



Your **XRD**
Specialists

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August 15, 2014

Mr. Richard Weir
EESstor Inc.
715 Discovery Drive, Bldg. I - #107
Cedar Park, TX 78613-2287
e-mail: Dick_weir@eestor.us

Ref: XRD analysis of CMBT powder #071514/1250

Dear Mr. Weir:

As you requested, I have run XRD analysis on the above referenced powder sample. Since the powder was sufficiently fine for analysis, no further processing was needed before testing. Instead, the sample was placed in a standard sample holder and put into a Panalytical X'Pert Pro diffractometer using Cu radiation at 45KV/40ma. The scan was run over the range of 10° to 90° with a step size of 0.0167° and a counting time of 500 seconds per step.

Once the diffraction pattern had been collected, the phases were identified with the aid of the Powder Diffraction File published by the International Centre for Diffraction Data. This database is the world's largest source of XRD data with over 700,000 entries. The diffraction pattern is shown in Figure 1a at full scale along with the stick pattern of the only identified phase: BaTiO₃. In addition to the BaTiO₃, I noted a single very small peak at $2\theta \approx 30^\circ$ which cannot be positively identified. I estimate that this peak contributes approximately 0.1% to the total crystalline pattern. An exploded view is shown in Figure 1b that more clearly shows this peak. Therefore, based on the pattern obtained, my quantitative analysis is as follows:

Phase Analysis (wt %)	
#071514/1250	
BaTiO ₃ (Cubic)	99.9%
Unidentified	0.1%

I was also able to extract information on the lattice parameter of the major cubic phase and the domain size as summarized below:

Lattice Parameter and Domain Size	
#071514/1250	
Lattice Parameter, a_0	4.0469(1) Å
Domain size	>1,000 Å

The attached Tables list the peak positions, peak intensities and peak breadths that you requested. I have only included the data for the majority phase.

I hope that these data will be useful in your project. Please feel free to call me at (609) 758-5700 if you have any questions.

Sincerely,



Steve Miller, Ph.D.
Scientist

Table I
XRD Data for CMBT Powder, #071514/1250

CMBT Batch #071514/1250
File: [EEstor_G081409.xrdml]

Two Theta (°)	(HKL)	Peak Height	Relative Intensity	FWHM (°)
21.959	(1 0 0)	10,712	11.9%	0.123
31.236	(1 1 0)	89,975	100.0%	0.140
38.504	(1 1 1)	15,581	17.3%	0.153
44.754	(2 0 0)	24,060	26.7%	0.181
50.385	(2 1 0)	3,697	4.1%	0.189
55.583	(2 1 1)	22,440	24.9%	0.209
65.142	(2 2 0)	9,902	11.0%	0.235
69.638	(2 2 1)	1,483	1.6%	0.220
74.015	(3 1 0)	6,616	7.4%	0.264
78.293	(3 1 1)	1,990	2.2%	0.265

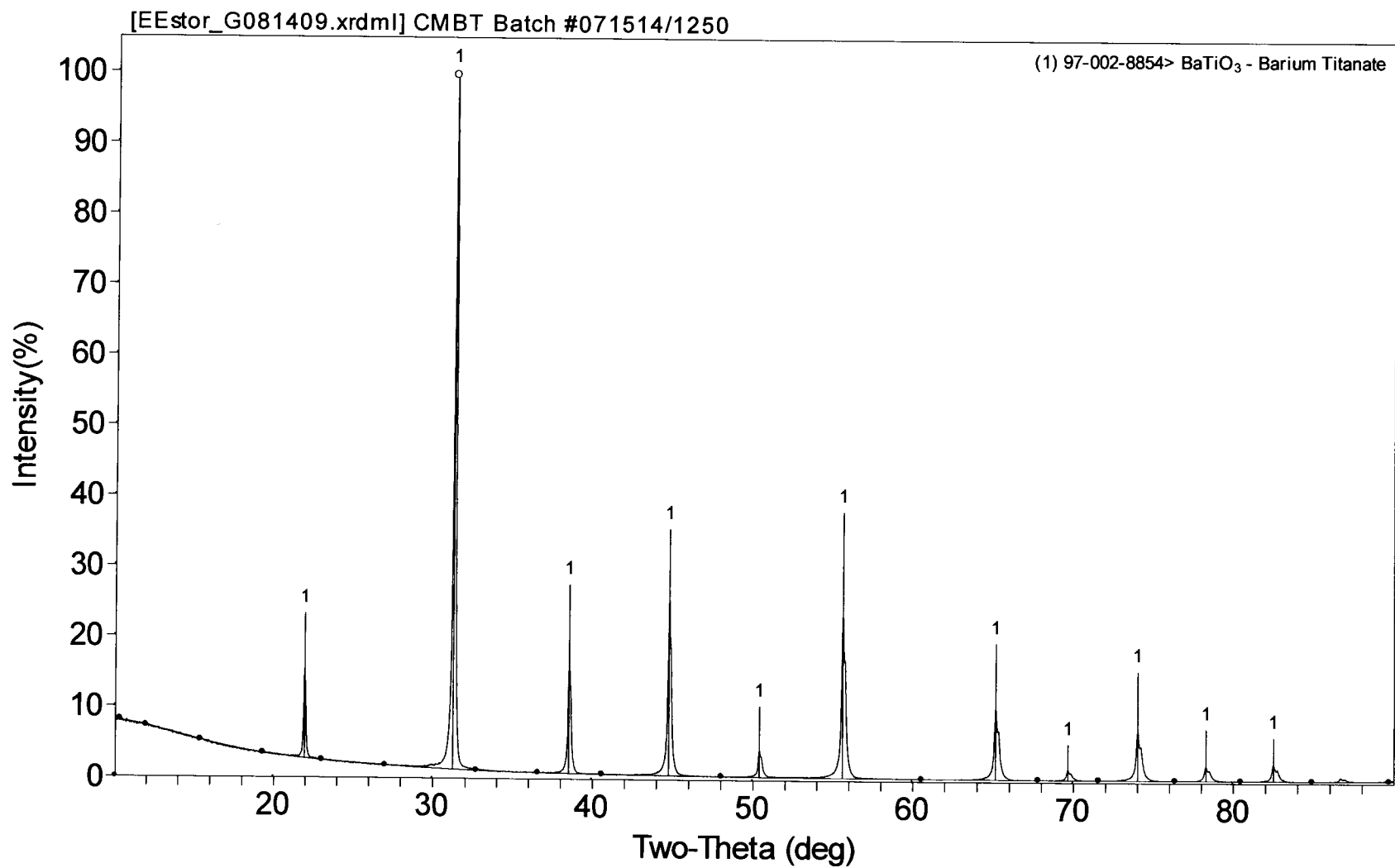


Figure 1a Phase identification for CMBT powder #071514/1250

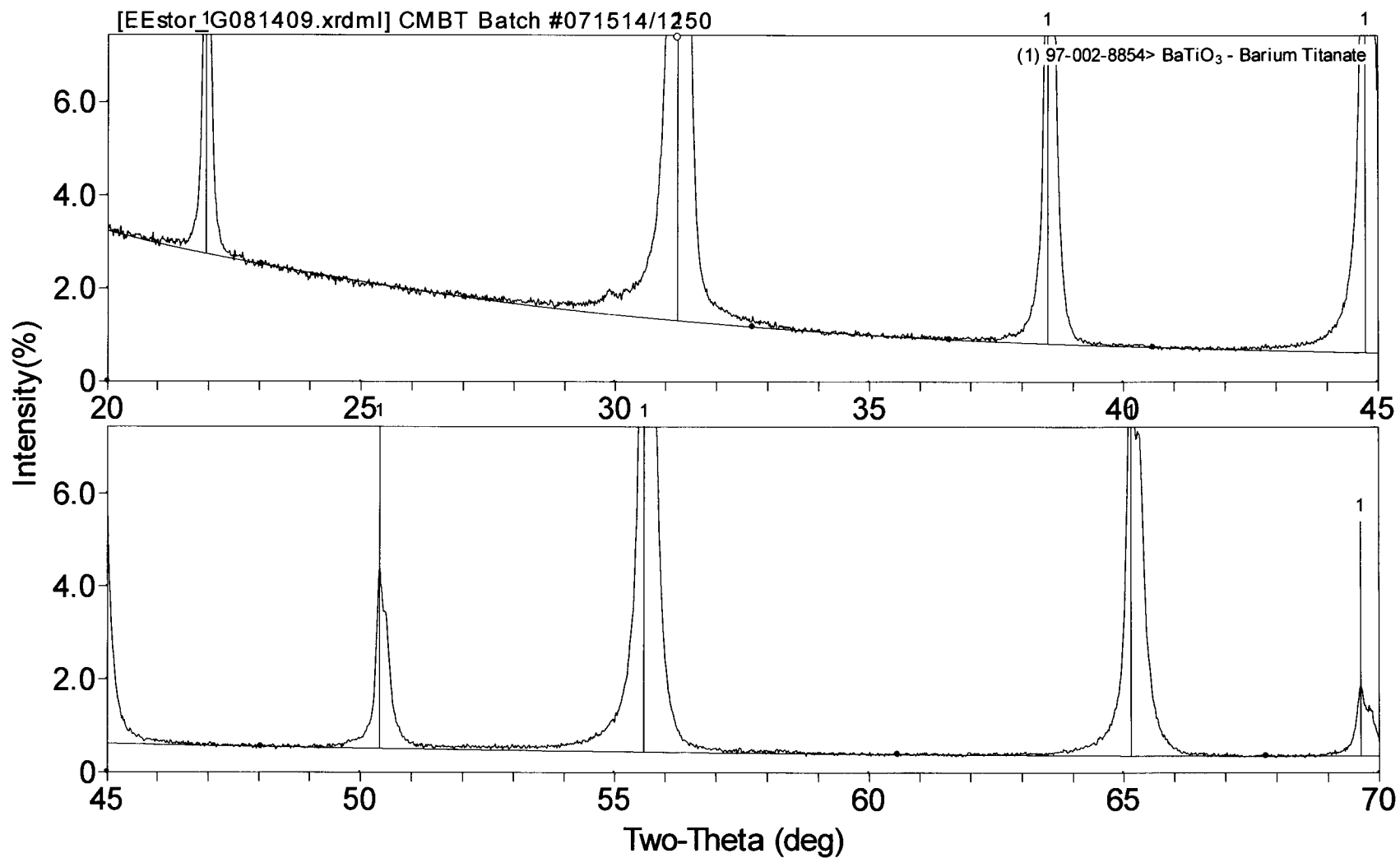


Figure 1b Exploded view showing the phase identification for CMBT powder #071514/1250



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December 15, 2014

Mr. Richard Weir
EESstor Inc.
715 Discovery Drive, Bldg. I - #107
Cedar Park, TX 78613-2287
Email: Dick_weir@eestor.us

Ref: Scanning Electron Microscope (SEM) Imaging of CMBT Powder
#110514/1250

Dear Mr. Weir:

As you requested, I have obtained an SEM image on the above referenced sample. The sample was deposited as received on a standard SEM sample stud using carbon tape and coated with approximately 20nm of carbon to eliminate charging. Imaging was performed at 5kV at a working distance of approximately 8.6 mm. The attached Image 1, taken at 50,000x, shows the nanoscale crystallites of your CMBT powder.

If you have any questions, please feel free to call me at (609) 758-5700.

Regards,

Steve Miller, Ph.D.
Scientist

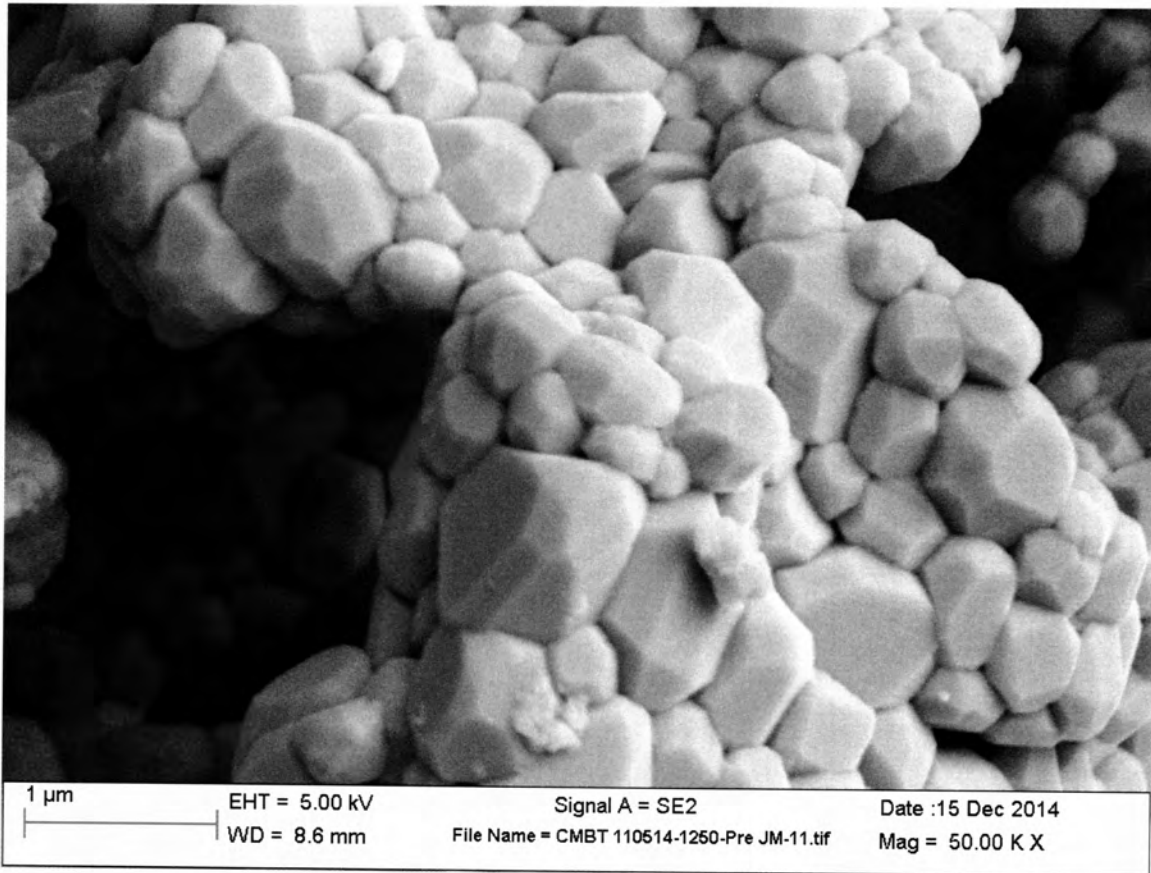


Image 1 – CMBT Powder #110514/1250 imaged at 50,000x