate that the Clemex Vision image analysis system can distinguish the crystals to perform overall count and mean spacing measurements inside aligned groups.

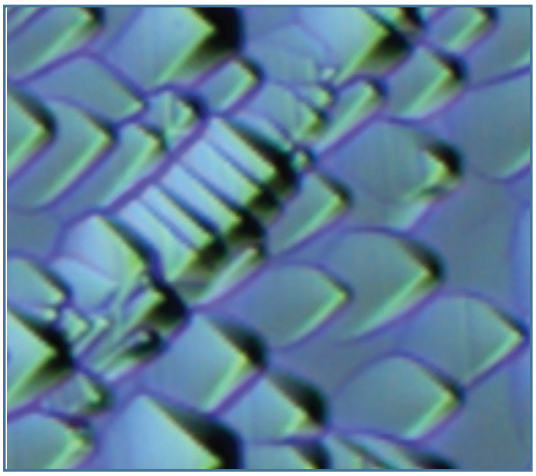


Figure 1: Part of the original image.

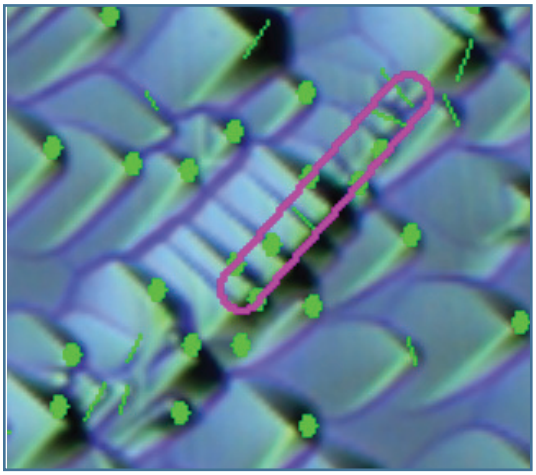


Figure 2: Outline view of an aligned group in magenta and crystals as counted in green.

Procedure[1]

Crystals are automatically detected into the green bitplane. A Pause allows the operator to draw a green line over each missing crystal and to delete any false detection if any (some may be detected twice). At the next Pause, the operator have to draw a magenta line over each aligned group of crystals to be characterized.

Results[2]

Count measurement was performed on the bitplane representing the crystals (green) and mean spacing measurement was performed for each identified group of aligned crystals (magenta). Automated statistics and graph were generated and would be cumulated if analyzing several images (sample). Final results could be printed directly from Clemex Vision and 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.

Crystals Count: 227

Mean Spacing inside Groups of Aligned Crystals:

Minimum:	13.36 pixels
Maximum:	18.10 pixels
Mean:	14.82 pixels
Std Dev.:	2.22 pixels

Equipment

Image Analysis System:	Clemex Vision PE Report Generator Module
Calibration:	Unknown - 1 microns/pixel

Discussion

The main difficulty of this analysis was to detect as many crystals as possible. The problem was overcome by the combinations of a few different binarization steps. Even then, some crystals were not detected or detected twice so a pause edit instruction was added to allow manual interventions from the user.

To obtain the mean crystal spacing per group, a custom measurement was created and would have to be adjusted in the case of a modification in the dilatation step of the drawn magenta lines.

Directly capturing images from the microscope would allow to work with calibrated images and obtain realistic results. It is also possible to work in calibrated unit with loaded images. When images are saved from the image analysis system, the calibration is saved with the images. When the images are exported or saved from another software, we can calibrate them at loading time based on their scale line if any, or on their total width if known, or simply entering the calibration factor if known. In the present case, any of these were supplied with the image.

Finally, only a part of the original image was analyzed because most of the aligned crystals were too close to one another to allow seeing a shadow between them, or their shadow were connected. A higher magnification might help to detect more crystals. It is also possible that another way of capturing the images would increase the detection performances.

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

2 *Complete results are available in appendix B.*

CLEMEX

Image Analysis Report

Appendix A: Image Analysis Steps

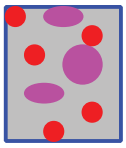


Image Analysis Steps

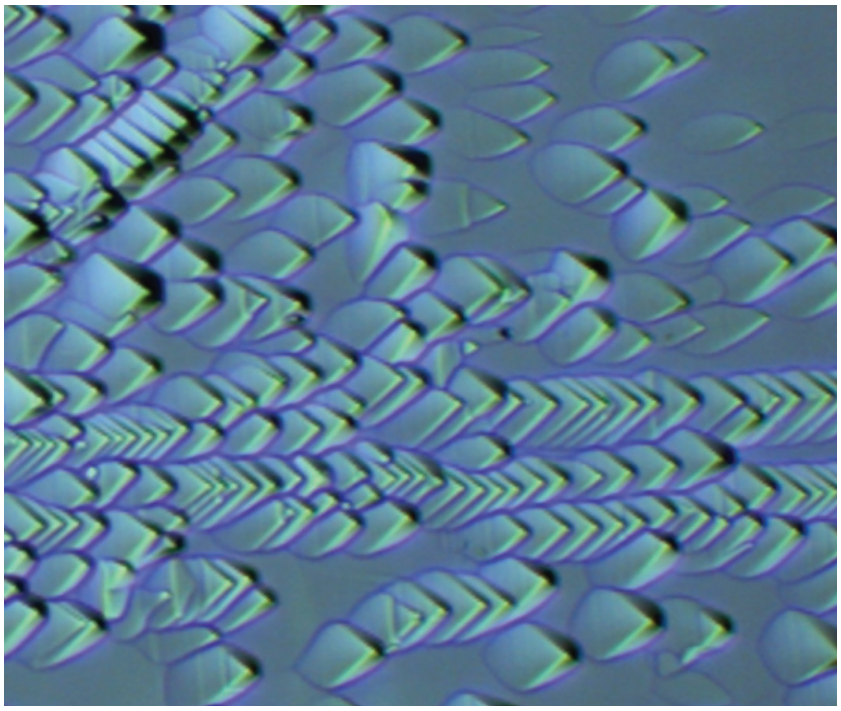


Image 1: Part of the original image. Unknown calibration.

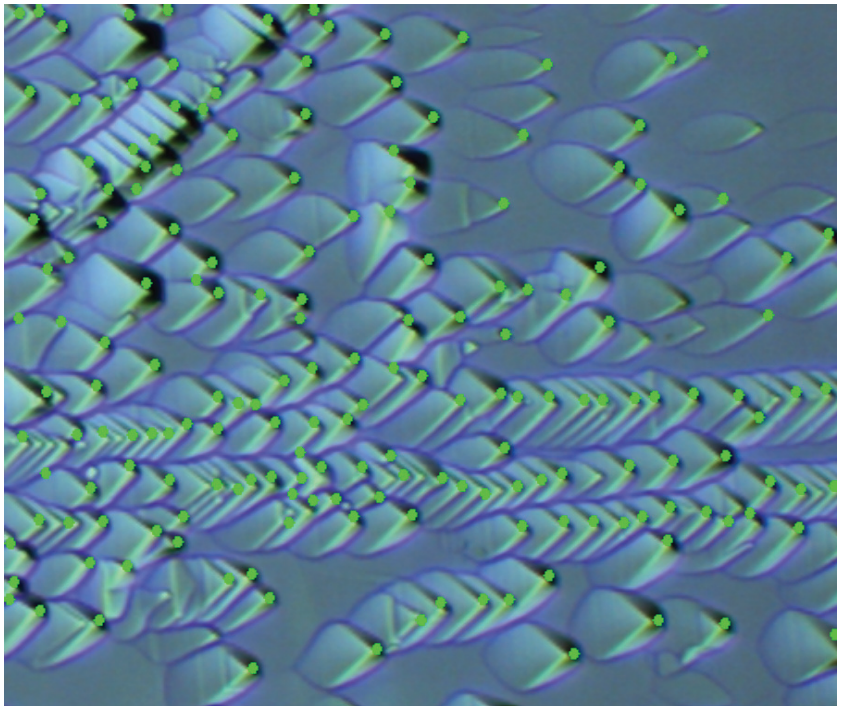


Image 2: All crystals that were automatically detected are identified here by a green dot.

Image Analysis Steps

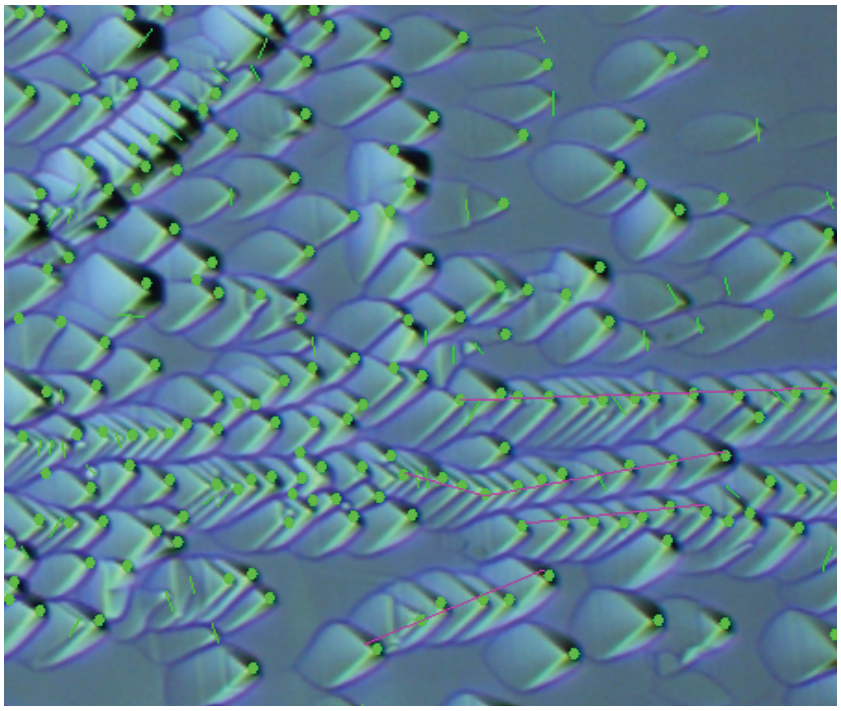


Image 3: The user draws a line over each missing crystal and delete any false detection if any. The user also draws a magenta line over any group of aligned crystals to obtain the mean spacing of crystals inside the group.

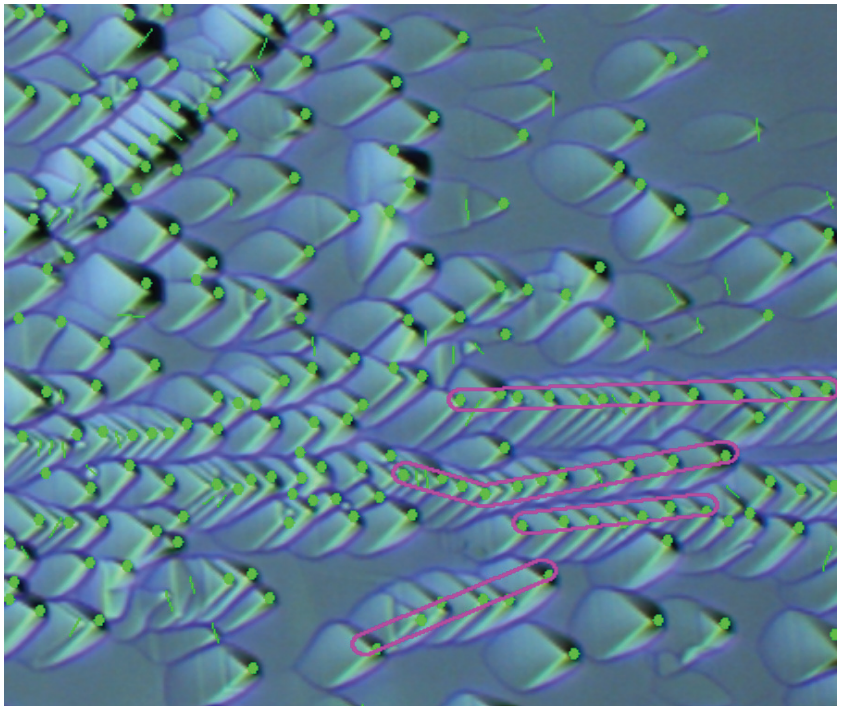
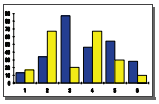


Image 4: The green bitplane represents the crystals as they were counted and the magenta bitplane represents the groups as they were measured for mean crystal spacing.

CLEMEX

Image Analysis Report

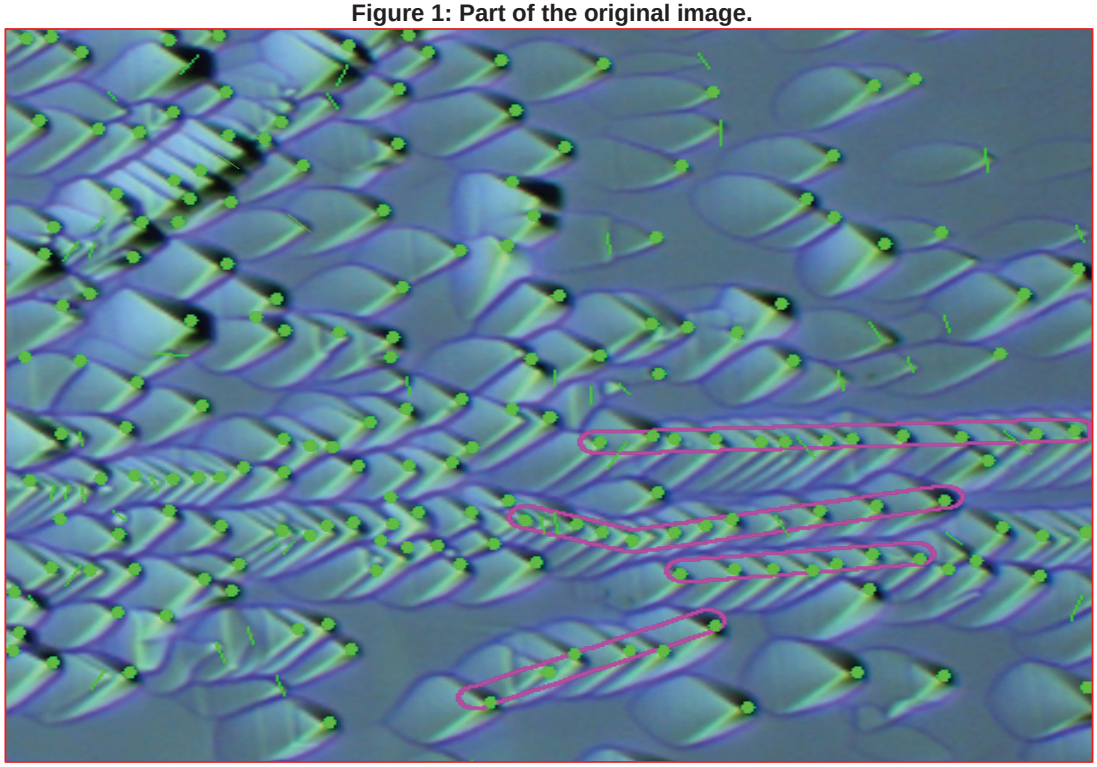
Appendix B: Results



Crystals Analysis

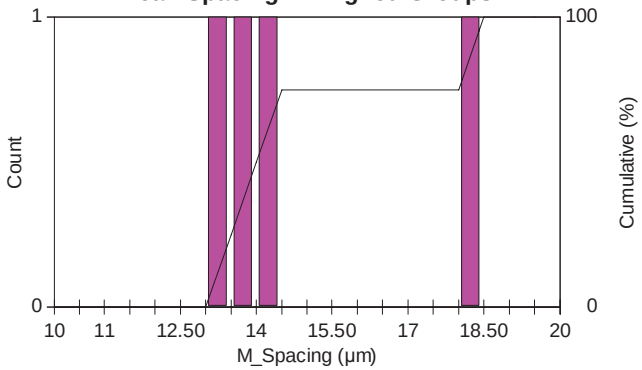
Date:	2006-Nov-08, 3:17:53 PM -05'00'	**Magnification:**	?
Company:	Clemex	**Calibration:**	?
Department:	Laboratory	**Units:**	pixels
User Name:	Myriam Savard	**# Fields:**	1
Sample ID:	Image 1		

Figure 1: Part of the original image.



Calibration was unknown so the pixel size was fixed to 1 mic/pixel. The green points represent crystals that were discriminated automatically. There is a Pause Edit in the routine and the user is prompted to add (or delete) missing (or false) crystal detections. These are represented by a straight green line. The user have to identify the aligned crystals to be measured by drawing a line over the groups. The routine works best when we see a space between crystals. It is possible that working at higher magnification would detect even more crystals automatically.

Mean Spacing in Aligned Groups



Statistics

Count:	4
Min:	13.36
Max.:	18.10
Mean:	14.82
Std. Dev.:	2.22
D10:	13.36
D50:	13.59
D90:	16.56

Crystal Count (green bitplane): 227

CLEMEX

The Image Analysis People