CLEMEX

Image Analysis Report

680

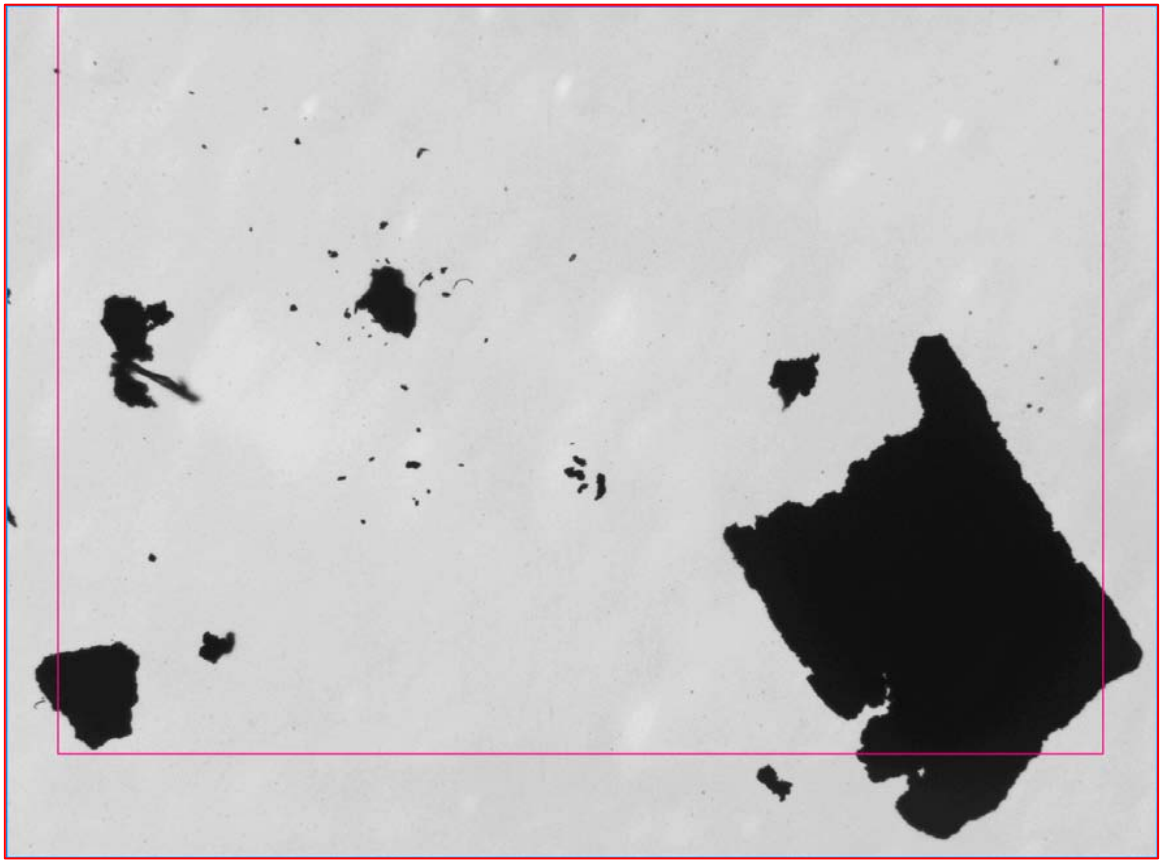
Particle Size Analysis on **Debris** Powder

Clemex Technologies Inc.

Particle Sizing Analysis

Compagny:	Clemex Technologies Inc.	**Magnification:**	50x
Date:	2006-Aug-15, 2:03:59 PM -04'00'	**Calibration:**	1.3546 µm/pixel
User:	Myriam Savard (signed on 2006-Aug-15 10:48:15 -04'00')	**Units:**	microns
Sample ID:	Debris from filter.	**# Fields:**	100
		Count:	3105

Figure 1: Longest particle found.

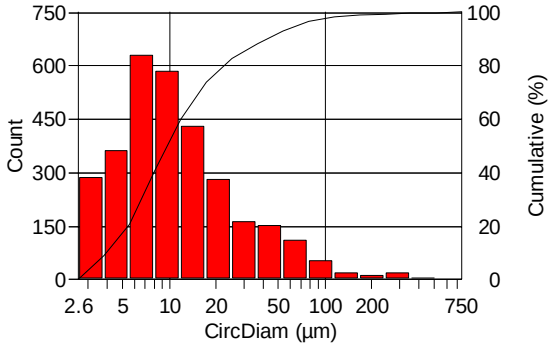


Comments:

Analysis was performed at 50x. The sample was spread on the slide to avoid agglomerates as much as possible. Particles thinner than the optical resolution limit (1.67 microns at 50x) and those smaller than twice this same limit were eliminated from the analysis. A guard frame was used to avoid separating particles by the field of view. Many measurements were performed. Their chart and statistics appear at the following pages. Many other measurements are available and we can always create custom ones if needed. The volume estimate is based on spherical features but again, it could be calculated differently.

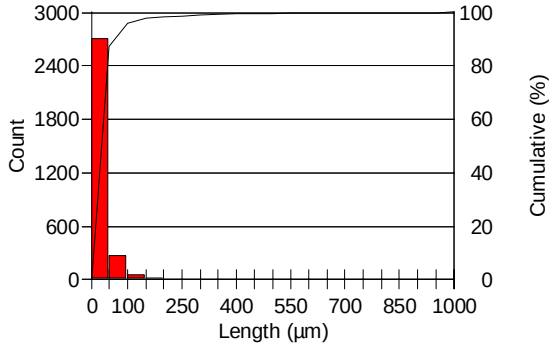
Particle Sizing Analysis

Diameter - Count



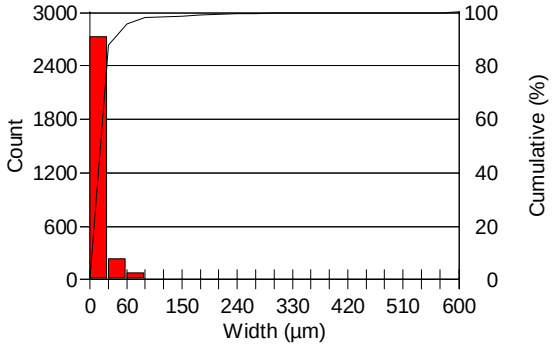
Minimum:	2.65	microns
Maximum:	692.49	microns
Mean:	19.70	microns
Std Dev.:	37.92	microns
D10:	3.86	microns
D50:	9.57	microns
D90:	42.40	microns

Length - Count



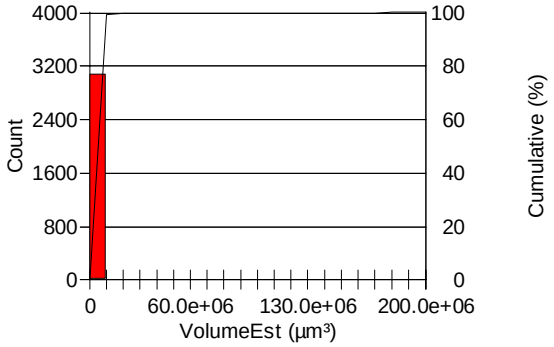
Minimum:	3.22	microns
Maximum:	976.67	microns
Mean:	28.60	microns
Std Dev.:	59.14	microns
D10:	4.76	microns
D50:	12.83	microns
D90:	62.90	microns

Width - Count



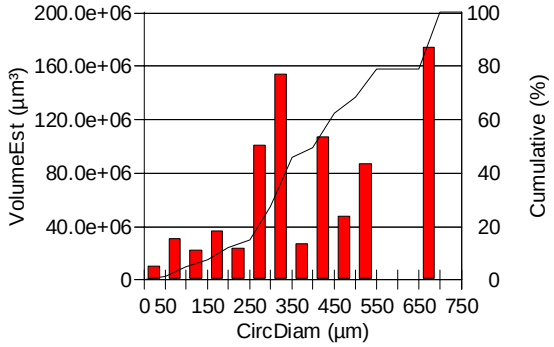
Minimum:	1.86	microns
Maximum:	580.45	microns
Mean:	16.78	microns
Std Dev.:	32.27	microns
D10:	3.08	microns
D50:	7.90	microns
D90:	35.81	microns

Volume - Count



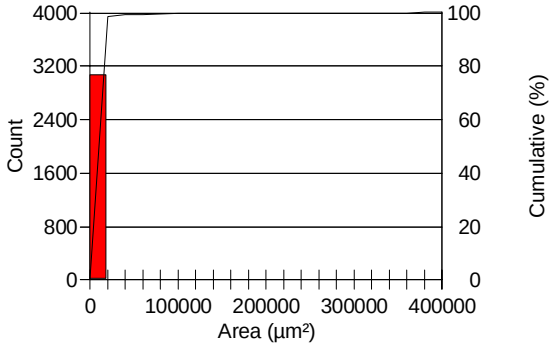
Minimum:	9.72	microns	^{3}
Maximum:	173873904.00	microns	^{3}
Mean:	264900.84	microns	^{3}
Std Dev.:	3968000.34	microns	^{3}
D10:	30.13	microns	^{3}
D50:	458.55	microns	^{3}
D90:	39912.46	microns	^{3}

Diameter - Volume



Minimum:	2.65	microns
Maximum:	692.49	microns
Mean:	414.02	microns
Std Dev.:	0.00	microns
D10:	169.72	microns
D50:	378.03	microns
D90:	624.93	microns

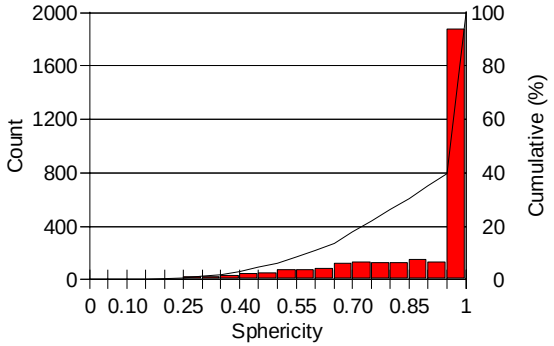
Area - Count



Minimum:	5.50	microns	^{2}
Maximum:	376629.00	microns	^{2}
Mean:	1433.61	microns	^{2}
Std Dev.:	11278.00	microns	^{2}
D10:	11.69	microns	^{2}
D50:	71.89	microns	^{2}
D90:	1411.98	microns	^{2}

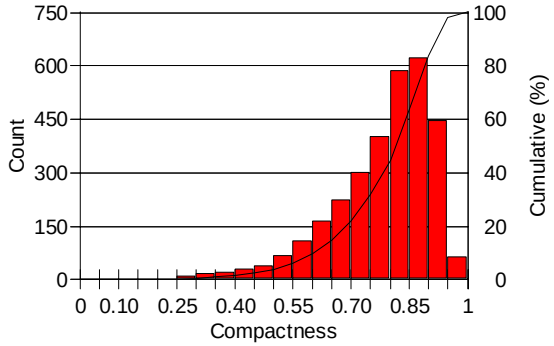
Particle Sizing Analysis

Sphericity - Count



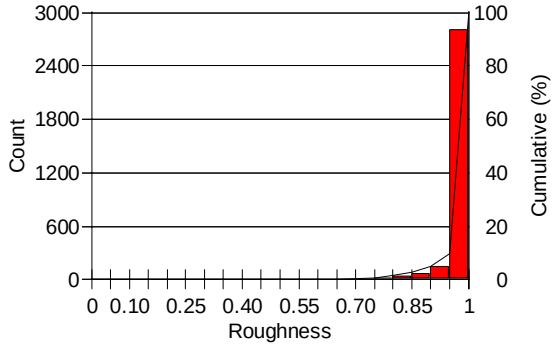
Minimum:	0.08
Maximum:	1.00
Mean:	0.88
Std Dev.:	0.19
D10:	0.58
D50:	1.00
D90:	1.00

Compactness - Count



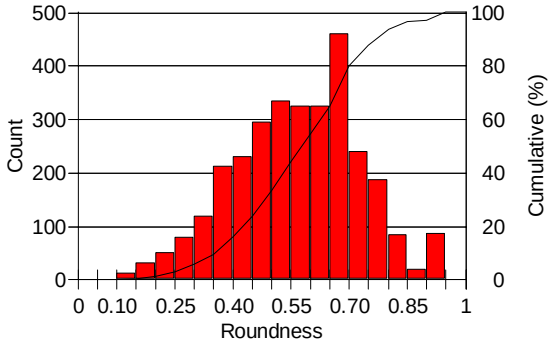
Minimum:	0.21
Maximum:	1.00
Mean:	0.78
Std Dev.:	0.13
D10:	0.60
D50:	0.82
D90:	0.91

Roughness - Count



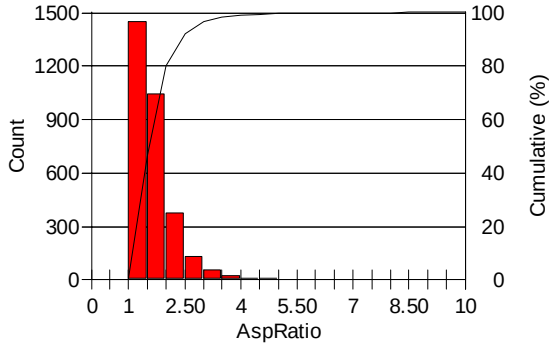
Minimum:	0.44
Maximum:	1.00
Mean:	0.99
Std Dev.:	0.05
D10:	0.95
D50:	1.00
D90:	1.00

Roundness - Count



Minimum:	0.09
Maximum:	0.93
Mean:	0.57
Std Dev.:	0.16
D10:	0.35
D50:	0.58
D90:	0.76

Aspect Ratio - Count



Minimum:	1.04
Maximum:	8.18
Mean:	1.71
Std Dev.:	0.58
D10:	1.20
D50:	1.56
D90:	2.37

Particle Sizing Analysis

Description of each measurement performed:

Length:	Longest feret
Width:	Shortest feret
Volume:	(Diameter ^ 3) * PI / 6
Diameter:	2 x (Area / PI) ^ 1/2
Area:	Calibrated detected pixels (see calibration in page 1)
Sphericity:	4 x PI x Area / (Perimeter ^ 2)
Compactness:	4 x PI x Area / (Convex Perimeter ^ 2)
Roughness:	Convex Perimeter / Perimeter
Roundness:	4 x Area / (PI x Length ^ 2)
Aspect Ratio:	Length / Width

* Perimeter accuracy decreases when measuring very small particles because of pixel shape

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Image Analysis Report

Appendix A: Image Analylis Steps

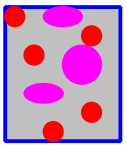


Image Analysis Steps

Figure 1: Original image at 50x (1.3546 micron / pixel).

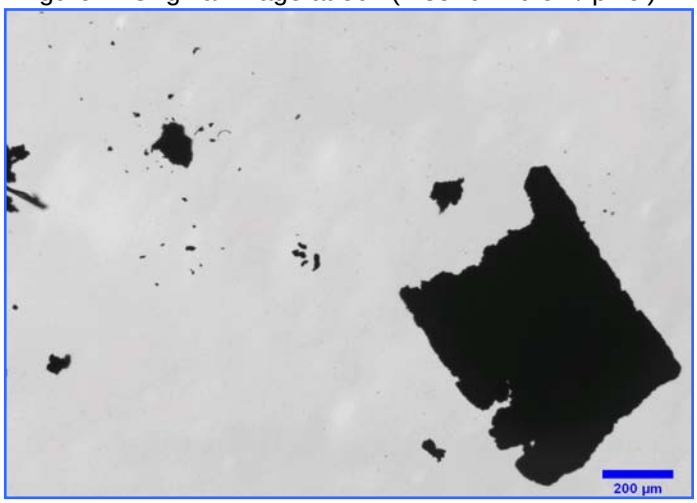


Figure 2: Particles as binarized and measured after artifacts elimination.

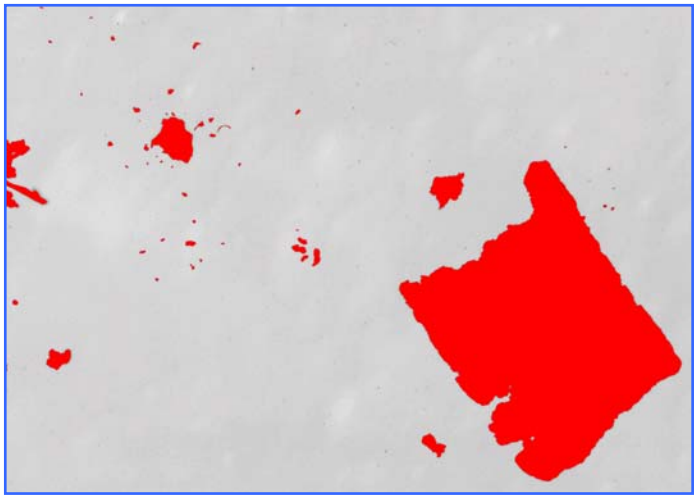
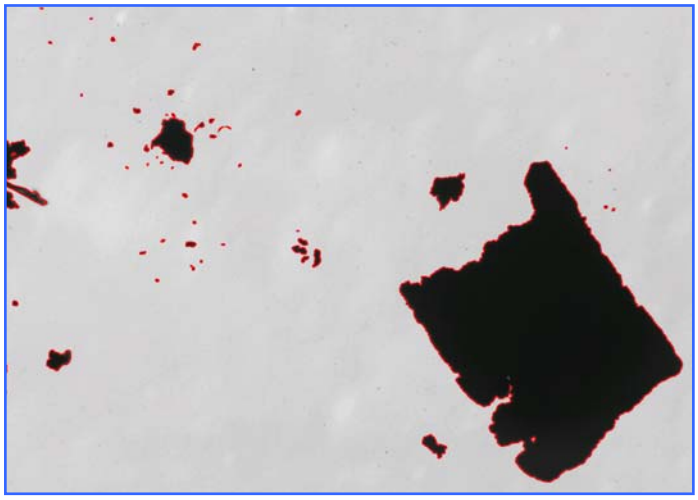


Figure 3: Remaining particles as measured (in outline view).



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The Image Analylis People