

Crystal Characterization

Image Analysis Report **280**

Sample Description

A BMP image was submitted for crystal analysis. The image was taken at 400x but no calibration ($\mu\text{m}/\text{pixel}$) was indicated.

Purpose of Analysis

Demonstrate the ability of the Clemex Vision image analyzer to discriminate alite crystals from belite crystals and to respectively measure their length and diameter.

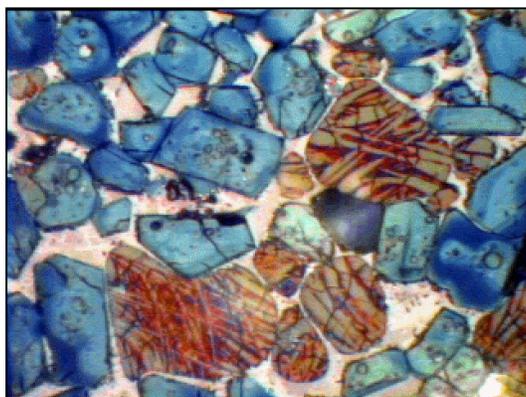


Figure 1: Original BMP Image (400x).

Procedure

The original color image was modified using different gray and color filters (Gray Closing, Color Smooth, and Color Gradient) helping the binarization process. One Gray Threshold was performed on edges and three Color Threshold were necessary to isolate alite and belite from the background.

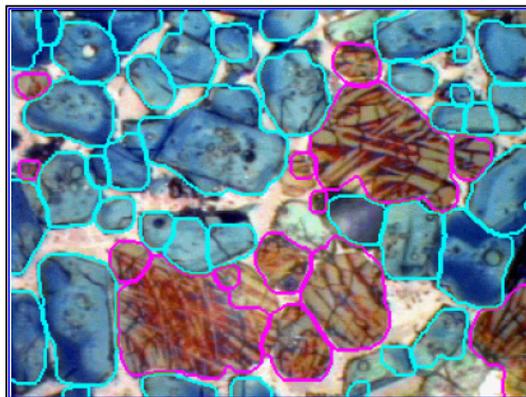


Figure 2: Outline of the final detected crystals superimposed over the original image.

Procedure (continued)

Some binary operations were used to remove artifacts from the crystals (Chord Size, Trap, Opening, Boolean, and Invert). Rough objects were isolated and separated using an Object Transfer by Limits and a Separate instruction.

Results Summary

	<i>belite</i>		<i>alite</i>	
(pixels)	Length	Diam.	Length	Diam.
Minimum	14.9	12.5	11	9.9
Maximum	101.5	79.5	94.9	73.2
Mean	43.7	35.4	40.5	31.2
Stand. Dev.	30.5	23.1	18.5	13.9

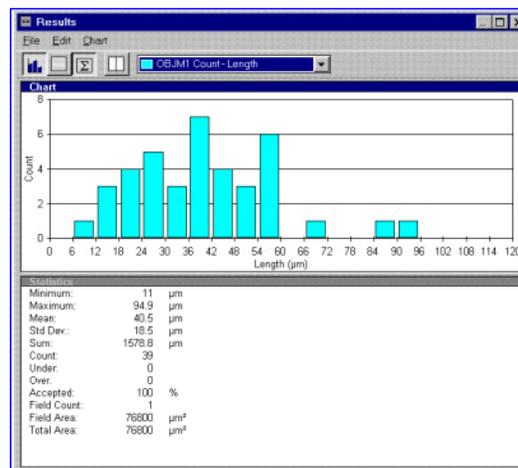


Figure 3: Length (pix) distribution of alite crystals.

Most of the crystals could be discriminated.

The main difficulty we encountered was to obtain clear edges. This problem was overcome by using gray and color filters and by combining four Thresholds.

Some crystals remained in contact with one another. Consequently, the Separate instruction was used to approximate the real crystal size. This instruction uses an algorithm based on the convexity of objects.

Using the separate instruction, some crystals were sectioned from adjacent crystals, while others were not separated. Therefore, the final results were not significantly influenced by an occasional erroneous detection.

Equipment

Image Analysis System: Clemex Vision PE
Calibration : 1 μm / pixel
Image Type: Color, BMP (320 x 240)