Appendix D

SEM/EDS Data for White Precipitant, Day-30 Fiberglass, Drain Screen Debris, Pipe Residue, Tank Sediment, Concrete Sample, Latent Debris Baselines, Test-1 Day-30 High-Volume Filtrate

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Following the conclusion of the 30-day period for Test 1, work was continued for the purpose of identifying the origin and chemical composition of the products that were formed during the test. One question of concern is whether the composition of the white precipitate evolved over the course of the study. To address this question partially, a set of precipitant samples was obtained from archival solutions representing three different time points. The first sample was obtained from unfiltered solution extracted on December 7, 2004, near the middle of the test. The second sample was obtained from an unfiltered solution extracted on November 26, 2004, near the beginning of the test. The third sample was obtained from an unfiltered solution that was archived in 1-l bottles at the end of the test. This appendix contains SEM/EDS data generated on January 18, 2005, for the sampled precipitate.

This appendix also presents additional SEM/EDS data that were generated on January 18, 2005, during a reexamination of Day-30 fiberglass. This analysis was conducted to obtain additional composition spectra and higher-quality images free from streaking caused by charge buildup on the samples.

On January 28, 2005, additional inspections were performed of (1) debris collected from the drain screen, (2) residual deposits scraped from inside the piping after the tank was drained, (3) sediment collected from the bottom of the tank, and (4) concrete chips that were introduced in a SS bag as a unique sample type. In addition, baseline characterizations were obtained for the soil and crushed concrete constituents of the surrogate latent debris.

On December 21, 2004 (termination date for Test 1), a high-volume filter sample was extracted from the tank. SEM/EDS data are presented here for the filtrate that was obtained from that filter paper on February 25, 2005. See Appendix C for optical microscopic characterization of this filtrate.

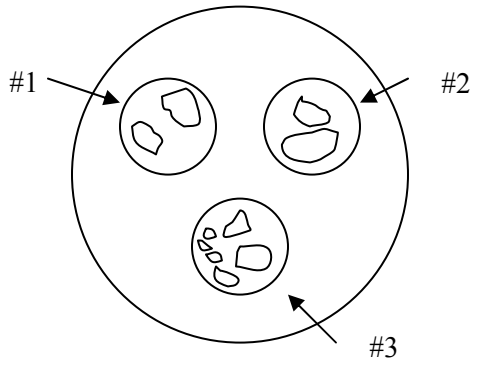
Transcribed Laboratory Log

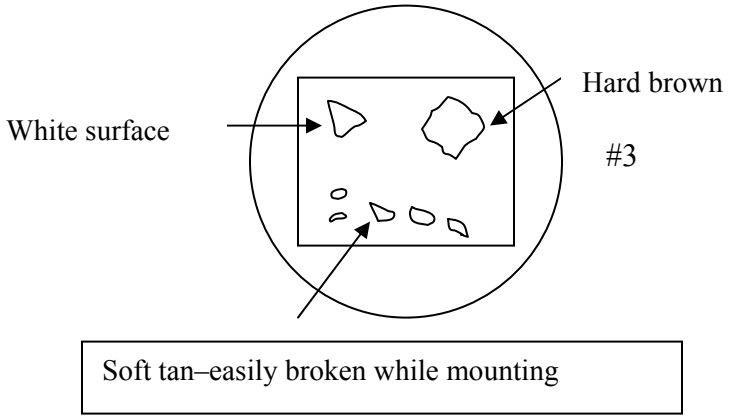
Laboratory session from January 18, 2005

Samples of precipitate from archival bottles at three time points during Test 1.

Sample	#1	ICET-1207-1000-u (from mid-test unfiltered daily water sample)
	#2	ICET-1126-1000-u (from early-test unfiltered daily water sample)
	#3	ICET-12-21-04 #7 (from end-of-test archive bottle #7)

Spatial arrangement of sample material on the SEM sample mounts. Noticeable color variations from cream to brown were evident. Samples arranged to allow examination of entire range.





Instrument Conditions: 15-kV, 1-nA beam current, Aperture 2, EDS = T3, 100 s

File: POST-T1_sample #1

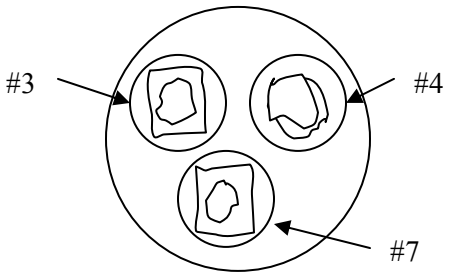
Image:	POST-T1001	40 ×	overview of chip
	POST-T1002	220 ×	on desiccation wrinkle

EDS: 1-1			O > Na > Al >> B, first time that boron has been noted
Image:	POST-T1003		2000 × on granular surface approximately 10- × 10-µm area
EDS: 1-2	EDS on area of granular surface		~10- × 10-µm area
Image:	POST-T1004		1000 × on coarse granular surface in upper part of photo T1001 above
EDS	1-3		EDS on area (10 × 10 µm) of coarse granular surface
EDS	1-4		particle on surface of image T1004 above
File: POST-T1_sample #2			
Image:	POST-T1005	40 ×	overview of one fragment on mount, coarsely granular structure
	POST-T1006	1000 ×	on coarse granular surface
EDS	2-5		EDS on area (10 × 10 µm) of granular surface
Image:	POST-T1007	40 ×	overview on other mounted fragment, smooth surface
	POST-T1008	2000 ×	on smooth granular surface
EDS	2-6		EDS on one area (10 × 10 µm) of the smooth surface
EDS	2-7		on another area of the smooth surface
File: POST-T1_sample #3			
Image:	POST-T1009	65 ×	on white surface
	POST-T1010	1000 ×	on white surface, coarse granular, appears to be on underside of smooth brown fragment
EDS:	3-8		EDS on area (10 × 10 µm) of coarse white surface in image T1010
Image:	POST-T1011	10,000 ×	close-up of image T1010
EDS:	3-9		area analysis (10 × 10 µm) on another area of white surface
Image:	POST-T1012	40 ×	overview of “smooth” hard brown fragment, surface wrinkled
	POST-T1013	500 ×	on wrinkled surface
	POST-T1014	2000 ×	close-up on wrinkled surface in image T1013
EDS:	3-10		area analysis (10 × 10 µm) on wrinkled surface in image T1014

Image:	POST-T1015	40 ×	overview of soft tan particles, concoidal fracturing
	POST-T1016	2000 ×	surface of concoidal fracture
EDS:	3-11		area analysis on surface in image T1016
	3-12		area analysis on another concoidal surface of a different particle

Reexamine samples from Day 30

Sample Definitions:	#3	High-flow sacrificial fiber from perimeter with dark crust
	#4	High-flow sacrificial fiber from perimeter with white deposits (visually surveyed but found to be similar to #3, no data saved)
	#7	Unsoaked fiberglass to serve as "clean" control sample.



Sample: T1D30 (30 day sample)

File: T1D30_3, sample #3

Image:	T1D30_3017	150 ×	overview
EDS:	T1D30_3-1		poor spectrum (not saved)
	T1D30_3-2		web-like film between fibers
	T1D30_3-3		web-like film between fibers
	T1D30_3-4		web-like film between fibers

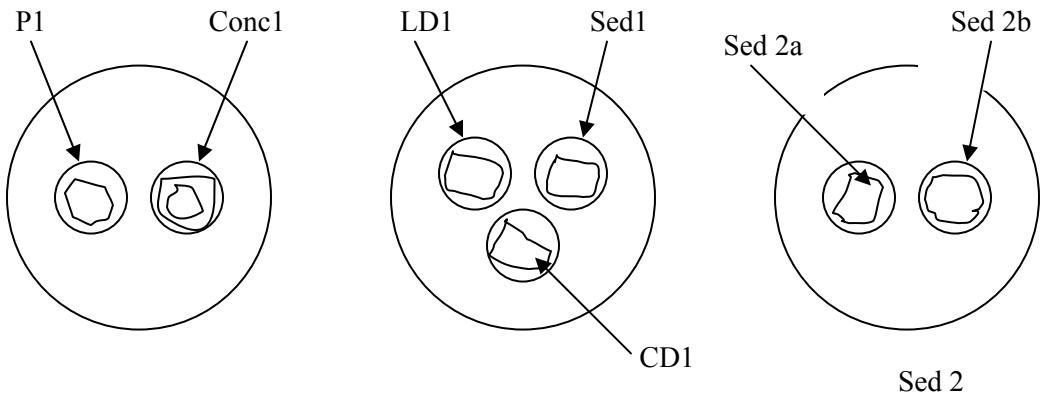
File: T1D30_7, sample #7

Image:	T1D30_7018	150 ×	overview on clean fiberglass
EDS:	T1D30_7-5		EDS on individual thick fiber
	T1D30_7-6		EDS on individual clump of fiber

Post-Test Analysis was done on January 28, 2005

ICET sample mounted:

Sample	#P1	pump suction debris
	#Sed1	sediment inside pipe (loose particles)
	#Sed2	tank sediment
	#Sed2a	one side of flake
	#Sed2b	other side of flake
	#LD1	latent debris (loose particles of sand and soil)
	#CD1	concrete dust (loose particles of crushed concrete)
	#Conc	concrete fragment



Conditions: 15-kV, 1-nA beam current, Aperture = 2, EDS aperture = 1, Process time = T2

File: Post-T1, sample #P1 pump suction debris

Image:	POST-T1017	35 ×	overview of fibers and other debris
	POST-T1018	220 ×	on larger particle (SEI)
	POST-T1019	220 ×	BSE same field as T1018
EDS:	P1-1		EDS on large flake in T1018
	P1-2		EDS on small cluster to lower left of flake in T1018
Image:	POST-T1020	60 ×	SEI at different area too much charging—beam current set to 0.1 nA
	POST-T1021		BSE same field as T1020
	POST-T1022	200 ×	SEI on flake (flake charged and jumped out of view—could not get EDS)
EDS:	P1-3		EDS on particles in foreground, below flake

File: Post-T1, sample conc			concrete fragment
Image:	POST-T1023	43 ×	BSE image overview of portion of concrete fragment. Large aggregate in upper right is quartz.
EDS:	Conc-4		EDS at 5500 × (20 × 20 μm) average on concrete matrix. Aggregate appears to be mostly quartz
Image:	POST-T1024	110 ×	SEI of another area
	POST-T1025	110 ×	BSE on same field as T1024
EDS:	Conc-5		aggregate particle in lower portion of image T1025
	Conc-6		surface granules on or in concrete; mostly carbon
	Conc-7		concrete matrix behind surface granules
File: POST-T1, sample CD1			concrete dust
Image:	POST-T1026	40 ×	SEI overview of dust particles mounted on carbon tape; many large particles
	POST-T1027	40 ×	BSE on same field as T1026; checked particles with EDS; most are quartz
EDS:	CD-8		EDS on particles in lower center of image T1027
Image:	POST-T1028	170 ×	SEI on smaller particles at different area
	POST-T1029	170 ×	BSE on same field as T1028
EDS:	CD-9		EDS on particle in lower right of image T1029; most large particles are quartz
Image:	POST-T1030	400 ×	SEI image of particle in center of image T1029
File: POST-T1, sample LD-1			Latent debris
Image: POST-T1031		40 ×	SEI overview of dust debris mounted on carbon tape
	POST-T1032	40 ×	BSE image of same field; large particles are quartz as k-feldspar
EDS:	LD-10		EDS on large particle at right side of k-feldspar
	LD-11		EDS on small bright particle in upper center of image T1032
	LD-12		EDS on thin fiber in lower center of image T1032
Image:	POST-T1033	400 ×	SEI of central portion of image T1031
	POST-T1034	400 ×	BSE image of same field as above
EDS:	LD-13		EDS on flake at left center of a Na-feldspar
	LD-14		EDS on large particle at upper center of image T1034

Image:	POST-T1035	40 ×	SEI overview of another area
	POST-T1036	40 ×	BSE of same field as above
EDS:	LD-15		EDS on bright particle in lower right of image T1036
	LD-16		EDS on round particle slightly right center of image T1036
	LD-17		EDS over area (425 × 425 μm) at 250 times; C and Cl in spectrum are from mounting tape
File: POST-T1, sample Sed1			pipe sediment
Image:	POST-T1037	40 ×	SEI image overview of particles
	POST-T1038	40 ×	BSE of same field as above
	POST-T1039	120 ×	SEI close-up
	POST-T1040	120 ×	BSE of same field as above (pretty uniform composition)
	POST-T1041	370 ×	SEI on single particle
	POST-T1042	3000 ×	SEI on small particle
EDS:	SED-18		EDS over particle in image T1042 at 6000 × (18 × 18 μm)
Image:	POST-T1043	300 ×	SEI on another particle
	POST-T1044	300 ×	BSE of same field as above
	POST-T1045	5000 ×	SEI on center of particle
	POST-T1046	10,000 ×	SEI on same particle
	POST-T1047	40 ×	overview of above
EDS:	SED-19		EDS on same field as image T1046 at 10,000 ×
File: POST-T1, sample Sed-2A			Tank sediment
Image:	POST-T1048	100 ×	SEI overview
	POST-T1049	100 ×	BSE same field as above
	POST-T1050		SEI on a representative large particle
	POST-T1051	550 ×	SEI on the same large particle

Note: *Samples Sed2-A and -B, and P1 were overcharged. Samples were recoated.

Image: POST-T1052		43 ×	SEI overview
	POST-T1053	370 ×	SEI 2 large particles
	POST-T1054	370 ×	BSE same field as above
	POST-T1055	1000 ×	BSE on fuzzy particle
	POST-T1056	5000 ×	same particle
EDS:	SED-20		EDS on fuzzy particle
	SED-21		EDS on another particle—no Fe, Cu, Zn
Image:	POST-T1057	1000 ×	SEI on particle analyzed
EDS:	SED-22		EDS on large round particle K-feldspar, probably from concrete

Image:	POST-T1058	150 ×	SEI of high-Z particles analyzed above (EDS SED-21 and SED-22)
File: POST-T1, sample Sed-2B			Tank sediment, other side of flake from 2A
Image:	POST-T1059	40 ×	SEI overview; number of large particles in view
	POST-T1060	40 ×	BSE same field as above
EDS:	Sed-23		EDS on plate; O>Na>Al; similar to filtrate composition from 1/18/05
	Sed-24		EDS on particle in above plate
Image:	POST-T1061	160 ×	SEI on agglomerate of small particles and fibers at left side of image T1059
	POST-T1062	160 ×	BSE same field as above
EDS:	Sed-25		EDS on particle in agglomerate of image T1062

Note: *Returned to sample P1 because of bad charging of the previous sample.

File: POST-T1, sample P1			pump suction debris after recoating
Image:	POST-T1063	40 ×	overview, large particles present in sample
	POST-T1064	40 ×	BSE on same field as above
EDS:	P1-26		EDS on large triangular particle
	P1-27		EDS on flat particle at lower right
	P1-28		EDS on bright particle in center

Sample: <u>High-Volume Filter</u> (T1D30) from February 25, 2005

Image:	T1D30_001	40 ×	Overview
	T1D30_002	300 ×	Close-up
EDS:	T1D30-EDS1		On filtrate
	T1D30-EDS2		On filtrate

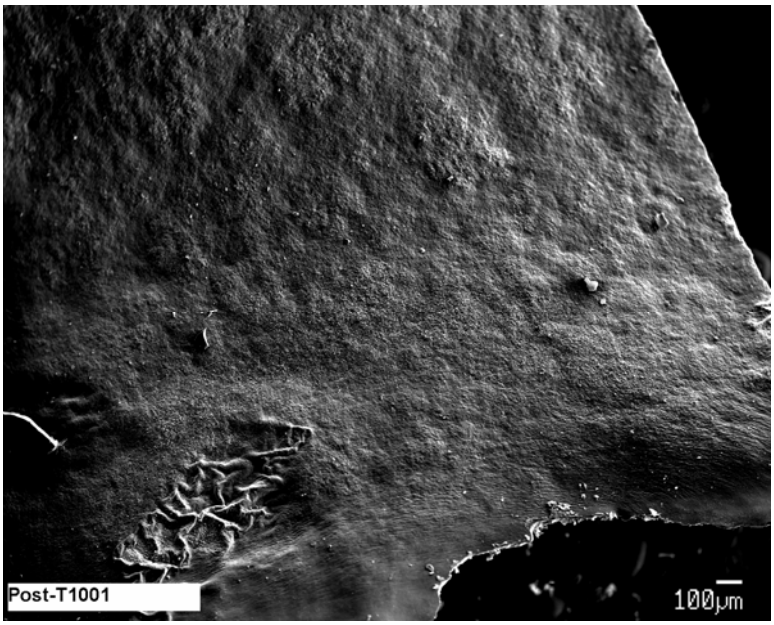


Figure D-1. Mid-test unfiltered water sample, post-T1 sample #1 SEM image (POST-T1001) magnified 40 times; overview of the white precipitant chip.

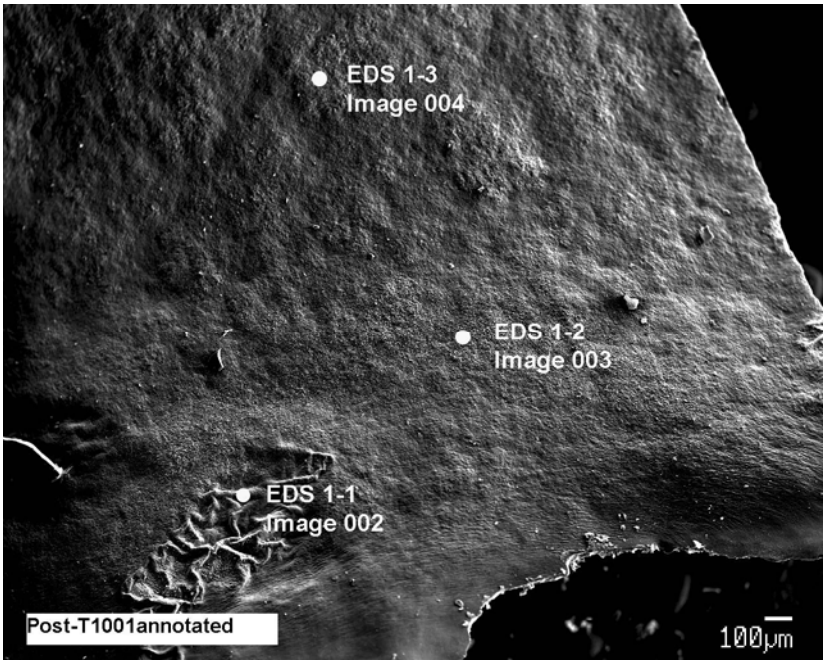


Figure D-2. Mid-test unfiltered water sample, post-T1 sample #1 SEM image (POST-T1001 annotated) annotating the EDS locations.

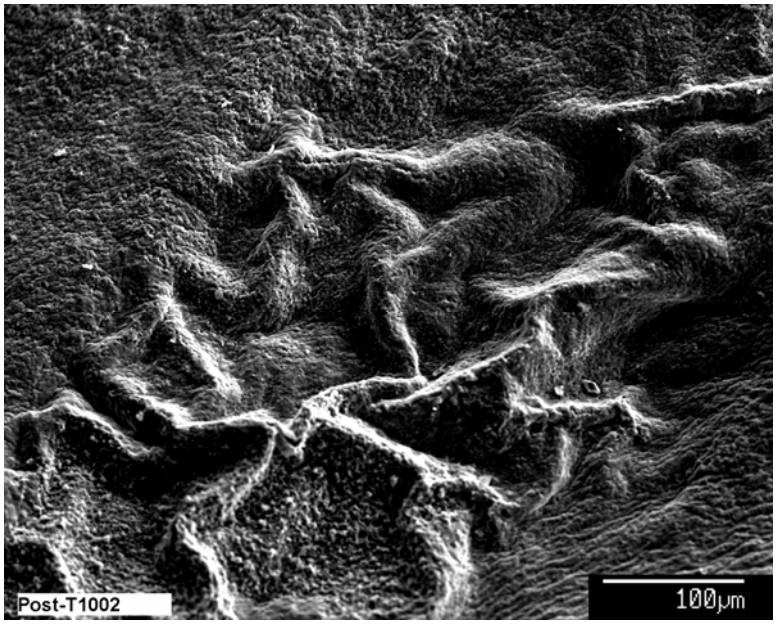


Figure D-3. Mid-test unfiltered water sample, post-T1 sample #1 SEM image (POST-T1002) magnified 220 times on the desiccation wrinkles, as shown in Figure D-2.

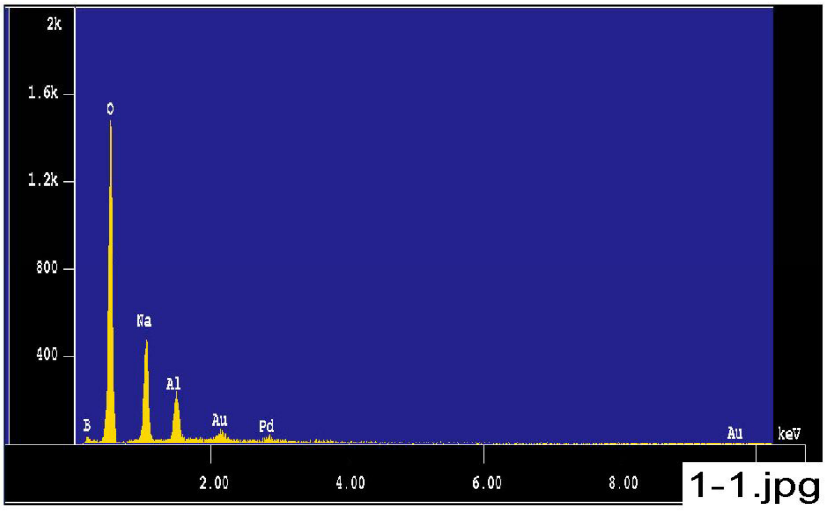


Figure D-4. Mid-test unfiltered water sample, post-T1 sample #1 counting spectrum (EDS 1-1) for the desiccation wrinkles in Figure D-3, showing the chemical compositions of O, Na, Al, and B (first time that B has been noted).

The results from the chemical composition analysis for EDS 1-1 are given in Table D-1.

Table D-1. The Chemical Compositions for EDS 1-1

```
Jan 18 11:17 2005  /tmp/eds_pout.log Page 1


 Group     : NRC
 Sample    : Post-T1  ID# : 1    From SEM#1 (Day 15)
 Comment   : wrinkled surface
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current  : 8.587E-10 A
             Stage Point : X=25.049 Y=59.828 Z=10.967
             Acq. Date   : Tue Jan 18 10:46:14 2005

 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   35.4629   0.0044    11879 /      17
  Na K      Normal   0.81- 1.27    4.5113   0.0016     4342 /      21
  Al K      Normal   1.19- 1.83    1.5205   0.0004     2113 /      19
   B K      Normal   0.00- 0.36    1.2097   0.0002      169 /       7
-----------------------------------------------------------------------
                              Chi_square = 44.3126

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   61.031  58.8793 0.7366 0.9686 0.7604 1.0000
    Na   13.715   9.2077 1.3011 1.0231 1.2716 1.0001
    Al    4.842   2.7699 1.3629 0.9965 1.3677 1.0000
     B   20.413  29.1432 7.2220 1.1244 6.4230 1.0000
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  2.3365
```

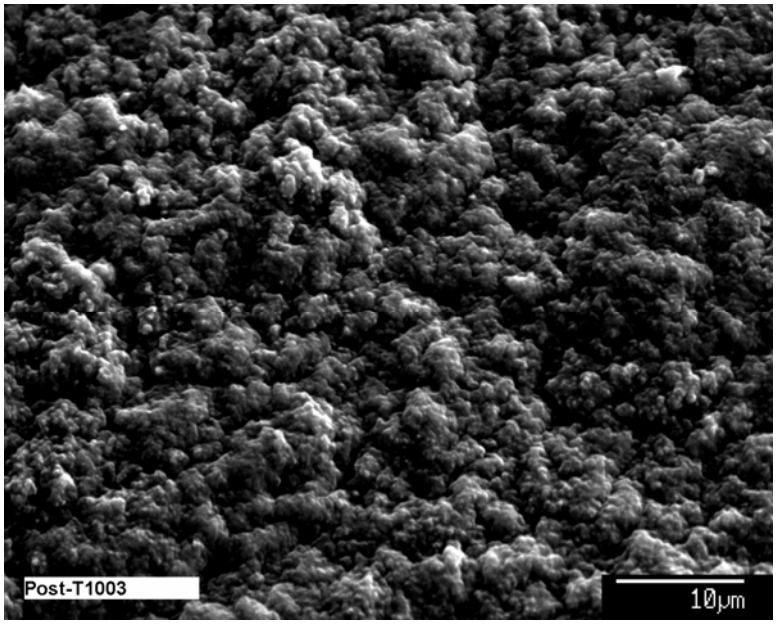


Figure D-5. Mid-test unfiltered water sample, post-T1 sample #1 image (POST-T1003) magnified 2000 times on granular surface, as shown in Figure D-2.

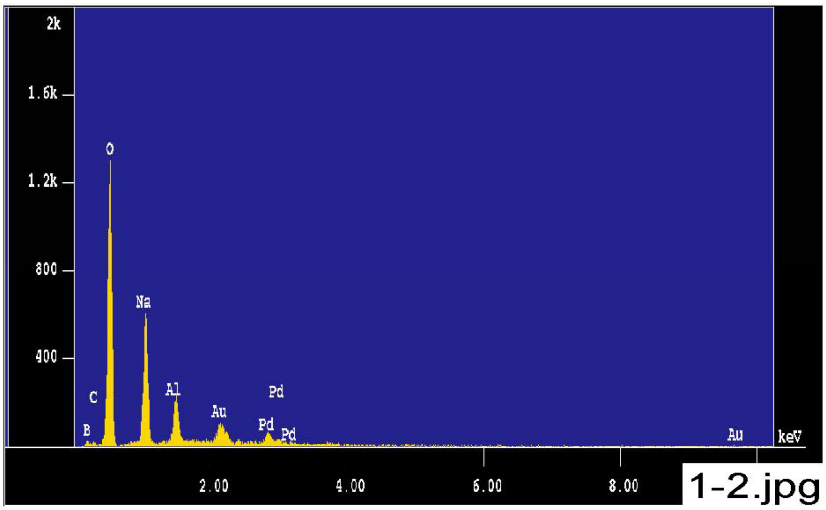


Figure D-6. Mid-test unfiltered water sample, post-T1 sample #1 counting spectrum (EDS 1-2) on the granular surface, as shown in Figure D-5, within an area about 10 × 10 µm.

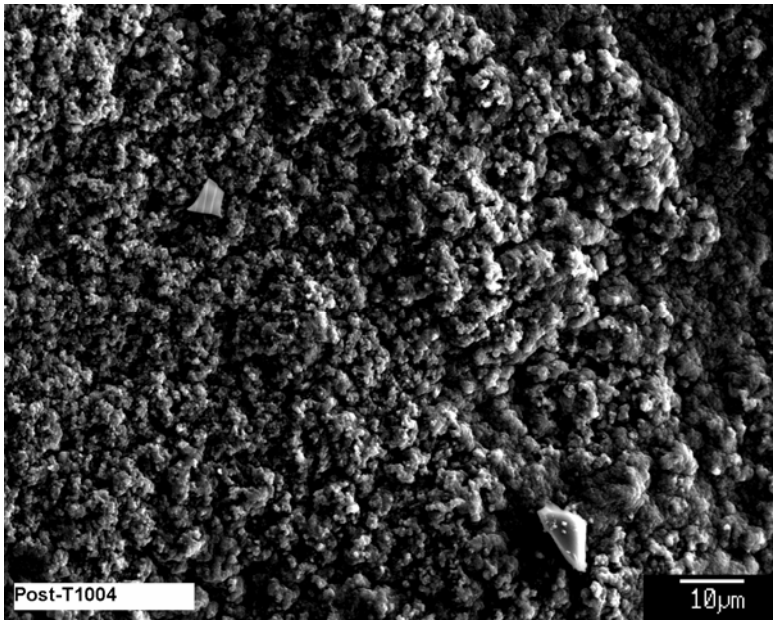


Figure D-7. Mid-test unfiltered water sample, post-T1 sample #1 SEM image (POST-T1004) magnified 1000 times on coarse granular surface in upper part of image (POST-T1001), as shown in Figure D-2.

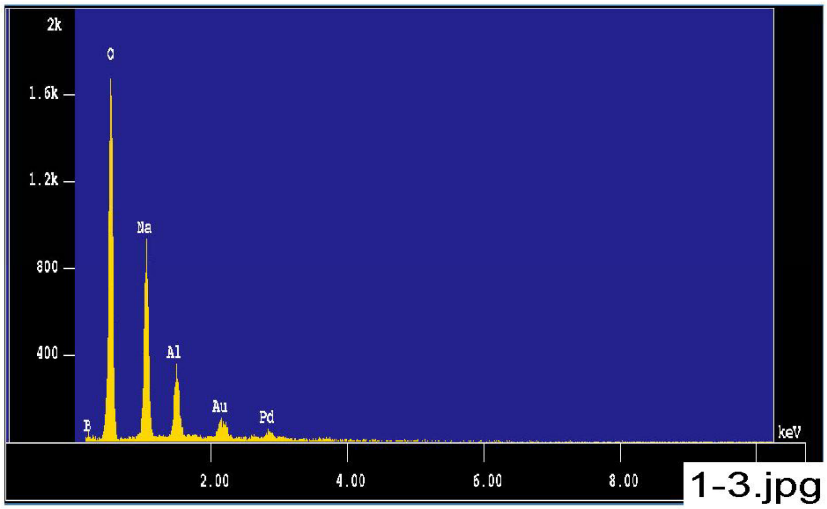


Figure D-8. Mid-test unfiltered water sample, post-T1 sample #1 counting spectrum (EDS 1-3) on an area (10 × 10 µm) of the coarse granular surface, as shown in Figure D-7.

The results from the chemical composition analysis for EDS 1-3 are given in Table D-2.

Table D-2. The Chemical Compositions for EDS 1-3

```
Jan 18 11:18 2005  /tmp/eds_pout.log Page 1


 Group     : NRC
 Sample    : Post-T1  ID# : 3   From SEM# 1 (Day 15)
 Comment   :  coarse granular surface area analysis
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 8.087E-10 A
             Stage Point : X=24.722 Y=58.294 Z=10.967
             Acq. Date   : Tue Jan 18 11:00:44 2005

 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   44.4103   0.0048    14010 /      20
  Na K      Normal   0.81- 1.27    8.5492   0.0020     7749 /      32
  Al K      Normal   1.19- 1.83    2.3330   0.0005     3054 /      35
   B K      Normal   0.00- 0.36    0.9836   0.0002      129 /      11
-----------------------------------------------------------------
                              Chi_square = 48.4646

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   58.466  59.0811 0.7212 0.9739 0.7406 0.9999
    Na   19.871  13.9741 1.2733 1.0285 1.2380 1.0000
    Al    6.080   3.6433 1.4278 1.0016 1.4255 1.0000
     B   15.582  23.3015 8.6782 1.1306 7.6756 1.0000
-----------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.8254
```

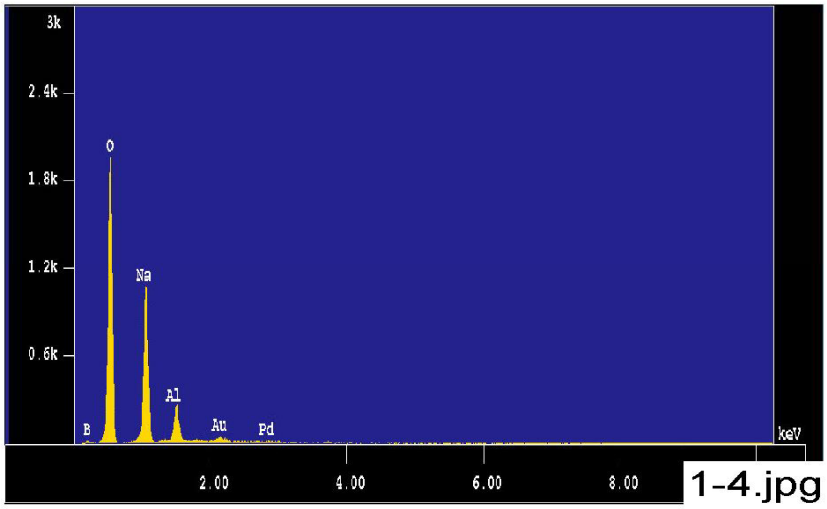


Figure D-9. Mid-test unfiltered water sample, post-T1 sample #1 counting spectrum (EDS 1-4) on the particle on surface of SEM image (POST-T1004), as shown in Figure D-7.

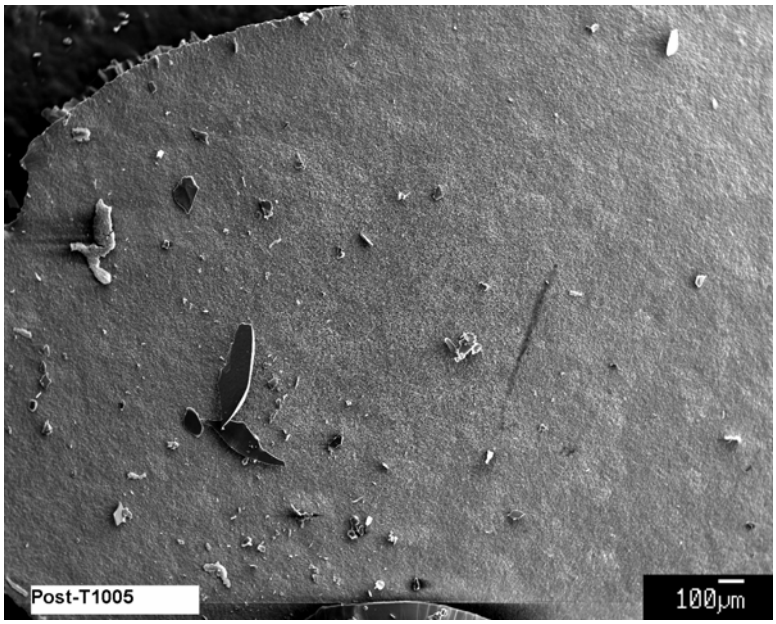


Figure D-10. Mid-test unfiltered water sample, post-T1 sample #2 SEM (POST-T1005) magnified 40 times for the overview of one fragment on mount showing coarsely granular structure.

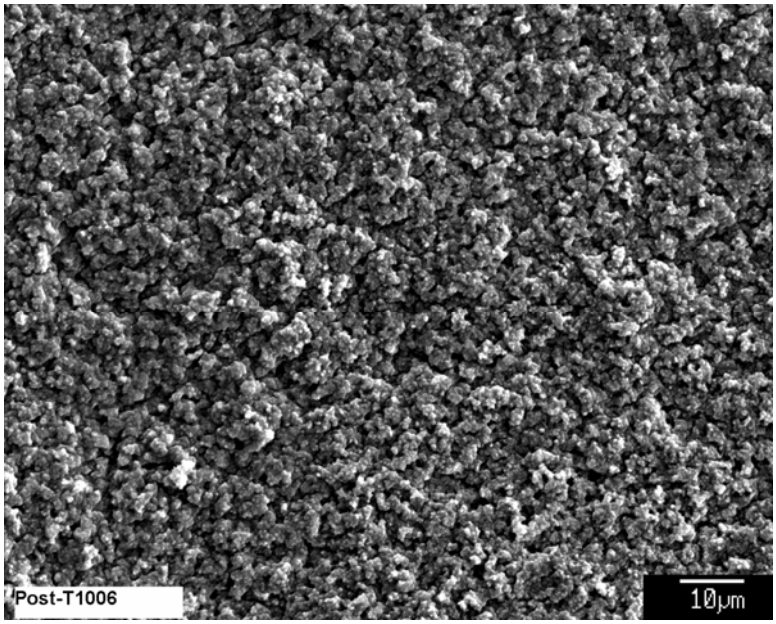


Figure D-11. Mid-test unfiltered water sample, post-T1 sample #2 SEM (POST-T1006) magnified 1000 times on the coarsely granular surface, as shown in Figure D-10.

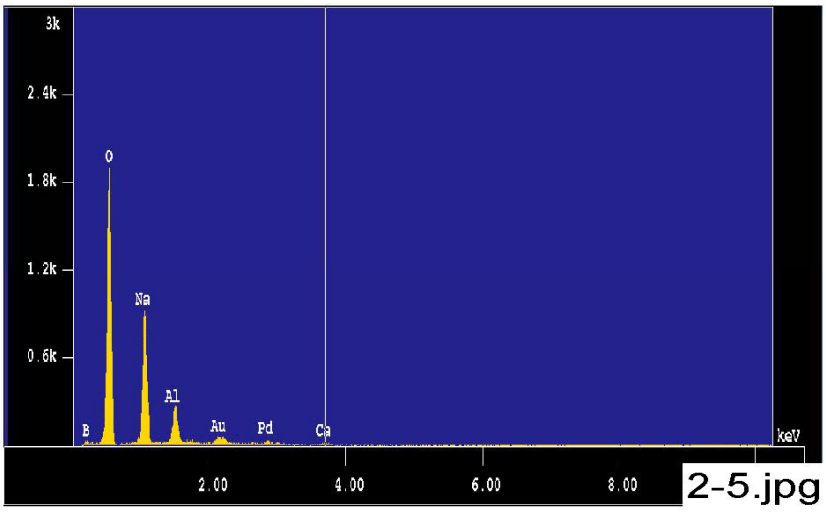


Figure D-12. Mid-test unfiltered water sample, post-T1 sample #2 counting spectrum (EDS 2-5) on the granular surface, as shown in Figure D-11.

The results from the chemical composition analysis for EDS 2-5 are given in Table D-3.

Table D-3. The Chemical Compositions for EDS 2-5

```
Jan 18 11:31 2005  /tmp/eds_pout.log Page 1


 Group     : NRC
 Sample    : Post-T1  ID# : 5          From SEM#2 (beginning)
 Comment   :  coarse granular surface area analysis
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 7.220E-10 A
             Stage Point : X=10.586 Y=55.990 Z=10.967
             Acq. Date   : Tue Jan 18 11:28:48 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   52.9682   0.0049    14918 /      24
  Na K      Normal   0.81- 1.27    9.8622   0.0021     7981 /      26
  Al K      Normal   1.19- 1.83    2.0175   0.0004     2358 /      32
   B K      Normal   0.00- 0.36    1.0850   0.0002      127 /      12
  Ca K      Normal   3.39- 4.30    0.3343   0.0009      177 /      13
-------------------------------------------------------------------
                              Chi_square = 35.4442

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   60.176  61.0351 0.7164 0.9754 0.7344 0.9999
    Na   20.230  14.2795 1.2935 1.0302 1.2555 1.0001
    Al    4.616   2.7762 1.4427 1.0032 1.4381 1.0000
     B   14.456  21.6982 8.4015 1.1325 7.4188 1.0000
    Ca    0.521   0.2110 0.9831 1.0039 0.9794 1.0000
-------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.5859
```

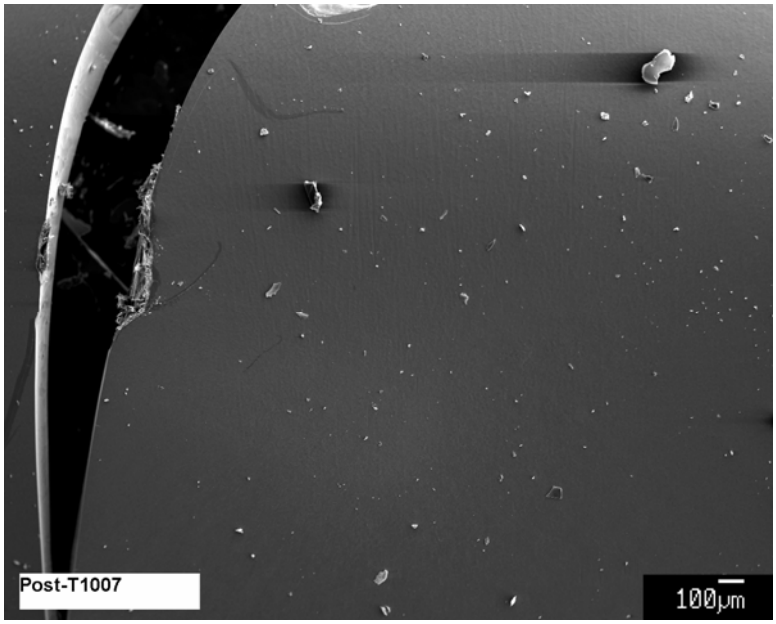


Figure D-13. Begin-test unfiltered water sample, post-T1 sample #2 SEM (POST-T1007) magnified 40 times of the overview on the other mounted fragment with smooth surface.

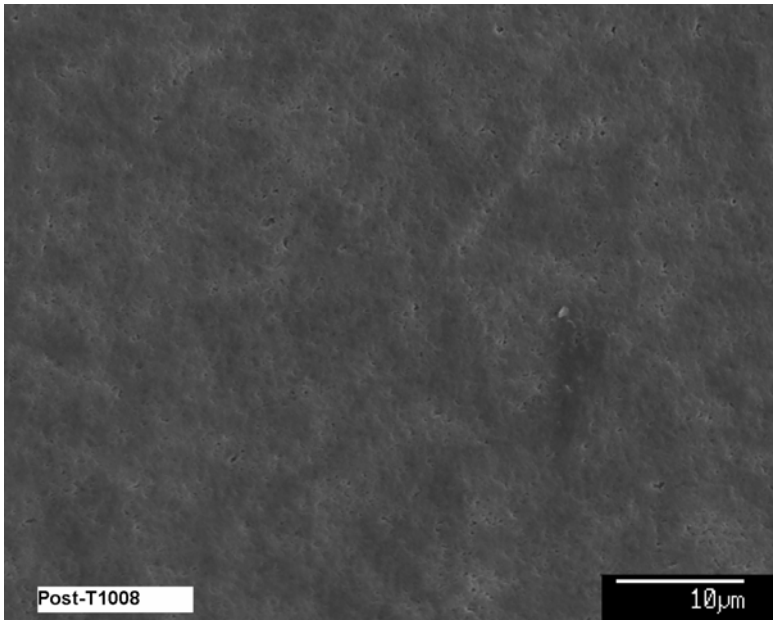


Figure D-14. Begin-test unfiltered water sample, post-T1 sample #2 SEM image (POST-T1008) magnified 2000 times on the smooth surface, as shown in Figure D-13.

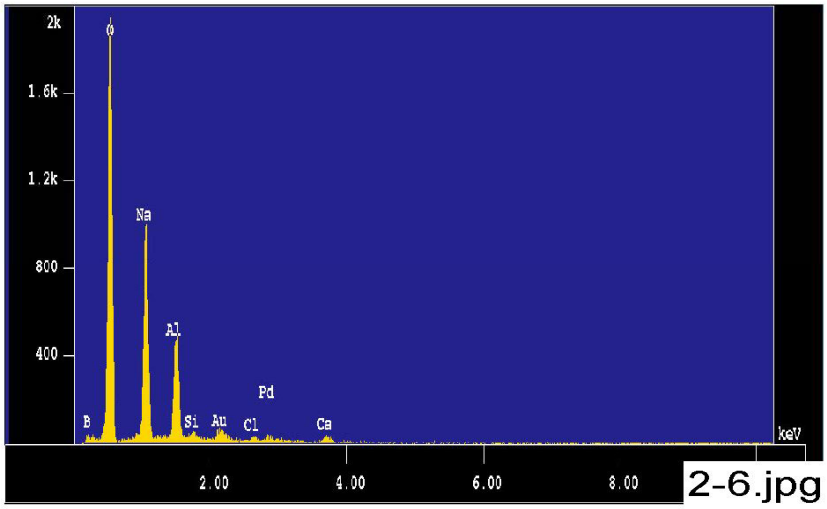


Figure D-15. Begin-test unfiltered water sample, post-T1 sample #2 counting spectrum (EDS 2-6) on one area (10 × 10 µm) of the smooth surface, as shown in Figure D-14.

The results from the chemical composition analysis for EDS 2-6 are given in Table D-4.

Table D-4. The Chemical Compositions for EDS 2-6

```
Jan 18 11:46 2005  /tmp/eds_pout.log Page 1


 Group     : NRC
 Sample    : Post-T1  ID# : 6      SEM#2 (beginning)
 Comment   : smooth surface area analysis
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec     Aperture #     : 1
             Acc. Volt   : 15.0 KV         Probe Current : 6.840E-10 A
             Stage Point : X=10.350 Y=59.471 Z=10.967
             Acq. Date   : Tue Jan 18 11:43:23 2005

 Element     Mode      ROI(KeV)    K-ratio(%)  +/-    Net/Background
   B K      Normal   0.00- 0.36     1.2246   0.0002      136 /      14
   O K      Normal   0.25- 0.77    59.8482   0.0051    15969 /      28
  Na K      Normal   0.81- 1.27    11.1361   0.0022     8537 /      25
  Al K      Normal   1.19- 1.83     4.2719   0.0006     4730 /      32
  Si K      Normal   1.50- 2.05     0.1862   0.0003      192 /     267
  Cl K      Normal   2.34- 3.06     0.4244   0.0007      300 /      14
  Ca K      Normal   3.39- 4.30     0.7458   0.0010      374 /      10
-----------------------------------------------------------------
                              Chi_square = 26.7443

 Element Mass%    Atomic%   ZAF      Z      A      F
     B   14.058  21.4396 8.9766 1.1319 7.9308 1.0000
     O   58.125  59.9001 0.7594 0.9749 0.7790 0.9999
    Na   18.281  13.1106 1.2836 1.0295 1.2470 0.9999
    Al    7.721   4.7183 1.4133 1.0025 1.4099 0.9999
    Si    0.310   0.1818 1.3007 0.9804 1.3267 0.9999
    Cl    0.565   0.2626 1.0402 1.0342 1.0062 0.9996
    Ca    0.941   0.3870 0.9863 1.0030 0.9834 1.0000
-----------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.2789
```

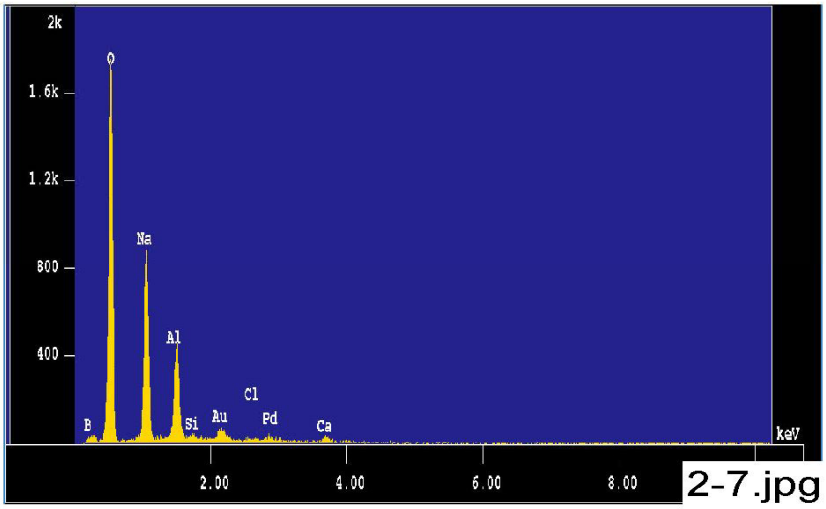


Figure D-16. Begin-test unfiltered water sample, post-T1 sample #2 counting spectrum (EDS 2-7) on another area of the smooth surface, as shown in Figure D-14.

The results from the chemical composition analysis for EDS 2-7 are given in Table D-5.

Table D-5. The Chemical Compositions for EDS 2-7

```
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 Group     : NRC
 Sample    : Post-T1  ID# : 7     SEM#2 (beginning)
 Comment   : smooth surface area analysis
 Condition : Full Scale   : 20KeV(10eV/ch,2Kch)
             Live Time    : 100.000 sec     Aperture #     : 1
             Acc. Volt    : 15.0 KV         Probe Current : 6.705E-10 A
             Stage Point  : X=12.518 Y=59.220 Z=10.967
             Acq. Date    : Tue Jan 18 11:49:08 2005


 Element     Mode     ROI(KeV)    K-ratio(%)  +/-    Net/Background
   B K      Normal   0.00- 0.36    0.0000    0.0000        0 /      12
   O K      Normal   0.25- 0.77   55.3551    0.0049    14478 /      26
  Na K      Normal   0.81- 1.27   10.1545    0.0020     7631 /      26
  Al K      Normal   1.19- 1.83    3.8370    0.0005     4164 /      32
  Si K      Normal   1.50- 2.05    0.1735    0.0003      176 /     248
  Ca K      Normal   3.39- 4.30    0.7780    0.0010      383 /      15
-----------------------------------------------------------------
                              Chi_square = 31.2526

 Element Mass%    Atomic%   ZAF      Z      A      F
     B    0.000   0.0000 11.2455 1.1536 9.7482 1.0000
     O   64.445  73.4935 0.6695 0.9934 0.6740 0.9999
    Na   23.652  18.7708 1.3394 1.0487 1.2774 0.9998
    Al   10.115   6.8395 1.5159 1.0210 1.4849 0.9999
    Si    0.422   0.2742 1.3986 0.9983 1.4010 1.0000
    Ca    1.366   0.6220 1.0099 1.0202 0.9900 1.0000
-----------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.7390
```

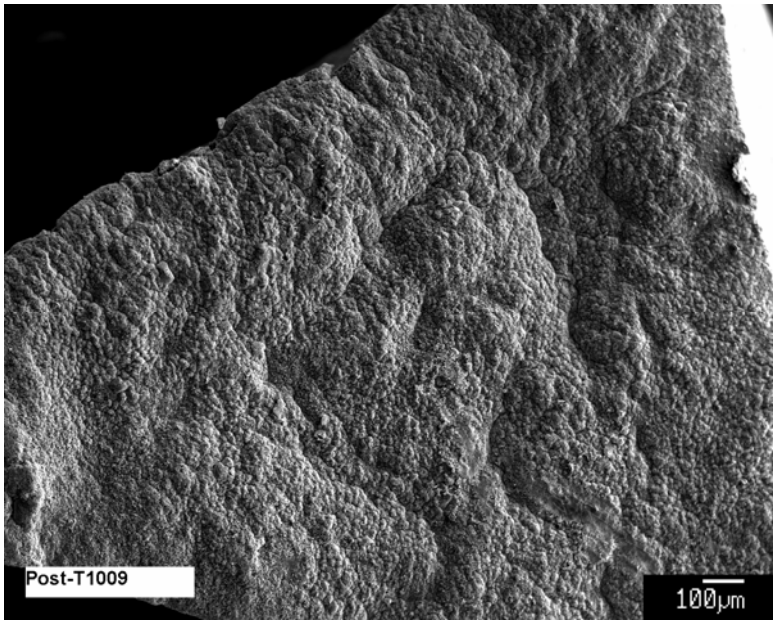

Figure D-17. End-test archive, post-T1 sample #3 SEM image (POST-T1009) magnified 65 times on the white surface of the white precipitant.

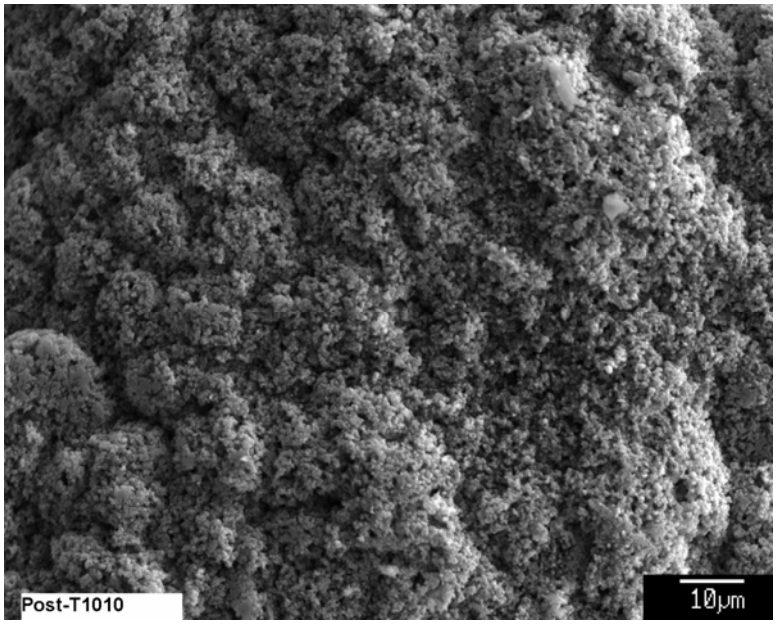

Figure D-18. End-test archive, post-T1 sample #3 SEM image (POST-T1010) magnified 1000 times on the white surface in Figure D-17, showing a coarsely granular structure on the underside of the smooth brown fragments.

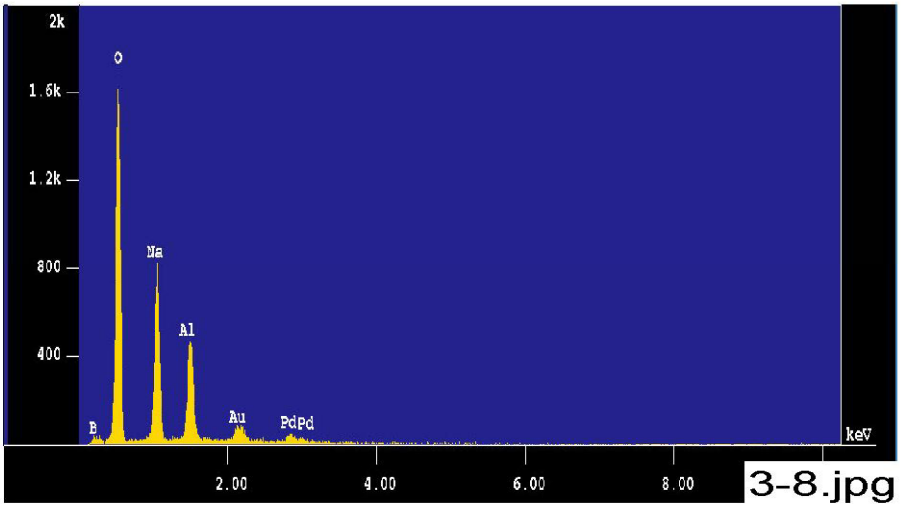

Figure D-19. End-test archive, post-T1 sample #3 counting spectrum (EDS 3-8) on an area (10 × 10 m) of the coarse white surface in the image (POST-T1010), as shown in Figure D-18.

The results from the chemical composition analysis for EDS 3-8 are given in Table D-6.

Table D-6. The Chemical Compositions for EDS 3-8

```
Jan 18 12:02 2005  /tmp/eds_pout.log Page 1


 Group     : NRC
 Sample    : Post-T1  ID# : 8     SEM#3 (Day 30)
 Comment   : white coarse surface area analysis  - bottom of flake
 Condition : Full Scale   : 20KeV(10eV/ch,2Kch)
             Live Time    : 100.000 sec     Aperture #     : 1
             Acc. Volt    : 15.0 KV         Probe Current : 6.439E-10 A
             Stage Point  : X=16.090 Y=65.380 Z=10.967
             Acq. Date    : Tue Jan 18 12:00:59 2005


 Element     Mode     ROI(KeV)    K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   55.1199   0.0048    13845 /      23
  Na K      Normal   0.81- 1.27    9.4895   0.0020     6848 /      28
  Al K      Normal   1.19- 1.83    4.5307   0.0006     4722 /      28
   B K      Normal   0.00- 0.36    0.4438   0.0002       46 /      16
-----------------------------------------------------------------------
                              Chi_square = 49.0164

 Element Mass%    Atomic%   ZAF      Z      A      F
      O   61.576  66.1306 0.6849 0.9841 0.6960 0.9999
     Na   20.172  15.0761 1.3032 1.0391 1.2545 0.9998
     Al   10.726   6.8301 1.4514 1.0117 1.4346 1.0000
      B    7.527  11.9632 10.3982 1.1426 9.1004 1.0000
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.6311
```

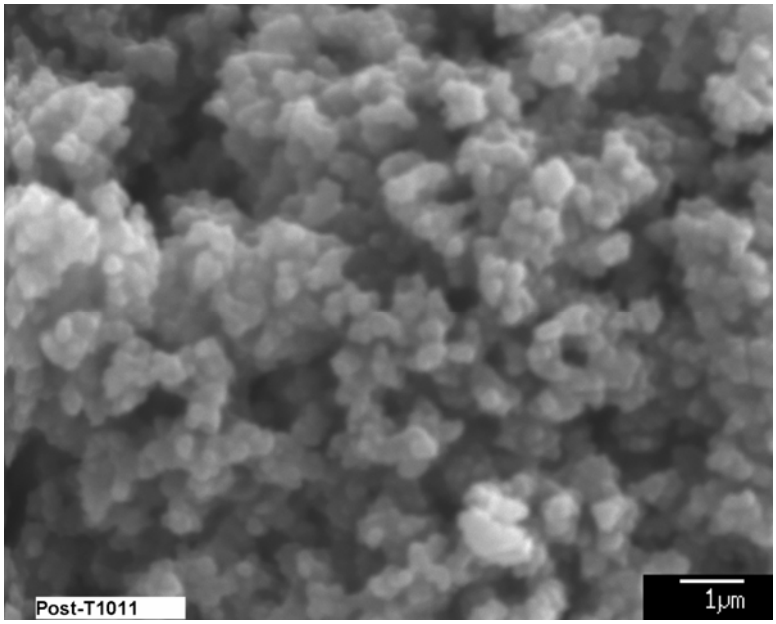

Figure D-20. End-test archive, post-T1 sample #3 SEM (POST-T1011) magnified 10,000 times; close-up of the white surface, as shown in Figure D-18.

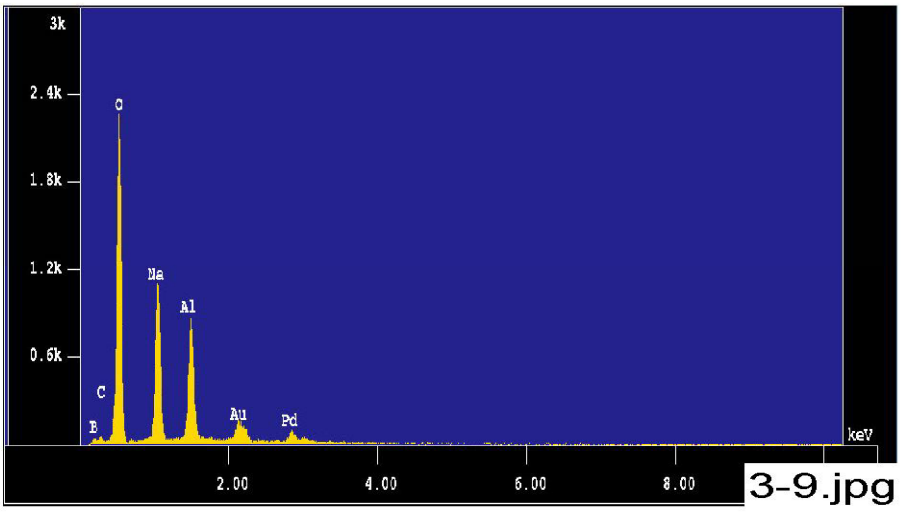

Figure D-21. End-test archive, post-T1 sample #3 counting spectrum (EDS 3-9) on another area of the white surface, as shown in Figure D-20.

The results from the chemical composition analysis for EDS 3-9 are given in Table D-7.

Table D-7. The Chemical Compositions for EDS 3-9

```
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 Group     : NRC
 Sample    : Post-T1  ID# : 9      SEM# 3 (Day 30)
 Comment   : white coarse surface area analysis -bottom of flake
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.022E-09 A
             Stage Point : X=16.404 Y=65.334 Z=10.967
             Acq. Date   : Tue Jan 18 12:12:46 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   47.7843   0.0056    19050 /      44
  Na K      Normal   0.81- 1.27    8.6181   0.0023     9872 /      42
  Al K      Normal   1.19- 1.83    4.8672   0.0007     8052 /      48
   B K      Normal   0.00- 0.36    0.8142   0.0003      135 /      16
-----------------------------------------------------------------------
                              Chi_square = 59.4370

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   57.627  59.8374 0.7343 0.9763 0.7522 0.9999
    Na   17.957  12.9762 1.2687 1.0310 1.2309 0.9997
    Al   11.219   6.9075 1.4034 1.0039 1.3980 1.0000
     B   13.197  20.2790 9.8692 1.1335 8.7068 1.0000
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.6424
```

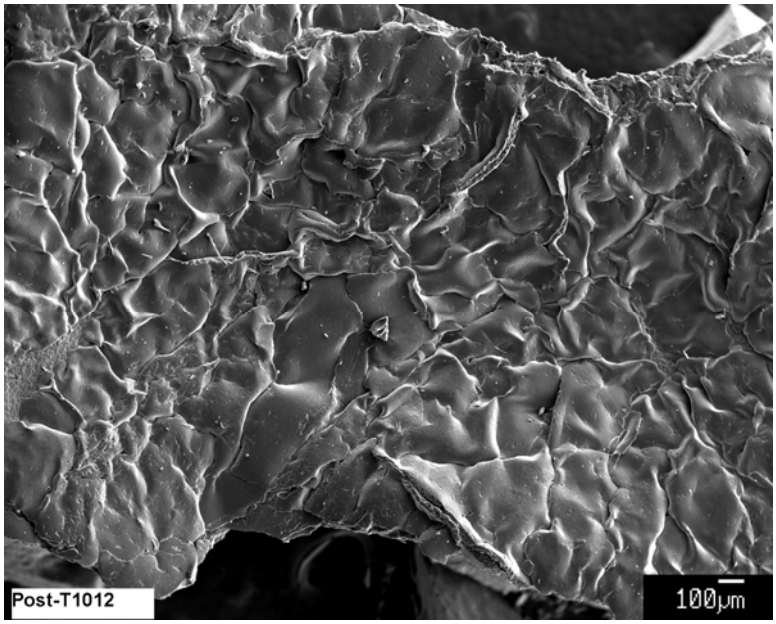

Figure D-22. End-test archive, post-T1 sample #3 SEM image (POST-T1012) magnified 40 times; overview of the smooth and hard brown fragment with wrinkled surface.

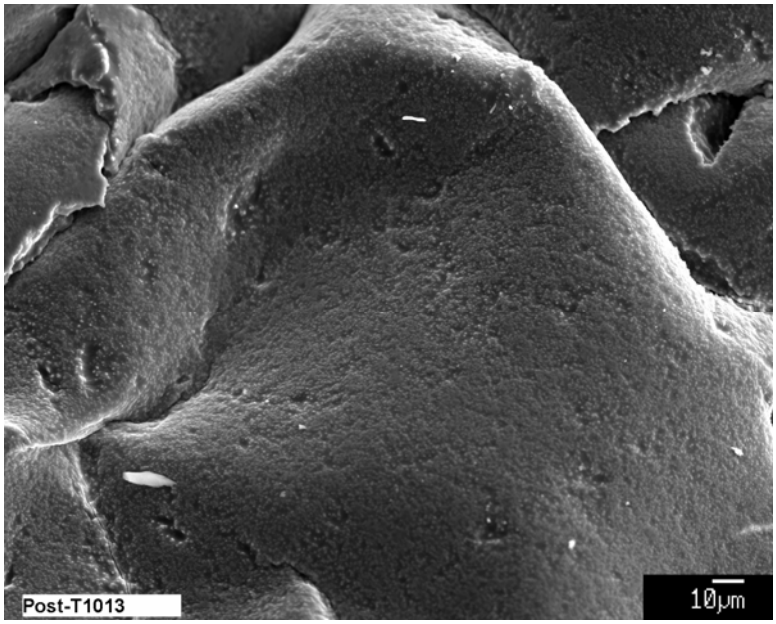

Figure D-23. End-test archive, post-T1 sample #3 SEM image (POST-T10013) magnified 500 times on the wrinkled surface, as shown in Figure D-22.

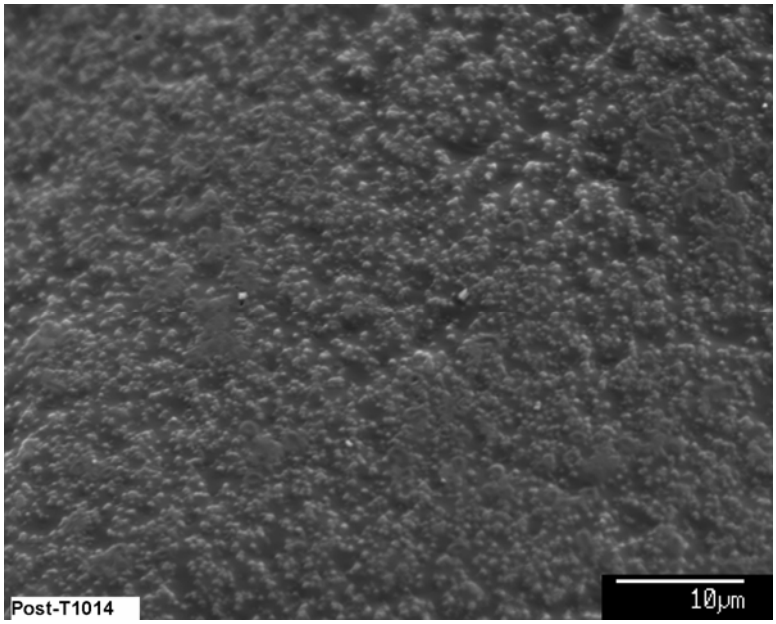

Figure D-24. End-test archive, post-T1 sample #3 SEM image (POST-T1014) magnified 2000 times; close-up on the wrinkled surface in SEM image (POST-T1013), as shown in Figure D-23.

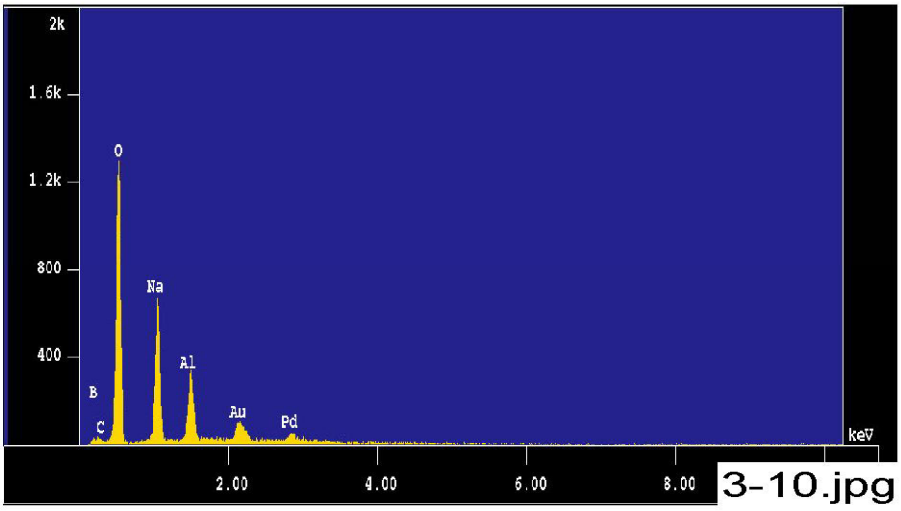

Figure D-25. End-test archive, post-T1 sample #3 counting spectrum (EDS 3-10) on an area (10 × 10 µm) of the wrinkled surface in the SEM image (POST-T1014), as shown in Figure D-24.

The results from the chemical composition analysis for EDS 3-10 are given in Table D-8.

Table D-8. The Chemical Compositions for EDS 3-10

```
Jan 18 12:27 2005  /tmp/eds_pout.log Page 1


 Group     : NRC
 Sample    : Post-T1  ID# : 10    SEM#3 (Day 30)
 Comment   : smooth surface area analysis        - top of flake
 Condition : Full Scale   : 20KeV(10eV/ch,2Kch)
             Live Time    : 100.000 sec    Aperture #     : 1
             Acc. Volt    : 15.0 KV        Probe Current : 9.846E-10 A
             Stage Point  : X=14.364 Y=69.744 Z=10.967
             Acq. Date    : Tue Jan 18 12:26:01 2005


 Element     Mode     ROI(KeV)    K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   27.4160   0.0042    10530 /      30
  Na K      Normal   0.81- 1.27    5.1217   0.0018     5652 /      22
  Al K      Normal   1.19- 1.83    1.9239   0.0005     3066 /      31
   B K      Normal   0.00- 0.36    0.4361   0.0002       70 /      10
-----------------------------------------------------------------------
                              Chi_square = 35.3338

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   59.189  61.3093 0.7111 0.9776 0.7274 0.9999
    Na   19.917  14.3574 1.2809 1.0324 1.2409 0.9999
    Al    8.376   5.1446 1.4341 1.0053 1.4265 1.0000
     B   12.518  19.1887 9.4555 1.1351 8.3304 1.0000
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  3.0360
```

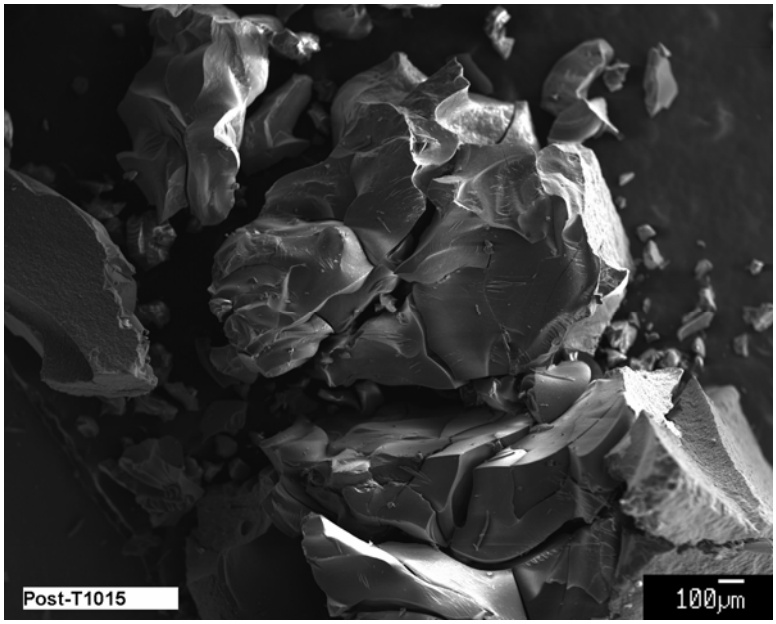

Figure D-26. End-test archive, post-T1 sample #3 SEM image (POST-T1015) magnified 40 times; overview of the soft tan particles with concoidal fracturing.

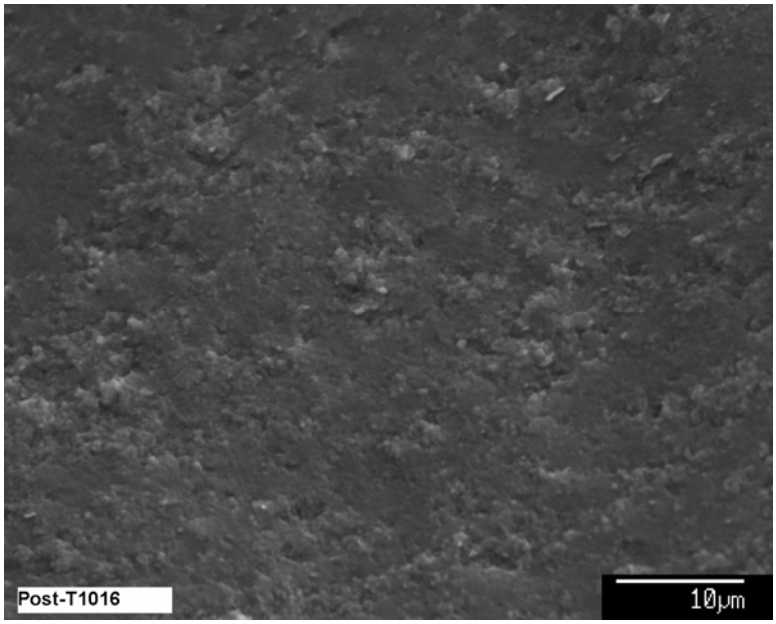

Figure D-27. End-test archive, post-T1 sample #3 SEM image (POST-T1016) magnified 2000 times on the surface of the concoidal fracture, as shown in Figure D-26.

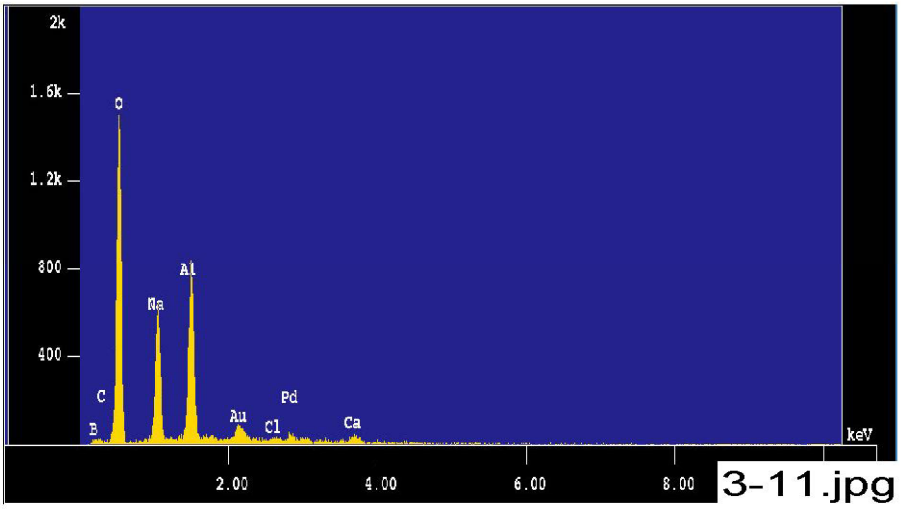

Figure D-28. End-test archive, post-T1 sample #3 counting spectrum (EDS 3-11) on an area (10 × 10 µm) on the surface in SEM image POST-T1016, as shown in Figure D-27.

The results from the chemical composition analysis for EDS 3-11 are given in Table D-9.

Table D-9. The Chemical Compositions for EDS 3-11

```
Jan 18 12:38 2005  /tmp/eds_pout.log Page 1


 Group     : NRC
 Sample    : Post-T1  ID# : 11  SEM#3 (Day 30)
 Comment   : concoidal surface area analysis
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 9.560E-10 A
             Stage Point : X=19.341 Y=67.891 Z=10.967
             Acq. Date   : Tue Jan 18 12:36:40 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   33.3149   0.0045    12424 /      24
  Na K      Normal   0.81- 1.27    5.0959   0.0018     5460 /      26
  Al K      Normal   1.19- 1.83    4.9523   0.0007     7663 /      28
   B K      Normal   0.00- 0.36    0.0000   0.0000        0 /      14
  Ca K      Normal   3.39- 4.30    0.6178   0.0012      433 /      12
  Cl K      Normal   2.34- 3.06    0.2676   0.0007      264 /      28
-----------------------------------------------------------------------
                              Chi_square = 22.8528

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   62.147  72.2967 0.7289 0.9919 0.7349 0.9999
    Na   17.338  14.0366 1.3295 1.0471 1.2705 0.9994
    Al   18.165  12.5300 1.4333 1.0193 1.4062 1.0000
     B    0.000   0.0000 12.1965 1.1519 10.5881 1.0000
    Ca    1.604   0.7446 1.0142 1.0182 0.9960 1.0000
    Cl    0.747   0.3921 1.0905 1.0507 1.0384 0.9995
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  2.5592
```

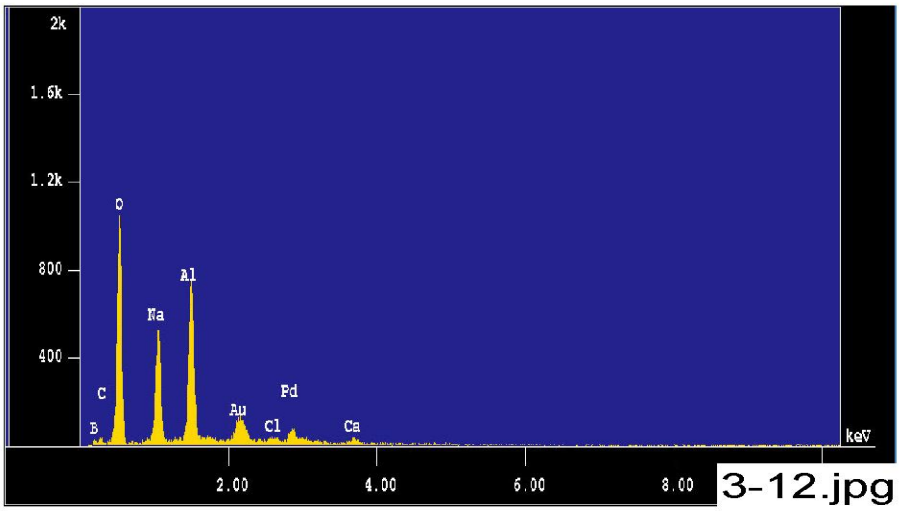

Figure D-29. End-test archive, post-T1 sample #3 counting spectrum (EDS 3-12) on another concoidal surface of a different particle in SEM image POST-T1016, as shown in Figure D-27.

The results from the chemical composition analysis for EDS 3-12 are given in Table D-10.

Table D-10. The Chemical Compositions for EDS 3-12

```
Jan 18 12:43 2005  /tmp/eds_pout.log Page 1


 Group     : NRC
 Sample    : Post-T1  ID# : 12      SEM#3 (Day 30)
 Comment   : concoidal surface area analysis
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 9.432E-10 A
             Stage Point : X=20.778 Y=66.810 Z=10.967
             Acq. Date   : Tue Jan 18 12:42:24 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   24.4363   0.0039     8991 /      30
  Na K      Normal   0.81- 1.27    4.4039   0.0017     4655 /      30
  Al K      Normal   1.19- 1.83    4.5798   0.0007     6992 /      30
   B K      Normal   0.00- 0.36    0.3873   0.0002       59 /      14
  Ca K      Normal   3.39- 4.30    0.4315   0.0011      299 /      15
  Cl K      Normal   2.34- 3.06    0.2999   0.0008      292 /      32
-------------------------------------------------------------------
                              Chi_square = 15.3263

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   54.203  58.3833 0.8118 0.9762 0.8316 0.9999
    Na   15.113  11.3286 1.2559 1.0308 1.2192 0.9994
    Al   17.053  10.8912 1.3627 1.0036 1.3578 1.0000
     B   11.587  18.4692 10.9486 1.1335 9.6590 1.0000
    Ca    1.174   0.5046 0.9954 1.0035 0.9920 1.0000
    Cl    0.870   0.4231 1.0623 1.0350 1.0268 0.9996
-------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  2.7325
```

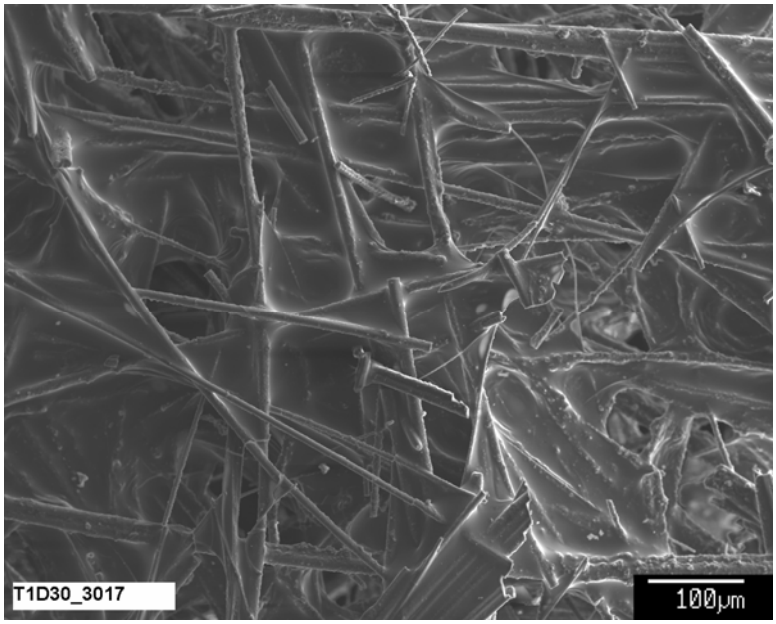

Figure D-30. Day-30, T1D30 sample #3 SEM image (T1D30-3017) magnified 150 times; overview of fiberglass from high-flow sacrificial sample.

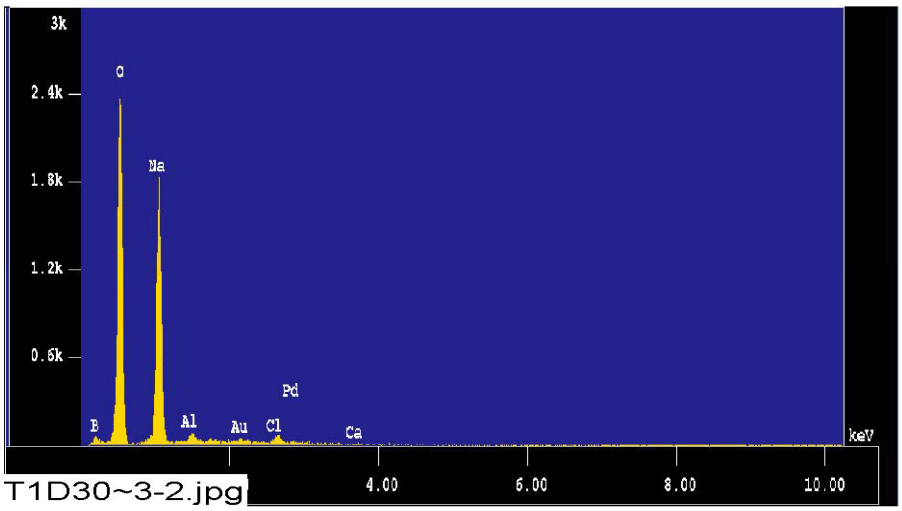

Figure D-31. Day-30, T1D30 sample #3 counting spectrum (EDS T1D30-3-2) of the web-like film between the fibers.

The results from the chemical composition analysis for EDS T1D30-3-2 are given in Table D-11.

Table D-11. The Chemical Compositions for EDS T1D30-3-2

```
Jan 18 15:18 2005  /tmp/eds_pout.log Page 1


 Group     : NRC
 Sample    : T1D30  ID# : 2        From sample #3 (12/21/04)
 Comment   : web-like film between fibers
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #    : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.010E-09 A
             Stage Point : X=21.255 Y=59.925 Z= 9.989
             Acq. Date   : Tue Jan 18 15:15:57 2005

 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   50.7380   0.0058   19990 /      36
  Na K      Normal   0.81- 1.27   13.1256   0.0028   14858 /      35
  Al K      Normal   1.19- 1.83    0.2843   0.0003     465 /      33
   B K      Normal   0.00- 0.36    1.3261   0.0003     217 /      20
  Ca K      Normal   3.39- 4.30    0.1149   0.0009      85 /      19
  Cl K      Normal   2.34- 3.06    0.6698   0.0009     699 /      38
-----------------------------------------------------------------------
                              Chi_square = 33.8015

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   56.581  57.0707 0.7265 0.9724 0.7472 0.9999
    Na   25.315  17.7694 1.2565 1.0270 1.2231 1.0003
    Al    0.648   0.3878 1.4856 1.0001 1.4855 1.0000
     B   16.227  24.2224 7.9723 1.1289 7.0619 1.0000
    Ca    0.173   0.0697 0.9809 1.0008 0.9801 1.0000
    Cl    1.055   0.4801 1.0259 1.0319 0.9943 0.9999
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.5350
```

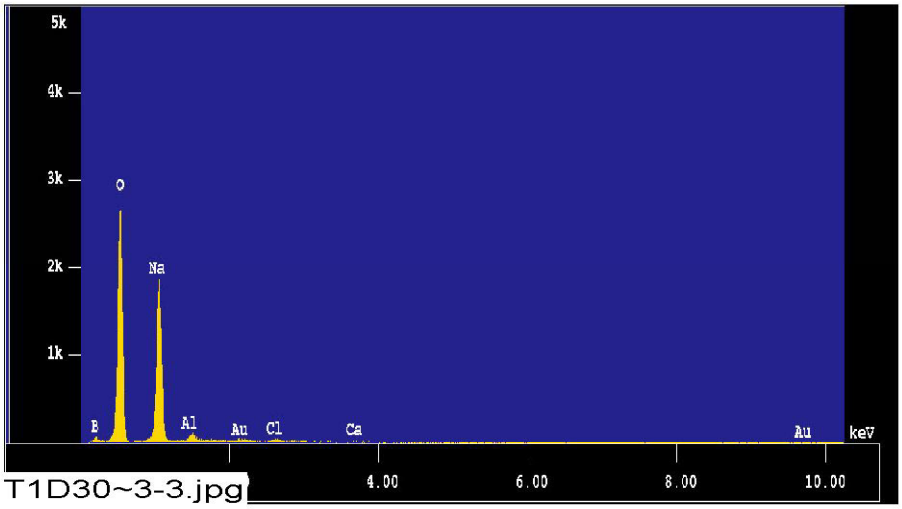

Figure D-32. Day-30, T1D30 sample #3 counting spectrum (EDS T1D30-3-3) of the web-like film between fibers in Figure D-30; replicate analysis at second location.

The results from the chemical composition analysis for EDS T1D30-3-3 are given in Table D-12.

Table D-12. The Chemical Compositions for EDS T1D30-3-3

Jan 18 15:24 2005 /tmp/eds_pout.log Page 1

Group : NRC
Sample : T1D30 ID# : 3 From sample #3 (12/21/04)
Comment : web-like film between fibers
Condition : Full Scale : 20KeV(10eV/ch,2Kch)
Live Time : 100.000 sec Aperture # : 1
Acc. Volt : 15.0 KV Probe Current : 1.003E-09 A
Stage Point : X=21.255 Y=59.925 Z= 9.989
Acq. Date : Tue Jan 18 15:23:07 2005

Element	Mode	ROI(KeV)	K-ratio(%)	+/-	Net/Background	
O K	Normal	0.25- 0.77	57.2962	0.0062	22418 /	34
Na K	Normal	0.81- 1.27	14.2524	0.0029	16022 /	28
Al K	Normal	1.19- 1.83	0.4161	0.0003	676 /	31
B K	Normal	0.00- 0.36	1.7870	0.0003	291 /	14
Ca K	Normal	3.39- 4.30	0.1173	0.0009	86 /	14
Cl K	Normal	2.34- 3.06	0.2448	0.0008	254 /	28

Chi_square = 36.9226

Element	Mass%	Atomic%	ZAF	Z	A	F
O	56.205	55.6375	0.7308	0.9699	0.7536	0.9999
Na	23.929	16.4842	1.2508	1.0244	1.2207	1.0003
Al	0.818	0.4802	1.4645	0.9976	1.4680	1.0000
B	18.559	27.1876	7.7372	1.1259	6.8718	1.0000
Ca	0.154	0.0607	0.9760	0.9986	0.9773	1.0000
Cl	0.335	0.1499	1.0209	1.0295	0.9917	0.9999
Total	100.000	100.0000				

Normalization factor = 1.3423

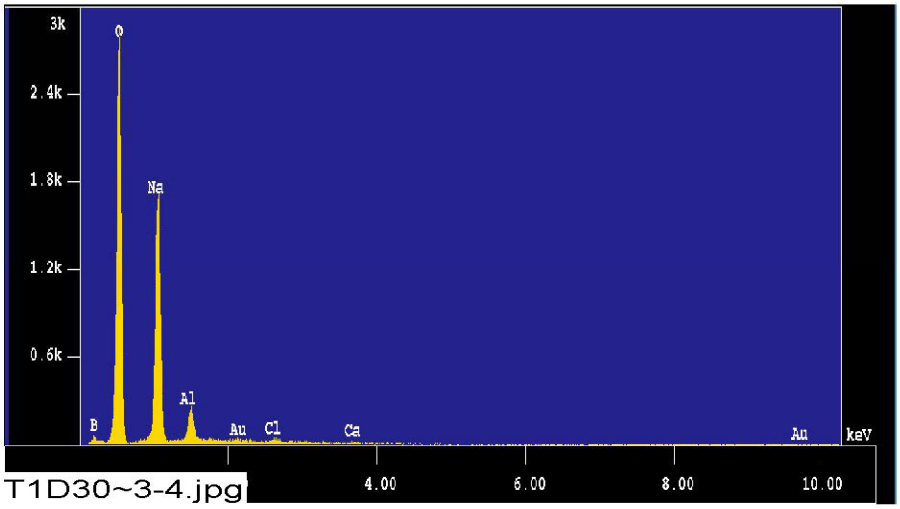

Figure D-33. Day-30, T1D30 sample #3 counting spectrum (EDS T1D30-3-4) of the web-like film between fibers in Figure D-30; replicate analysis at a third location.

The results from the chemical composition analysis for EDS T1D30-3-4 are given in Table D-13.

Table D-13. The Chemical Compositions for EDS T1D30-3-4

```
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Group     : NRC
Sample    : T1D30  ID# : 4      From sample #3 (12/21/04)
Comment   : web-like film between fibers
Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
            Live Time   : 100.000 sec     Aperture #     : 1
            Acc. Volt   : 15.0 KV         Probe Current : 9.984E-10 A
            Stage Point : X=21.255 Y=59.925 Z= 9.989
            Acq. Date   : Tue Jan 18 15:29:46 2005

Element     Mode      ROI(KeV)    K-ratio(%)  +/-     Net/Background
  O K      Normal   0.25- 0.77   58.2719   0.0062    22695 /      27
 Na K      Normal   0.81- 1.27   13.4543   0.0029    15055 /      44
 Al K      Normal   1.19- 1.83    1.3081   0.0004     2114 /      40
  B K      Normal   0.00- 0.36    1.7140   0.0003      278 /      14
 Ca K      Normal   3.39- 4.30    0.2180   0.0010      160 /      16
 Cl K      Normal   2.34- 3.06    0.2771   0.0008      286 /      27
-----------------------------------------------------------------
                            Chi_square = 37.2253

Element Mass%    Atomic%   ZAF      Z      A      F
     O   56.633  56.3842 0.7380 0.9705 0.7605 0.9999
    Na   22.285  15.4402 1.2578 1.0250 1.2269 1.0002
    Al    2.494   1.4723 1.4479 0.9983 1.4504 1.0000
     B   17.934  26.4238 7.9459 1.1267 7.0522 1.0000
    Ca    0.281   0.1115 0.9776 0.9992 0.9784 1.0000
    Cl    0.374   0.1679 1.0242 1.0301 0.9944 0.9999
-----------------------------------------------------------------
Total   100.000 100.0000
Normalization factor =  1.3168
```

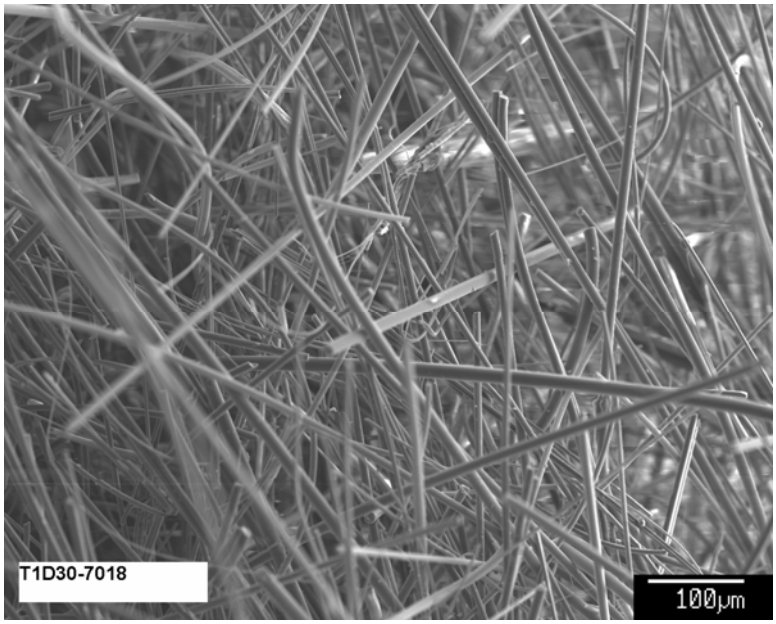

Figure D-34. T1D30 sample #7 SEM image (T1D30-7018) magnified 150 times; overview of clean fiberglass.

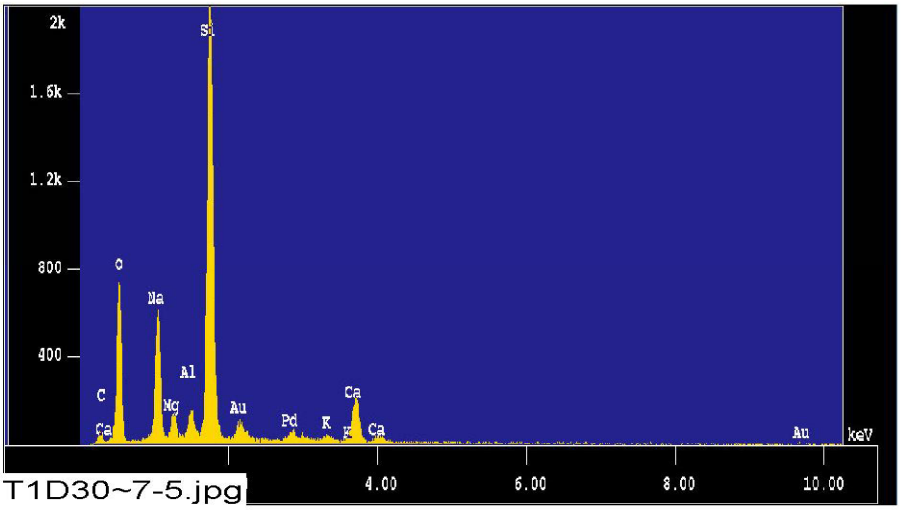

Figure D-35. T1D30 sample #7 counting spectrum (EDS T1D30-7-5) on an individual thick fiber.

The results from the chemical composition analysis for EDS T1D30-7-5 are given in Table D-14.

Table D-14. The Chemical Compositions for EDS T1D30-7-5

```
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 Group     : NRC
 Sample    : T1D30  ID# : 5
 Comment   : clean glass filbers      From sample #7 (12/21/04)
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.003E-09 A
             Stage Point : X=15.076 Y=66.231 Z=11.620
             Acq. Date   : Tue Jan 18 15:44:58 2005

 Element     Mode     ROI(KeV)    K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   17.6048   0.0036     6888 /      36
  Na K      Normal   0.81- 1.27    4.7404   0.0018     5329 /      83
  Mg K      Normal   0.97- 1.57    0.5839   0.0004      954 /      80
  Al K      Normal   1.19- 1.83    0.6942   0.0004     1127 /     144
  Si K      Normal   1.50- 2.05   14.3850   0.0013    21778 /      94
  Ca K      Normal   3.39- 4.30    3.8044   0.0021     2799 /      24
   C K      Normal   0.09- 0.46    0.0969   0.0004       56 /      76
-----------------------------------------------------------------------
                              Chi_square =  9.1028

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   41.639  54.6247 1.2000 0.9920 1.2097 1.0000
    Na   11.653  10.6381 1.2471 1.0468 1.1926 0.9990
    Mg    1.750   1.5106 1.5203 0.9854 1.5481 0.9966
    Al    1.834   1.4264 1.3402 1.0187 1.3280 0.9907
    Si   34.048  25.4442 1.2009 0.9959 1.2060 0.9998
    Ca    7.768   4.0679 1.0359 1.0160 1.0197 1.0000
     C    1.309   2.2881 6.8540 1.0403 6.5890 1.0000
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.9710
```

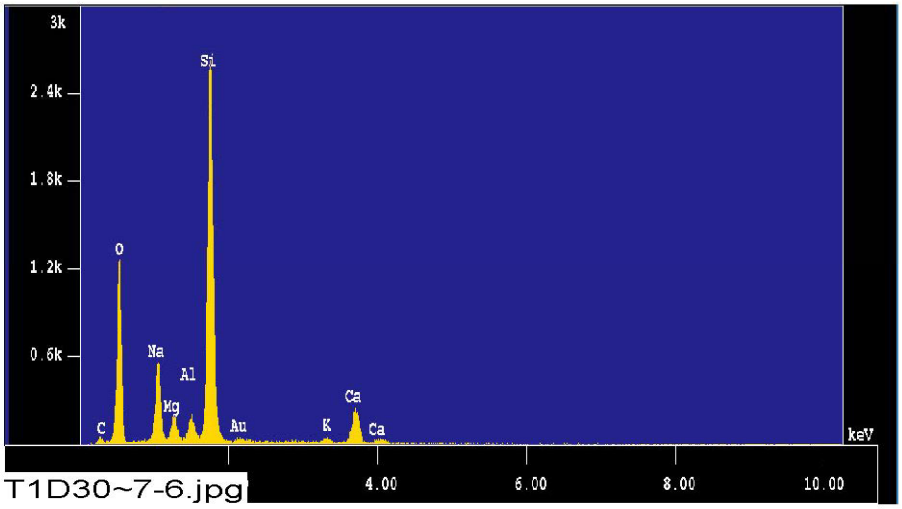

Figure D-36. T1D30 sample #7 counting spectrum (EDS T1D30-7-6) on an individual clump fiber.

The results from the chemical composition analysis for EDS T1D30-7-6 are given in Table D-15.

Table D-15. The Chemical Compositions for EDS T1D30-7-6

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```
Group     : NRC
Sample    : T1D30  ID# : 6
Comment   : clean glass filbers
Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
            Live Time   : 100.000 sec    Aperture #     : 1
            Acc. Volt   : 15.0 KV        Probe Current : 9.958E-10 A
            Stage Point : X=14.777 Y=66.987 Z=11.620
            Acq. Date   : Tue Jan 18 15:54:13 2005
```

Element	Mode	ROI (KeV)	K-ratio(%)	+/-	Net/Background
O K	Normal	0.25- 0.77	27.3788	0.0043	10635 / 48
Na K	Normal	0.81- 1.27	4.3174	0.0018	4819 / 114
Mg K	Normal	0.97- 1.57	0.8765	0.0004	1421 / 82
Al K	Normal	1.19- 1.83	0.8334	0.0004	1343 / 164
Si K	Normal	1.50- 2.05	17.8096	0.0014	26769 / 112
Ca K	Normal	3.39- 4.30	4.4556	0.0022	3255 / 23
K K	Normal	3.01- 3.86	0.6160	0.0018	376 / 24
C K	Normal	0.09- 0.46	0.0000	0.0000	0 / 135

Chi_square = 17.7249

Element	Mass%	Atomic%	ZAF	Z	A	F
O	47.563	61.4845	1.1461	0.9931	1.1541	1.0000
Na	8.481	7.6293	1.2960	1.0480	1.2378	0.9990
Mg	1.992	1.6948	1.4995	0.9866	1.5250	0.9967
Al	1.682	1.2893	1.3316	1.0199	1.3175	0.9910
Si	32.230	23.7332	1.1939	0.9971	1.1977	0.9998
Ca	7.004	3.6143	1.0372	1.0173	1.0195	1.0000
K	1.048	0.5546	1.1230	1.2432	0.9109	0.9917
C	0.000	0.0000	6.4648	1.0414	6.2081	1.0000
Total	100.000	100.0000				

Normalization factor = 1.5157

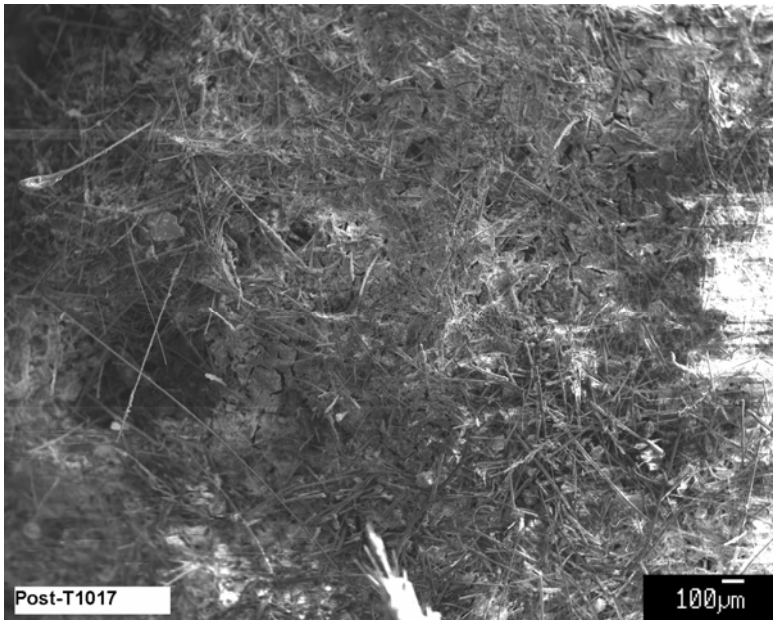

Figure D-37. Day-30, post-T1 sample P1 SEM image (Post-T1017) magnified 35 times; overview of the fibers and the other debris.

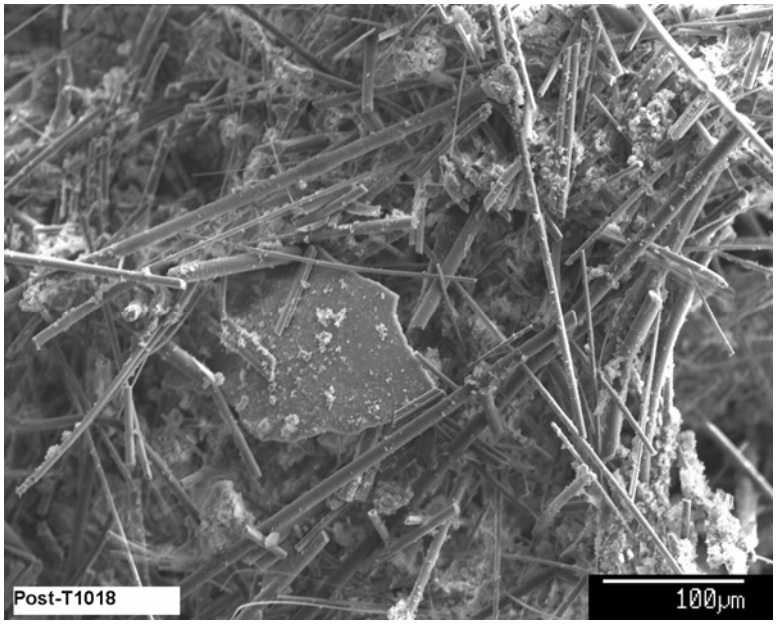

Figure D-38. Day-30, post-T1 sample P1 SEM-SE image (Post-T1018) magnified 220 times on large particles at left corner of image T1017, as shown in Figure D-37.

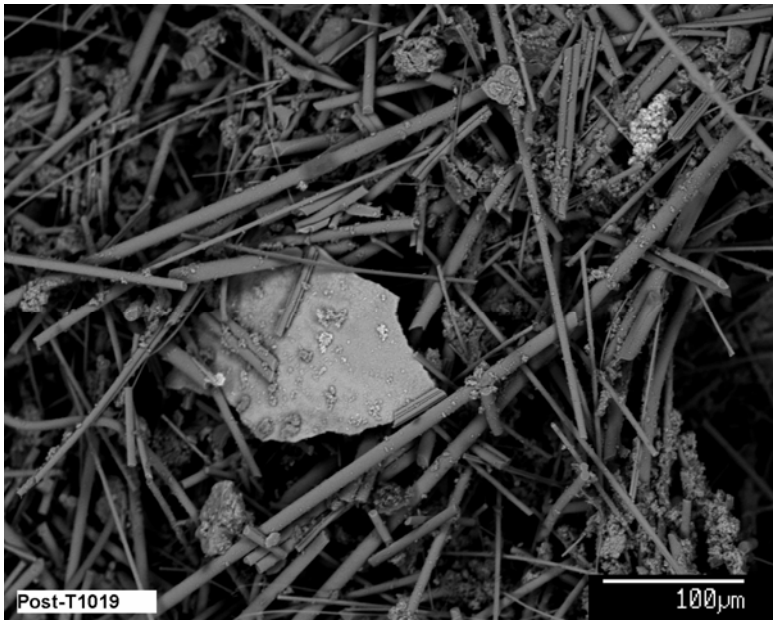

Figure D-39. Day-30, post-T1 sample P1 SEM-BSE image (Post-T1019) magnified 220 times on the same field as image T1018, as shown Figure D-38.

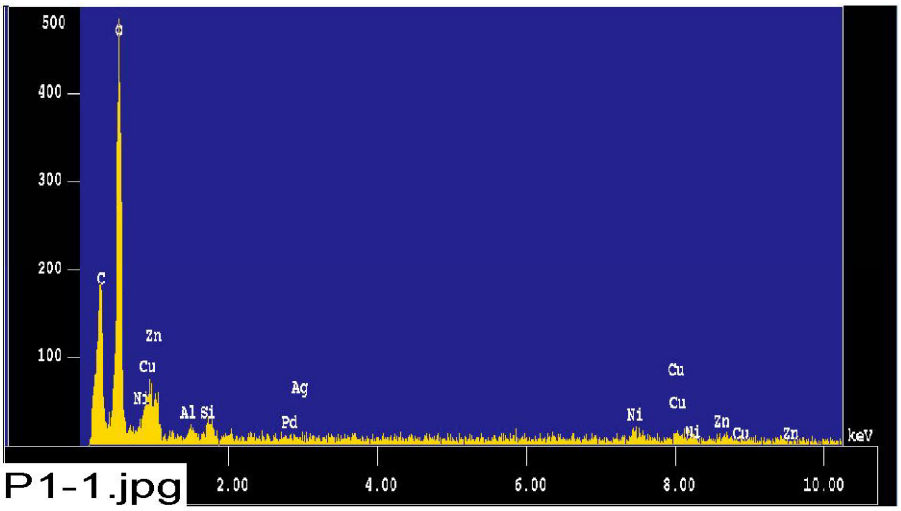

Figure D-40. Day-30, post-T1 sample P1 counting spectrum (EDS P1-1) on the large flake in image T1018, as shown in Figure D-38.

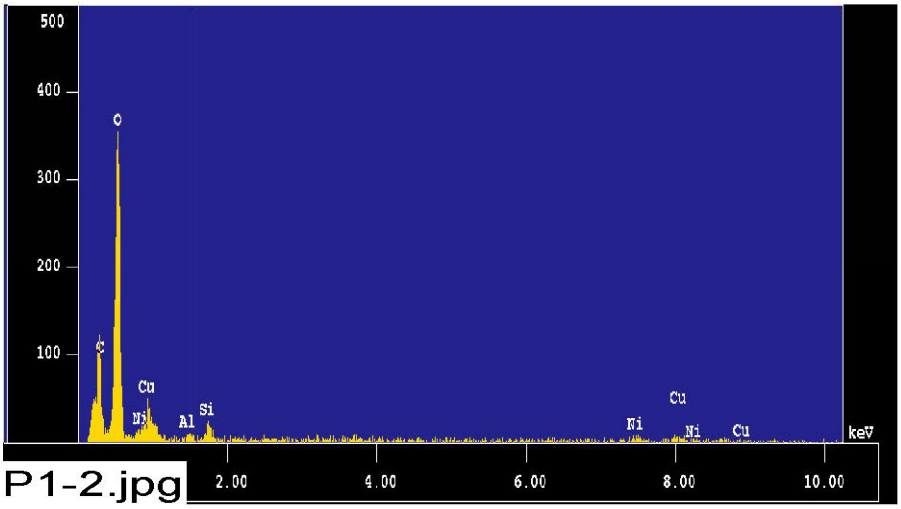

Figure D-41. Day-30, post-T1 sample P1 counting spectrum (EDS P1-2) on the small cluster to lower left of large flake shown in image T1018, as shown in Figure D-38.

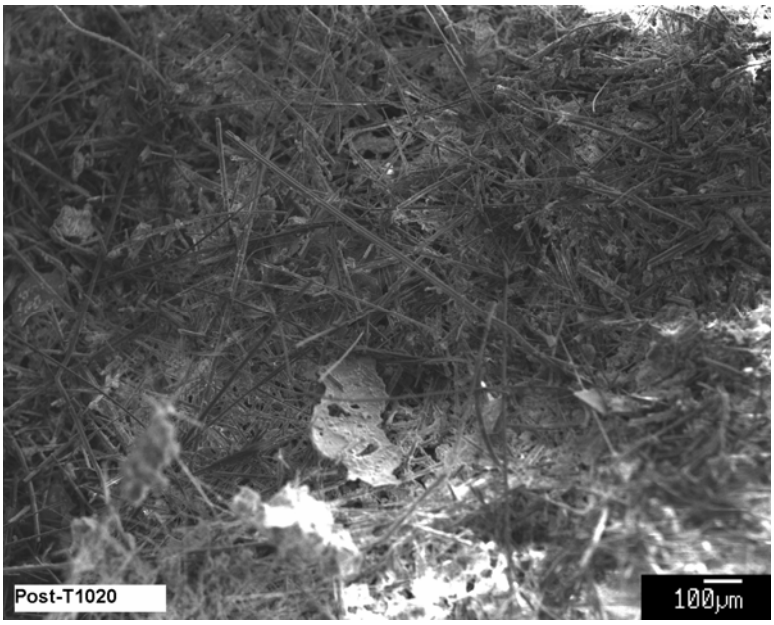

Figure D-42. Day-30, post-T1 sample P1 SEM-SE image (post-T1020) magnified 60 times on a different area of sample P1.

Figure D-43. Day-30, post-T1 sample P1 SEM-BSE image (Post-T1021) magnified 60 times on the same field as image T1020, as shown in Figure D-42.

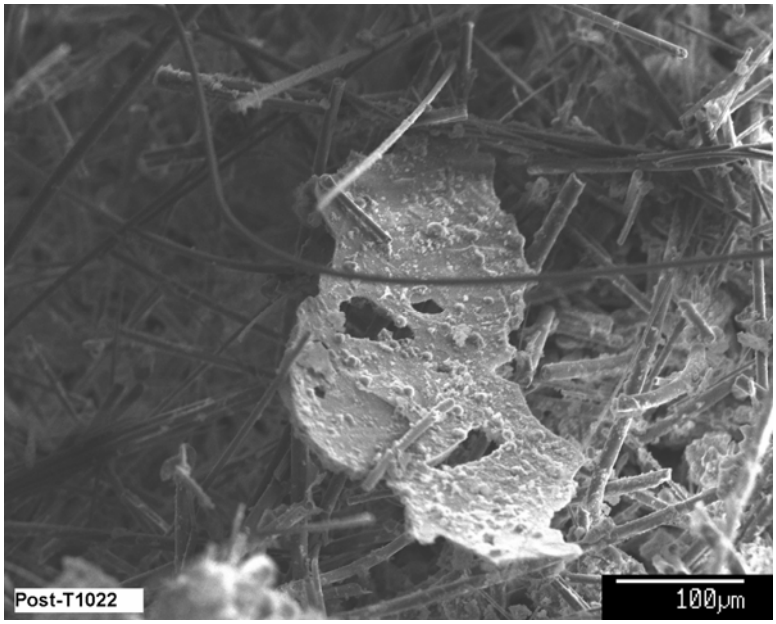

Figure D-44. Day-30, post-T1 sample P1 SEM-SE image (Post-T1022) magnified 200 times on the flake, as shown in Figure D-43.

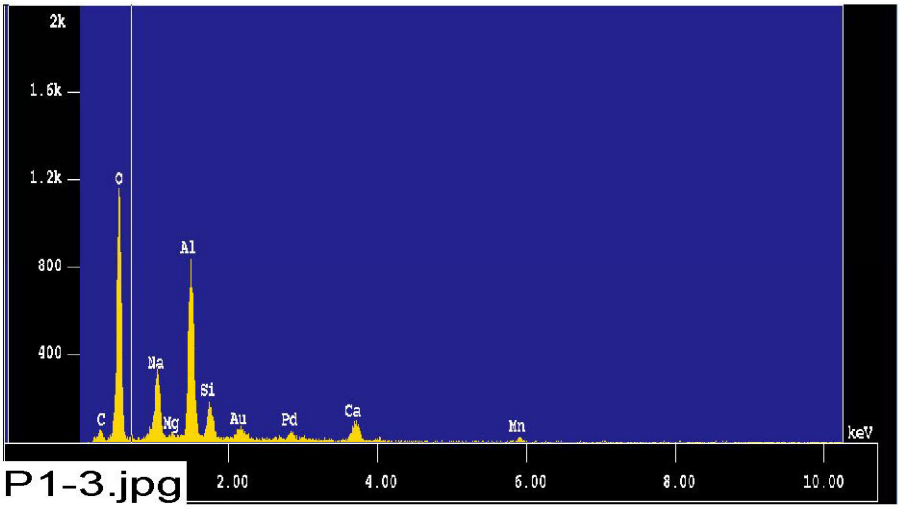

Figure D-45. Day-30, post-T1 sample P1 counting spectrum (EDS P1-3) on the particles in foreground below the flake shown in image T1021.

The results from the chemical composition analysis for EDS P1-3 are given in Table D-16.

Table D-16: The Chemical Compositions for EDS P1-3

```
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 Group     : NRC
 Sample    : Post-T1_1-28-05 ID# : 3
 Comment   : P1 particles
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 6.753E-10 A
             Stage Point : X=81.768 Y=61.832 Z=10.582
             Acq. Date   : Fri Jan 28 10:03:44 2005

 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   39.9049   0.0044    10512 /      39
  Na K      Normal   0.83- 1.28    2.7379   0.0085     2268 /      30
  Mg K      Normal   1.03- 1.52    0.0604   0.0010       63 /     448
  Al K      Normal   1.26- 1.78    5.7166   0.0015     7138 /      79
  Si K      Normal   1.50- 2.07    1.1338   0.0010     1415 /     376
  Ca K      Normal   3.40- 4.30    1.7209   0.0063     1136 /      14
  Mn K      Normal   5.53- 6.82    1.1673   0.0008      282 /       7
   C K      Normal   0.09- 0.46    0.0000   0.0000        0 /     112
-------------------------------------------------------------------
                            Chi_square =  8.7099

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   67.623  78.8082 0.7645 0.9886 0.7733 1.0000
    Na    7.221   5.8567 1.1899 0.9931 1.1973 1.0007
    Mg    0.157   0.1201 1.1709 0.9957 1.1772 0.9989
    Al   14.925  10.3139 1.1779 1.0013 1.1772 0.9993
    Si    3.112   2.0657 1.2380 0.9891 1.2518 0.9999
    Ca    3.755   1.7467 0.9843 1.0029 0.9824 0.9990
    Mn    3.208   1.0887 1.2397 1.2426 0.9977 1.0000
     C    0.000   0.0000 3.9691 1.0365 3.8297 0.9999
-------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  2.2166
```

Figure D-46. Day-30, post-T1-sample-Conc SEM-BSE image (Post-T1023) magnified 43 times; overview of portion of concrete fragment.

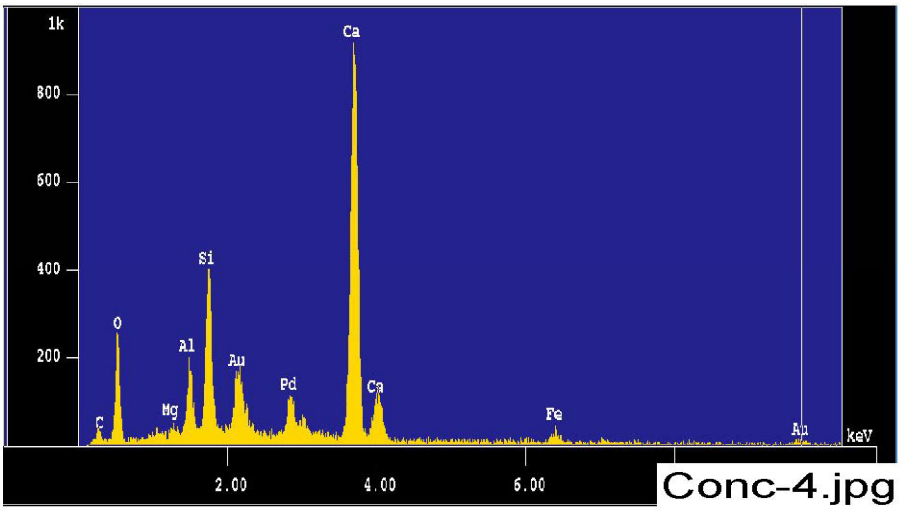

Figure D-47. Day-30, post-T1-sample-Conc counting spectrum (EDS Conc-4) on an average area (20 × 20 µm) of the concrete matrix magnified 5500 times.

The results from the chemical composition analysis for EDS Conc-4 are given in Table D-17.

Table D-17. The Chemical Compositions for EDS Conc-4

```
Jan 28 10:34 2005  /tmp/eds_pout.log Page 1


 Group     : NRC
 Sample    : PostTl_1-28-05  ID# : 4
 Comment   : Concrete
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.038E-09 A
             Stage Point : X=69.901 Y=61.652 Z=10.565
             Acq. Date   : Fri Jan 28 10:30:24 2005

 Element     Mode     ROI(KeV)    K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77    5.6143   0.0021     2273 /      30
  Mg K      Normal   1.03- 1.52    0.1044   0.0010      168 /      98
  Al K      Normal   1.26- 1.78    0.7042   0.0008     1352 /     133
  Si K      Normal   1.50- 2.07    1.8080   0.0014     3468 /     130
  Ca K      Normal   3.40- 4.30   11.5423   0.0159    11712 /      18
  Fe K      Normal   6.04- 7.40    0.8690   0.0473      284 /      16
-----------------------------------------------------------------------
                              Chi_square =  2.4699

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   43.793  64.5383 2.0502 0.9681 2.1178 1.0000
    Mg    0.453   0.4392 1.1408 0.9741 1.1708 1.0002
    Al    3.090   2.7000 1.1532 0.9792 1.1804 0.9977
    Si    7.508   6.3025 1.0914 0.9670 1.1299 0.9989
    Ca   41.877  24.6354 0.9536 0.9778 0.9756 0.9996
    Fe    3.279   1.3846 0.9919 0.9699 1.0219 1.0008
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  3.8047
```

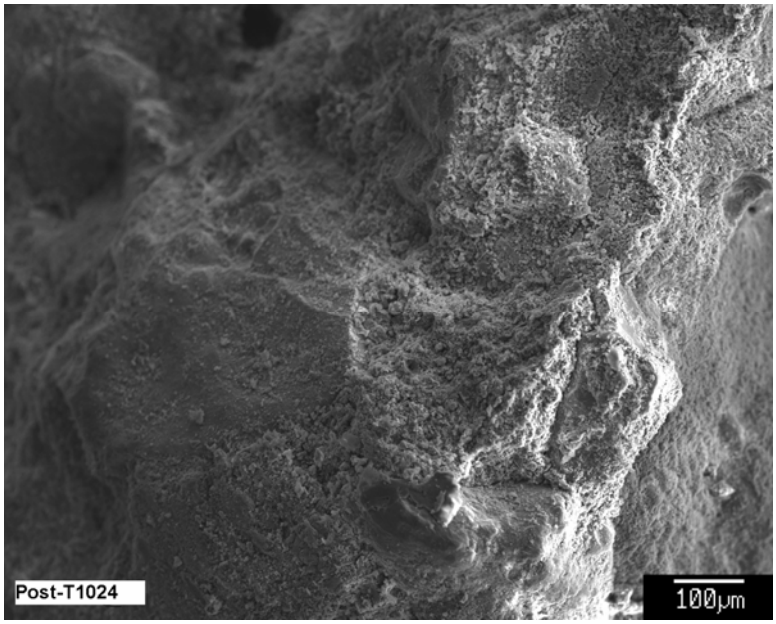

Figure D-48. Day-30, post-T1-sample-Conc SEM-SE image (Post-T1024) magnified 110 times on another area of the sample from the concrete fragment.

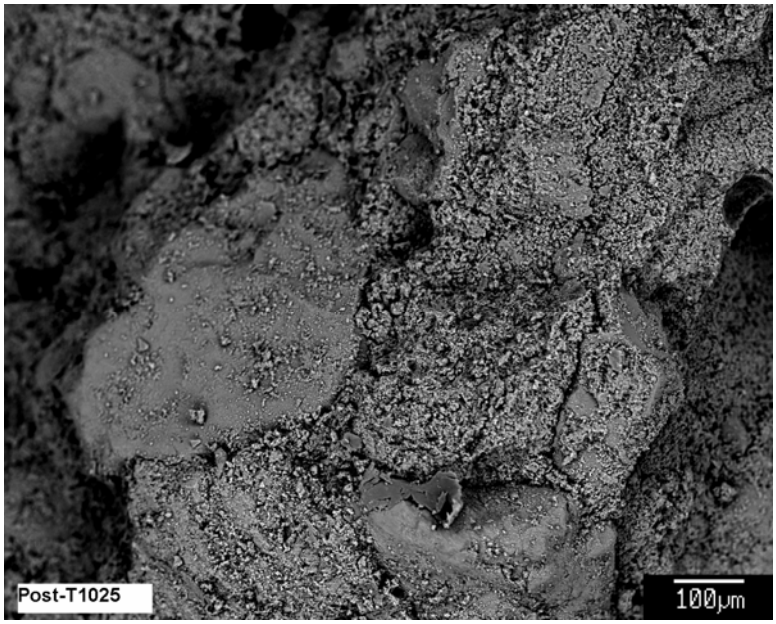

Figure D-49. Day-30, post-T1-sample-Conc SEM-BSE image (Post-T1025) magnified 110 times on the same field as in image Post-T1024 (see Figure D-48).

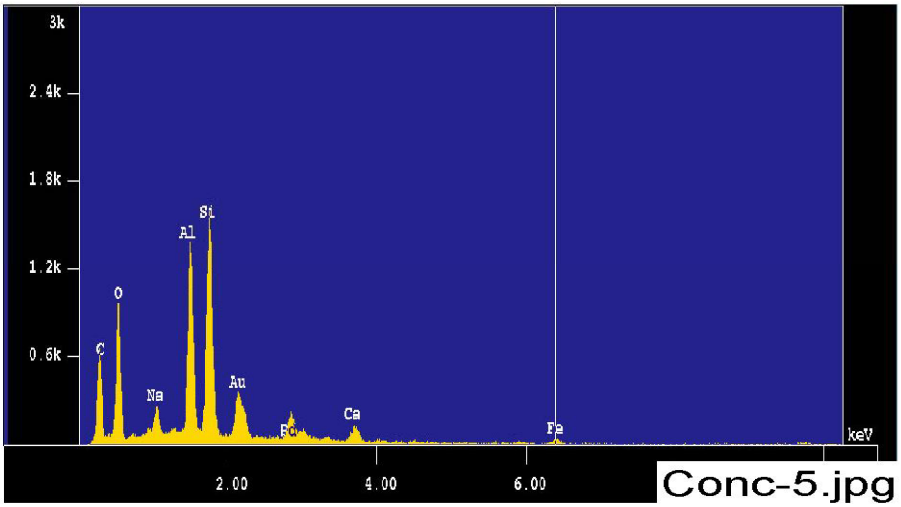

Figure D-50. Day-30, post-T1-sample-Conc counting spectrum (EDS Conc-5) on the aggregate particle in lower portion of image Post-T1025, as shown in Figure D-49.

The results from the chemical composition analysis for EDS Conc-5 are given in Table D-18.

Table D-18. The Chemical Compositions for EDS Conc-5

```
Jan 28 10:45 2005  /tmp/eds_pout.log Page 1


 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 5
 Comment   : Concrete aggregate
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.085E-09 A
             Stage Point : X=71.968 Y=63.927 Z=10.565
             Acq. Date   : Fri Jan 28 10:43:57 2005

 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   C K      Normal   0.09- 0.46    6.4490   0.0009     4049 /      87
   O K      Normal   0.25- 0.77   20.8346   0.0042     8818 /     310
  Na K      Normal   0.83- 1.28    1.0347   0.0086     1377 /      96
  Al K      Normal   1.26- 1.78    5.6526   0.0020    11340 /     525
  Si K      Normal   1.50- 2.07    6.8576   0.0027    13750 /     686
  Ca K      Normal   3.40- 4.30    1.2480   0.0076     1324 /      35
  Fe K      Normal   6.04- 7.40    0.9509   0.0533      324 /      10
-----------------------------------------------------------------------
                              Chi_square = 17.2326

 Element Mass%    Atomic%   ZAF      Z      A      F
     C   33.796  44.7339 3.6197 1.0266 3.5261 1.0000
     O   42.274  42.0080 1.4015 0.9794 1.4310 1.0000
    Na    1.561   1.0798 1.0424 0.9843 1.0583 1.0007
    Al    8.522   5.0215 1.0414 0.9928 1.0523 0.9968
    Si   10.725   6.0712 1.0803 0.9810 1.1013 0.9999
    Ca    1.758   0.6972 0.9727 0.9964 0.9765 0.9997
    Fe    1.365   0.3885 0.9912 0.9949 0.9955 1.0008
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.4478
```

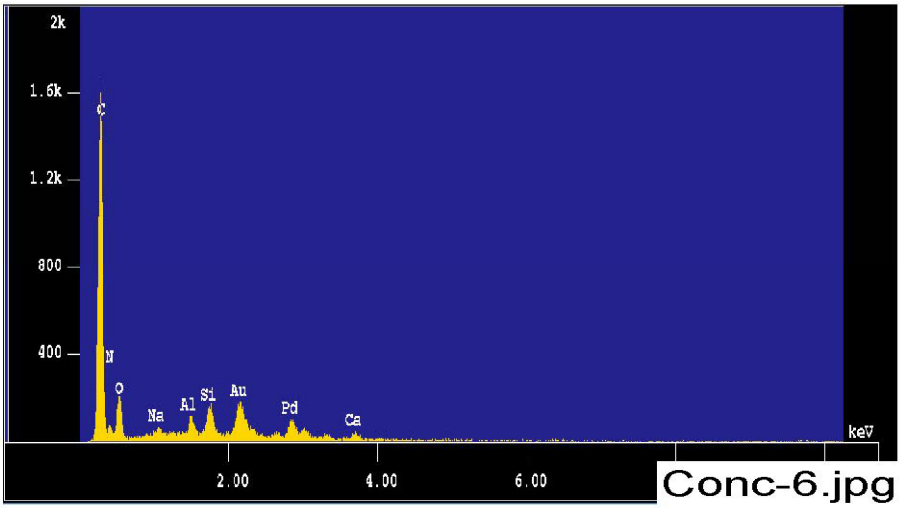

Figure D-51. Day-30, post-T1-sample-Conc counting spectrum (EDS Conc-6) on the surface granules on or in the concrete, as shown in image T1025.

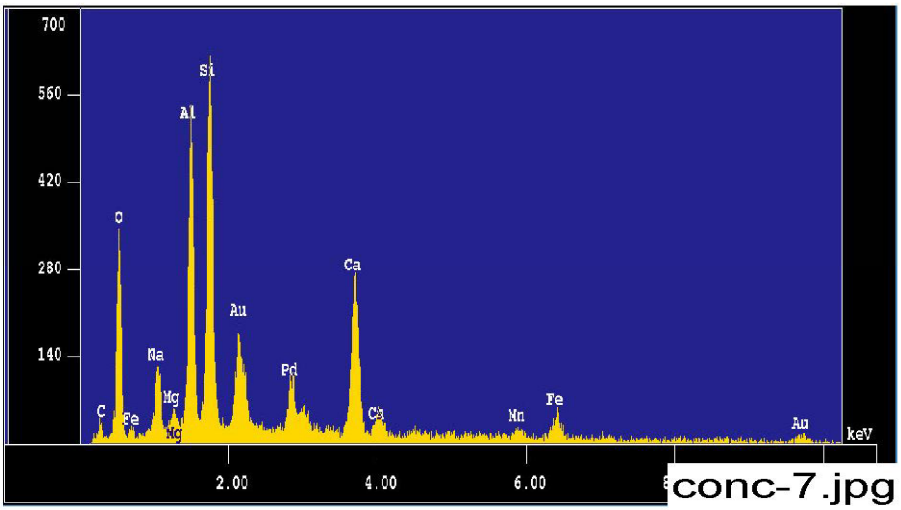

Figure D-52. Day-30, post-T1-sample-Conc counting spectrum (EDS Conc-7) on the concrete matrix behind surface granules, shown in image T1025.

The results from the chemical composition analysis for EDS Conc-7 are given in Table D-19.

Table D-19. The Chemical Compositions for EDS Conc-7

```
Jan 28 10:53 2005  /tmp/eds_pout.log Page 1


 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 7
 Comment   : Concrete matrix
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #    : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.104E-09 A
             Stage Point : X=71.902 Y=63.995 Z=10.565
             Acq. Date   : Fri Jan 28 10:51:55 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   C K      Normal   0.09- 0.46    0.0000   0.0000        0 /      22
   O K      Normal   0.25- 0.77    7.5549   0.0026     3254 /      22
  Na K      Normal   0.83- 1.28    0.6424   0.0057      870 /      32
  Al K      Normal   1.26- 1.78    2.1633   0.0012     4416 /     220
  Si K      Normal   1.50- 2.07    2.6236   0.0017     5353 /     282
  Ca K      Normal   3.40- 4.30    2.9940   0.0094     3231 /      26
  Fe K      Normal   6.04- 7.40    1.2796   0.0545      444 /      10
  Mg K      Normal   1.03- 1.52    0.1059   0.0010      181 /     221
  Mn K      Normal   5.53- 6.82    0.6354   0.0009      251 /      14
-------------------------------------------------------------------
                            Chi_square =  2.2310

 Element Mass%    Atomic%   ZAF      Z      A      F
     C    0.000   0.0000 4.9670 1.0196 4.8717 0.9999
     O   44.480  61.9981 1.2202 0.9723 1.2551 0.9999
    Na    3.815   3.7002 1.2307 0.9761 1.2601 1.0006
    Al   12.105  10.0042 1.1597 0.9837 1.1830 0.9966
    Si   15.039  11.9407 1.1880 0.9715 1.2233 0.9997
    Ca   14.137   7.8657 0.9786 0.9830 0.9973 0.9983
    Fe    6.077   2.4265 0.9843 0.9761 1.0076 1.0008
    Mg    0.586   0.5374 1.1465 0.9785 1.1735 0.9985
    Mn    3.762   1.5272 1.2272 1.2146 1.0104 1.0000
-------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  4.8249
```

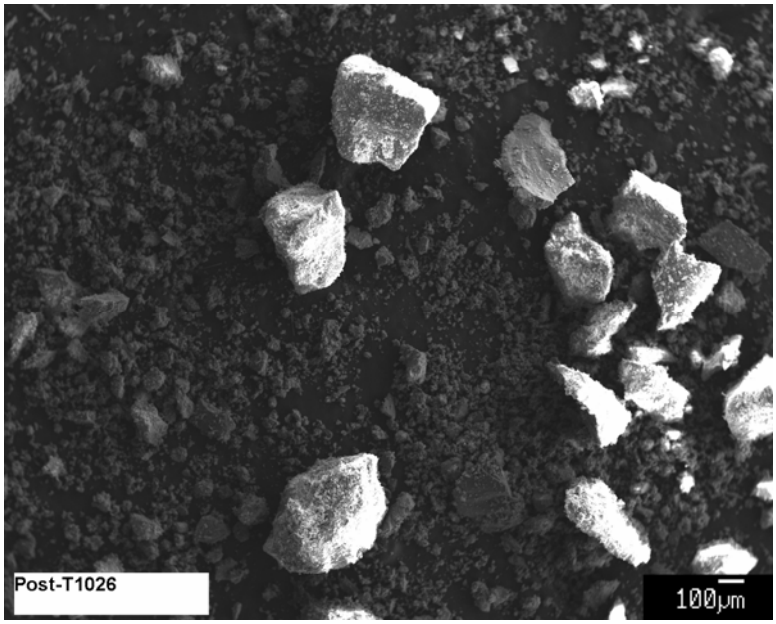

Figure D-53. Day-30, post-T1-sample-CD1 SEM-SE image (Post-T1026) magnified 40 times; overview of the dust particles mounted on carbon tape.

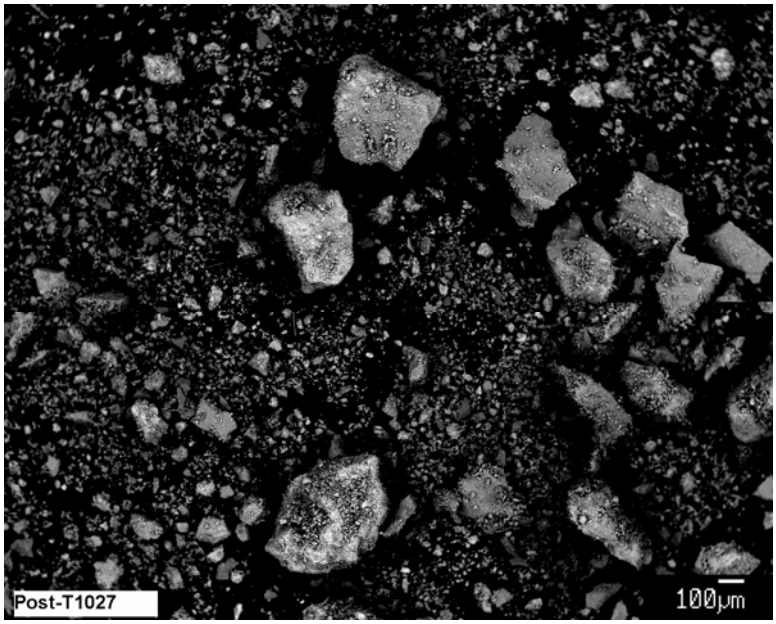

Figure D-54. Day-30, post-T1-sample-CD1 SEM-BSE image (Post-T1027) magnified 40 times on the same field as in image Post-T1026 (see Figure D-53).

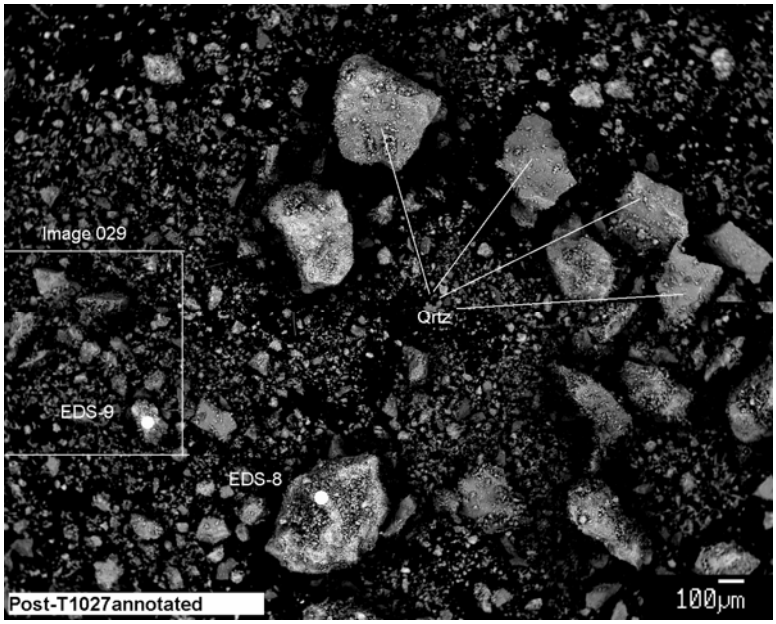

Figure D-55. Day-30, post-T1-sample-CD1 SEM-SE image (Post-T1027 annotated) magnified 40 times, annotating the EDS locations.

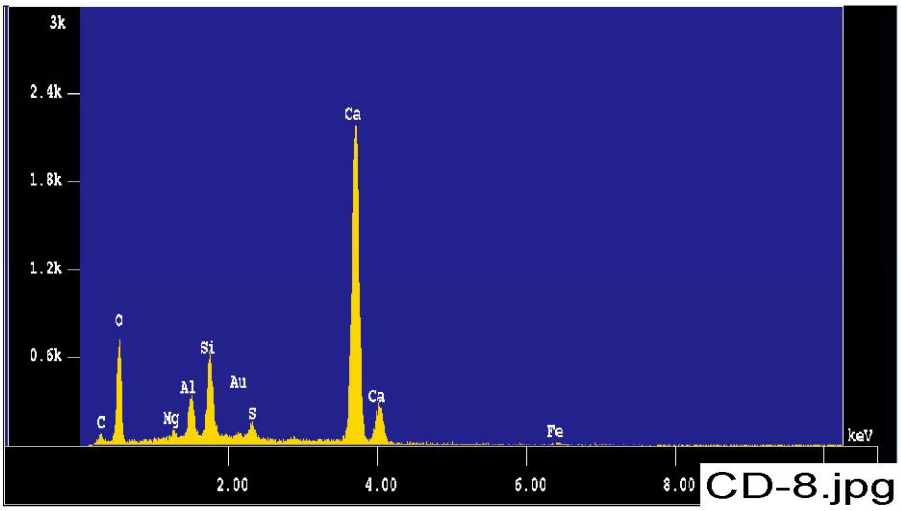

Figure D-56. Day-30, post-T1-sample-CD1 counting spectrum (EDS CD-8) on particle in the lower center of image Post-T1027 (see Figure D-55).

The results from the chemical composition analysis for EDS CD-8 are given in Table D-20.

Table D-20. The Chemical Compositions for EDS CD-8

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 8
 Comment   : Concrete dust particle
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.146E-09 A
             Stage Point : X=43.880 Y=75.323 Z=10.565
             Acq. Date   : Fri Jan 28 11:15:28 2005

 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   15.2816   0.0036     6832 /      50
  Mg K      Normal   1.03- 1.52    0.2151   0.0014      382 /     148
  Al K      Normal   1.26- 1.78    1.1786   0.0011     2497 /     259
  Si K      Normal   1.50- 2.07    2.4899   0.0018     5273 /     210
   S K      Normal   2.04- 2.71    0.9062   0.0014     1099 /      42
  Ca K      Normal   3.40- 4.30   26.1728   0.0242    29320 /      33
  Fe K      Normal   6.04- 7.40    0.2300   0.0445       83 /      12
-----------------------------------------------------------------------
                              Chi_square =  5.1089

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   50.188  70.2325 2.0081 0.9733 2.0631 1.0000
    Mg    0.399   0.3673 1.1339 0.9796 1.1568 1.0006
    Al    2.215   1.8380 1.1492 0.9848 1.1689 0.9983
    Si    4.403   3.5098 1.0812 0.9726 1.1133 0.9986
     S    1.477   1.0310 0.9963 1.1195 0.8961 0.9932
    Ca   40.943  22.8710 0.9565 0.9840 0.9720 1.0000
    Fe    0.375   0.1505 0.9980 0.9769 1.0208 1.0008
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.6355
```

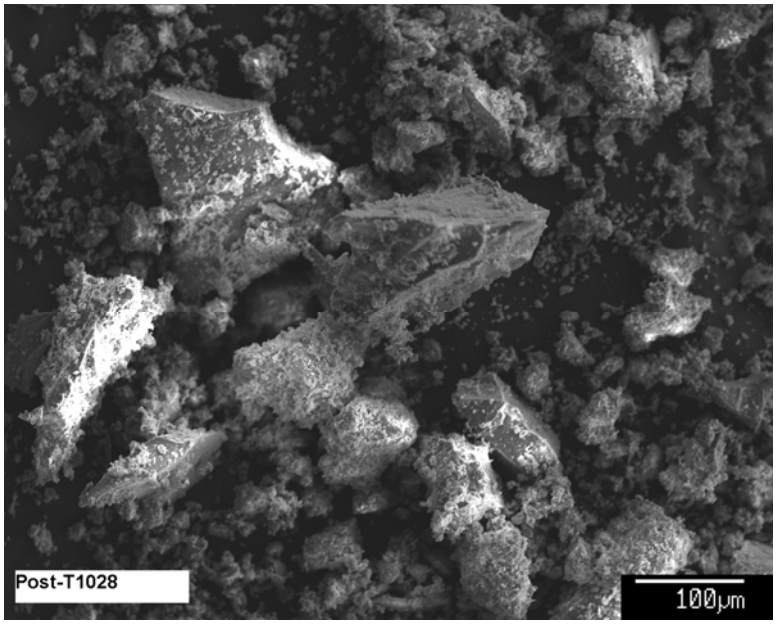

Figure D-57. Day-30, post-T1-sample-CD1 SEM-SE image (Post-T1028) magnified 170 times on the smaller particles at different area in the overview image, as shown in Figure D-55.

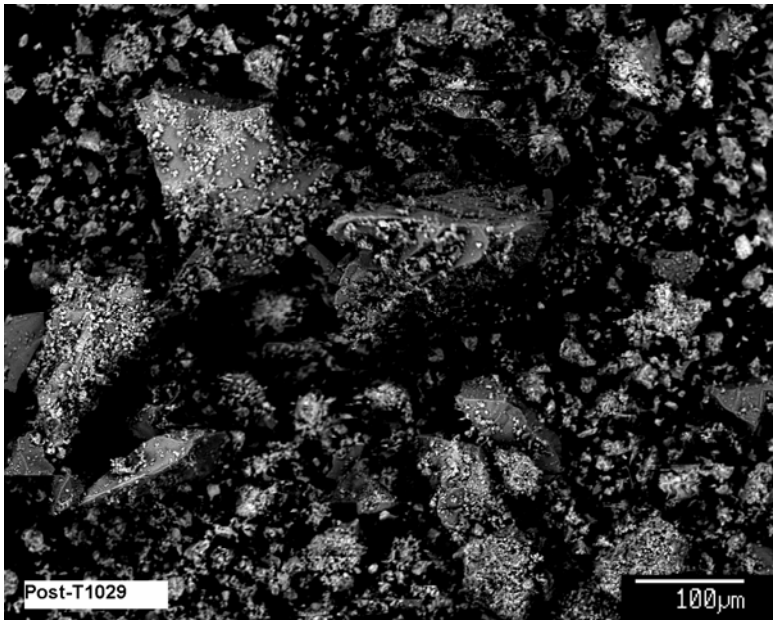

Figure D-58. Day-30, post-T1-sample-CD1 SEM-BSE image (Post-T1029) magnified 170 times on the same field as in image Post-T1028 (see Figure D-57).

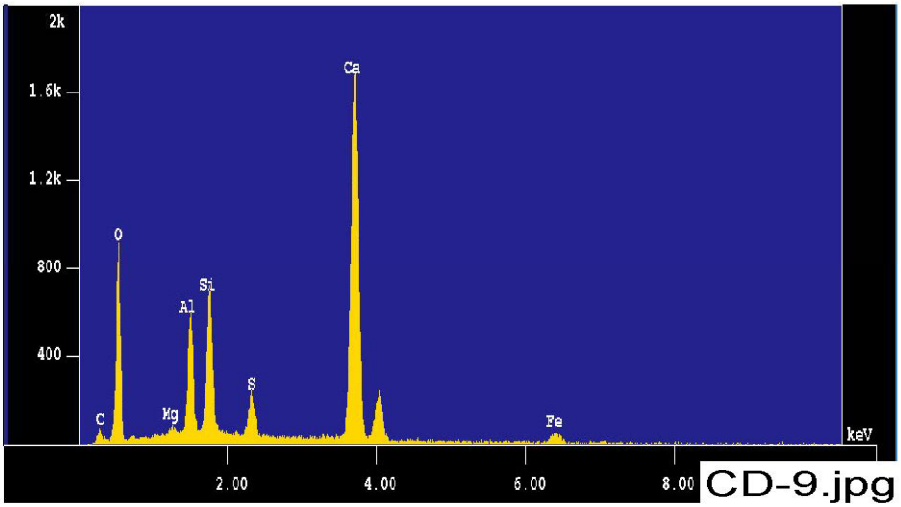

Figure D-59. Day-30, post-T1-sample-CD1 counting spectrum (EDS CD-9) on particle in the lower right of image Post-T1029 (see Figure D-58).

The results from the chemical composition analysis for EDS CD-9 are given in Table D-21.

Table D-21. The Chemical Compositions for EDS CD-9

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 9
 Comment   : Concrete dust particle
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.156E-09 A
             Stage Point : X=45.016 Y=75.364 Z=10.565
             Acq. Date   : Fri Jan 28 11:27:56 2005

 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   17.5957   0.0038     7935 /      44
  Mg K      Normal   1.03- 1.52    0.1183   0.0014      212 /     252
  Al K      Normal   1.26- 1.78    2.2695   0.0014     4851 /     268
  Si K      Normal   1.50- 2.07    2.8894   0.0019     6173 /     292
   S K      Normal   2.04- 2.71    1.9982   0.0015     2444 /      44
  Ca K      Normal   3.40- 4.30   19.4335   0.0215    21960 /      32
  Fe K      Normal   6.04- 7.40    1.5351   0.0612      558 /      11
-----------------------------------------------------------------------
                              Chi_square =  5.5950

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   51.920  71.1181 1.7330 0.9747 1.7780 1.0000
    Mg    0.228   0.2056 1.1328 0.9810 1.1546 1.0001
    Al    4.431   3.5988 1.1467 0.9862 1.1649 0.9981
    Si    5.421   4.2296 1.1018 0.9740 1.1329 0.9985
     S    3.450   2.3580 1.0140 1.1213 0.9087 0.9952
    Ca   31.948  17.4687 0.9655 0.9857 0.9798 0.9997
    Fe    2.602   1.0212 0.9957 0.9790 1.0163 1.0008
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.7027
```

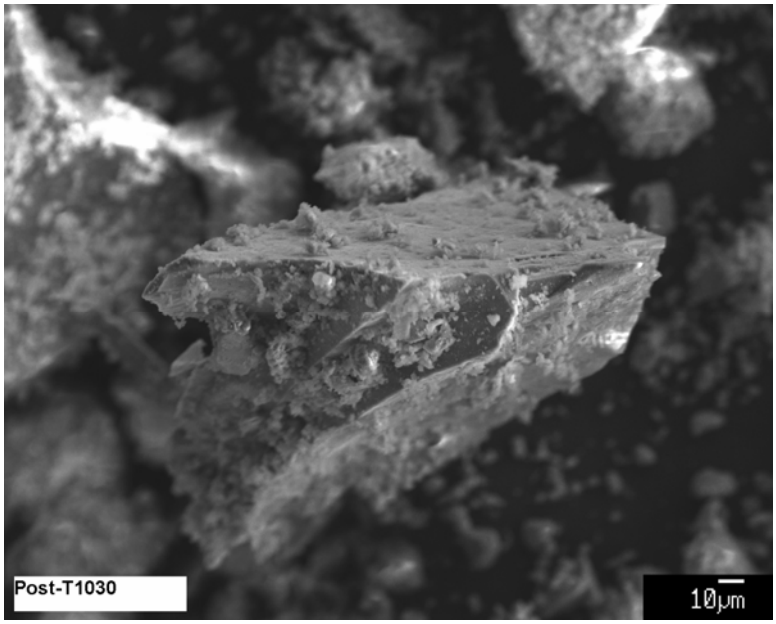

Figure D-60. Day-30, post-T1-sample-CD1 SEM-SE image (Post-T1030) magnified 400 times on the particle in the center of image Post-T1029 (see Figure D-58).

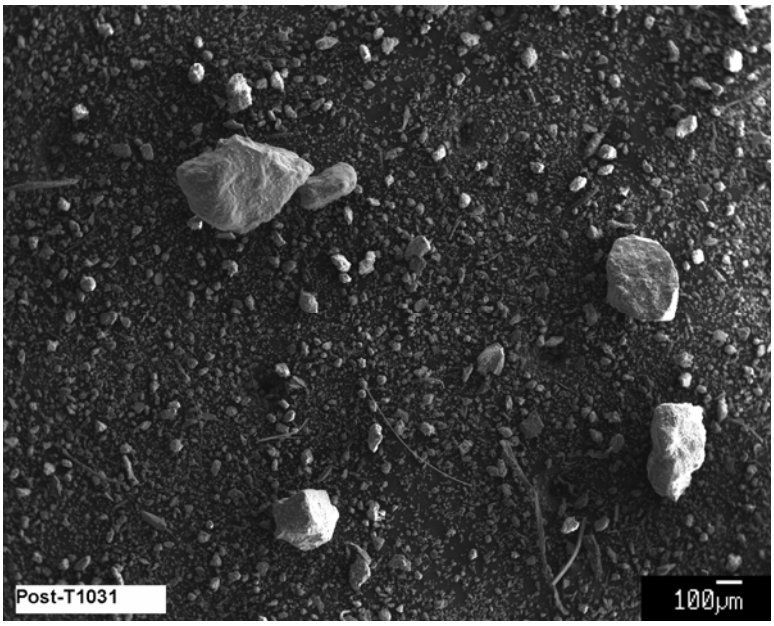

Figure D-61. Day-30, post-T1-sample-LD1 SEM-SE image (Post-T1031) magnified 40 times; overview of the dust sample mounted on carbon tape.

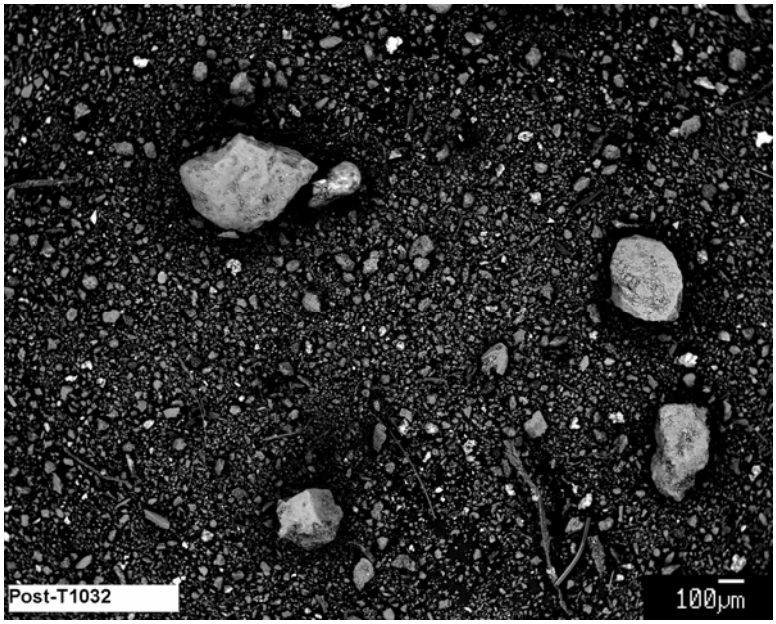

Figure D-62. Day-30, post-T1-sample-LD1 SEM-BSE image (Post-T1032) magnified 40 times on the same field as in image Post-T1031 (see Figure D-61); large particles are quartz as in K-feldspar.

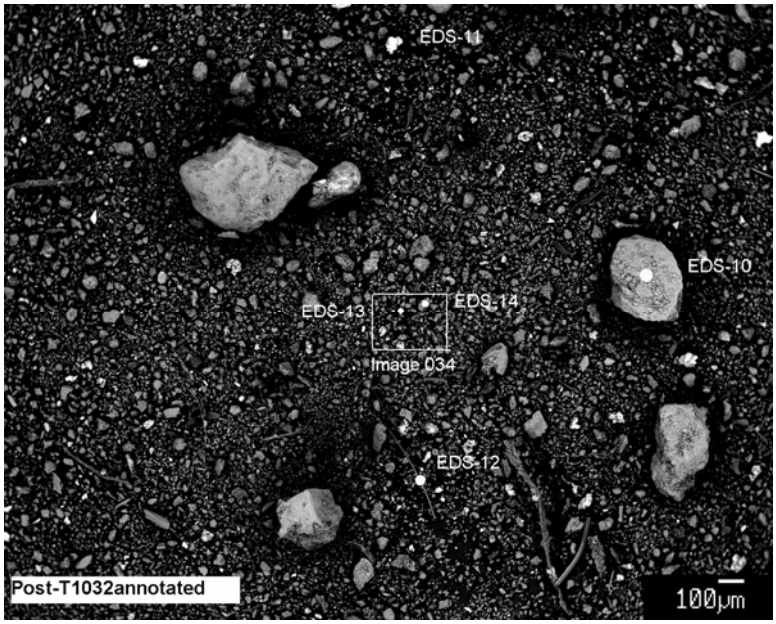

Figure D-63. Day-30, post-T1-sample-LD1 SEM-BSE image (Post-T1032 annotated) annotating the EDS locations.

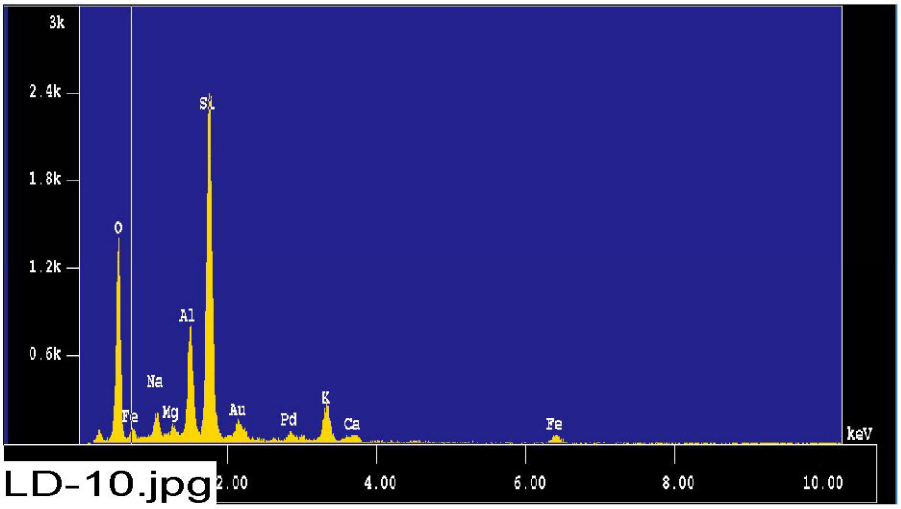

Figure D-64. Day-30, post-T1-sample-CD1 counting spectrum (EDS LD-10) on large particle at right of k-feldspar (see Figure D-63).

The results from the chemical composition analysis for EDS LD-10 are given in Table D-22.

Table D-22. The Chemical Compositions for EDS LD-10

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 10
 Comment   : K-feldspar in latent dust sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.165E-09 A
             Stage Point : X=46.733 Y=67.407 Z=10.565
             Acq. Date   : Fri Jan 28 11:45:29 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   27.0588   0.0047    12297 /      68
  Na K      Normal   0.83- 1.28    0.8837   0.0077     1263 /      82
  Mg K      Normal   1.03- 1.52    0.2752   0.0016      497 /     346
  Al K      Normal   1.26- 1.78    3.0567   0.0016     6585 /     720
  Si K      Normal   1.50- 2.07   10.0455   0.0032    21627 /     420
   K K      Normal   3.01- 3.86    4.5094   0.0034     3221 /      41
  Fe K      Normal   6.04- 7.40    1.9483   0.0596      714 /      13
  Ca K      Normal   3.40- 4.30    0.5385   0.0061      613 /      46
-------------------------------------------------------------------
                              Chi_square =  8.3513

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   55.460  70.6207 1.0754 0.9850 1.0918 1.0000
    Na    1.971   1.7468 1.1705 0.9892 1.1826 1.0006
    Mg    0.569   0.4770 1.0852 0.9917 1.0960 0.9984
    Al    6.501   4.9088 1.1159 0.9971 1.1256 0.9943
    Si   21.253  15.4161 1.1101 0.9849 1.1275 0.9996
     K    9.494   4.9464 1.1047 1.2332 0.8971 0.9985
    Fe    3.702   1.3506 0.9971 0.9923 1.0040 1.0008
    Ca    1.050   0.5335 1.0226 0.9975 1.0256 0.9996
-------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.9059
```

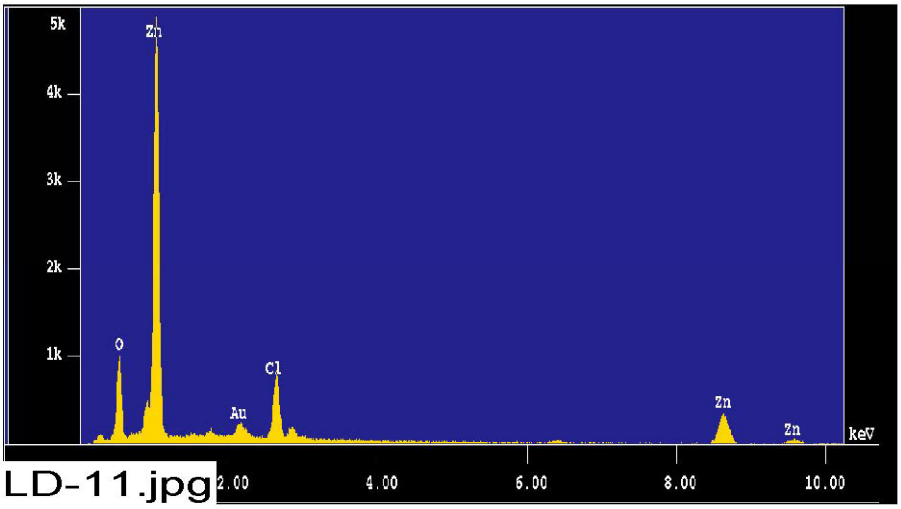

Figure D-65. Day-30, post-T1-sample-LD1 counting spectrum (EDS LD-11) on the small bright particle in the upper center of image Post-T1032, as shown in Figure D-63.

The results from the chemical composition analysis for EDS LD-11 are given in Table D-23.

Table D-23. The Chemical Compositions for EDS LD-11

```
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 Group     : NRC
 Sample    : PostT1 1-28-05  ID# : 11
 Comment   : ZnCl          . latent dust sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.167E-09 A
             Stage Point : X=46.743 Y=66.378 Z=10.565
             Acq. Date   : Fri Jan 28 11:50:31 2005

 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   19.9450   0.0045     9080 /     114
  Cl K      Normal   2.34- 3.06    7.9463   0.0025     9584 /      78
  Zn K      Normal   8.22-10.03   45.6297   0.0180     5999 /      13
-----------------------------------------------------------------
                              Chi_square =  6.8473

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   24.790  54.6092 0.9731 0.8709 1.1175 0.9999
    Cl   10.643  10.5798 1.0486 0.9156 1.1455 0.9999
    Zn   64.567  34.8110 1.1079 1.1086 0.9993 1.0000
-----------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.2772
```

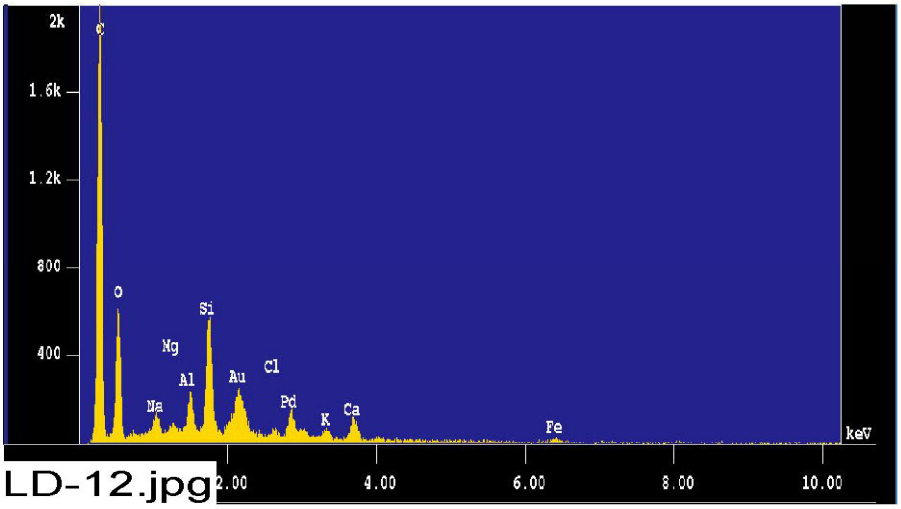

Figure D-66. Day-30, post-T1-sample-LD1 counting spectrum (EDS LD-12) on the thin fiber in the lower center of image Post-T1032, as shown in Figure D-63.

The results from the chemical composition analysis for EDS LD-12 are given in Table D-24.

Table D-24. The Chemical Compositions for EDS LD-12

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 12
 Comment   : Fiber in latent dust sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #    : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.169E-09 A
             Stage Point : X=46.614 Y=68.050 Z=10.565
             Acq. Date   : Fri Jan 28 11:56:29 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   C K      Normal   0.09- 0.46   22.4454   0.0014    15184 /      57
   O K      Normal   0.25- 0.77   13.1602   0.0034     6001 /     839
  Na K      Normal   0.83- 1.28    0.4650   0.0066      667 /      65
  Mg K      Normal   1.03- 1.52    0.1354   0.0014      245 /     158
  Al K      Normal   1.26- 1.78    0.7357   0.0010     1590 /     237
  Si K      Normal   1.50- 2.07    2.3036   0.0017     4976 /     188
  Cl K      Normal   2.34- 3.06    0.5360   0.0009      648 /      62
   K K      Normal   3.01- 3.86    0.8042   0.0021      576 /      39
  Ca K      Normal   3.40- 4.30    1.1517   0.0068     1316 /      26
-------------------------------------------------------------------
                            Chi_square = 64.9276

 Element Mass%    Atomic%   ZAF      Z      A      F
     C   57.981  66.9895 1.8889 1.0178 1.8559 1.0000
     O   33.753  29.2766 1.8754 0.9713 1.9309 1.0000
    Na    0.635   0.3834 0.9988 0.9766 1.0213 1.0014
    Mg    0.176   0.1003 0.9496 0.9797 0.9685 1.0008
    Al    1.016   0.5225 1.0098 0.9855 1.0259 0.9987
    Si    3.083   1.5232 0.9786 0.9740 1.0050 0.9997
    Cl    0.721   0.2824 0.9842 1.0327 0.9550 0.9979
     K    1.138   0.4037 1.0344 1.2240 0.8488 0.9956
    Ca    1.497   0.5183 0.9505 0.9910 0.9591 1.0001
-------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.3676
```

Results from an alternative chemical composition analysis for EDS LD-12 using a different set of elements from those selected in the previous table are given in Table D-25. The high mass fraction of carbon is from the tape used for mounting the latent dust.

Table D-25. The Chemical Compositions for Alternative Analysis of EDS LD-12

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 12
 Comment   : Fiber in latent dust sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #    : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.169E-09 A
             Stage Point : X=46.614 Y=68.050 Z=10.565
             Acq. Date   : Fri Jan 28 11:56:29 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   C K      Normal   0.09- 0.46   22.4454   0.0014    15184 /      57
   O K      Normal   0.25- 0.77   13.1602   0.0034     6001 /     839
  Na K      Normal   0.83- 1.28    0.4650   0.0066      667 /      65
  Mg K      Normal   1.03- 1.52    0.1354   0.0014      245 /     158
  Al K      Normal   1.26- 1.78    0.7357   0.0010     1590 /     237
  Si K      Normal   1.50- 2.07    2.3036   0.0017     4976 /     188
  Cl K      Normal   2.34- 3.06    0.5360   0.0009      648 /      62
   K K      Normal   3.01- 3.86    0.8042   0.0021      576 /      39
  Ca K      Normal   3.40- 4.30    1.1517   0.0068     1316 /      26
-------------------------------------------------------------------
                              Chi_square = 64.9276

 Element Mass%    Atomic%   ZAF      Z      A      F
      C   57.981  66.9895 1.8889 1.0178 1.8559 1.0000
      O   33.753  29.2766 1.8754 0.9713 1.9309 1.0000
     Na    0.635   0.3834 0.9988 0.9766 1.0213 1.0014
     Mg    0.176   0.1003 0.9496 0.9797 0.9685 1.0008
     Al    1.016   0.5225 1.0098 0.9855 1.0259 0.9987
     Si    3.083   1.5232 0.9786 0.9740 1.0050 0.9997
     Cl    0.721   0.2824 0.9842 1.0327 0.9550 0.9979
      K    1.138   0.4037 1.0344 1.2240 0.8488 0.9956
     Ca    1.497   0.5183 0.9505 0.9910 0.9591 1.0001
-------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.3676
```

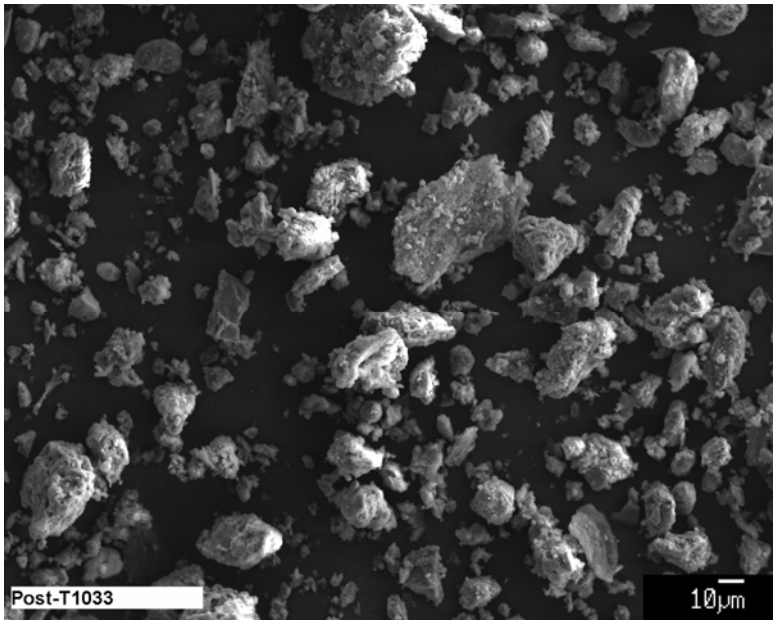

Figure D-67. Day-30, post-T1-sample-LD1 SEM-SE image (Post-T1033) magnified 400 times on the central portion of image Post-T1031, as shown in Figure D-61.

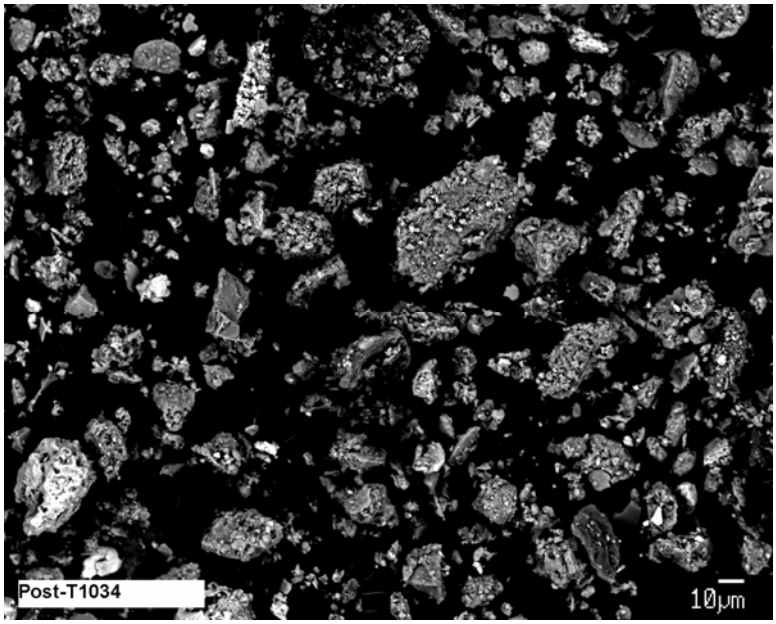

Figure D-68. Day-30, post-T1-sample-LD1 SEM-BSE image (Post-T1034) magnified 400 times on the same field as in image Post-T1033 (see Figure D-67).

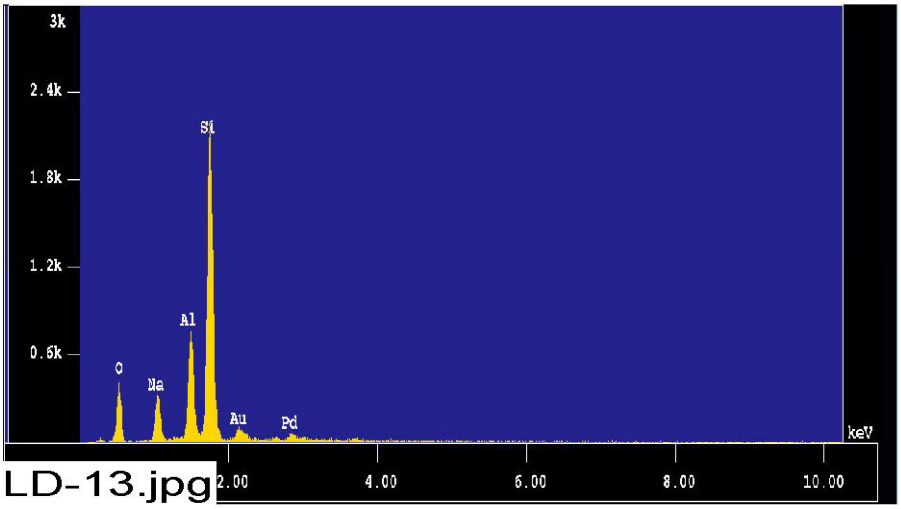

Figure D-69. Day-30, post-T1-sample-LD1 counting spectrum (EDS LD-13) on the flake at the left center of Na-feldspar in image Post-T1034 (see Figure D-68).

The results from the chemical composition analysis for EDS LD-13 are given in Table D-26.

Table D-26. The Chemical Compositions for EDS LD-13

```
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 Group     : NRC
 Sample    : PostTl_1-28-05  ID# : 13
 Comment   : Na-feldspar in latent dust sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #    : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.169E-09 A
             Stage Point : X=46.619 Y=67.410 Z=10.565
             Acq. Date   : Fri Jan 28 12:07:32 2005


 Element     Mode     ROI(KeV)    K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77    7.8674   0.0026     3588 /      18
  Na K      Normal   0.83- 1.28    1.7705   0.0081     2539 /      24
  Al K      Normal   1.26- 1.78    2.9692   0.0015     6418 /     686
  Si K      Normal   1.50- 2.07    9.1928   0.0030    19859 /     367
  Ca K      Normal   3.40- 4.30    0.1851   0.0046      212 /      16
-----------------------------------------------------------------------
                                Chi_square =  5.7053

 Element Mass%    Atomic%   ZAF      Z      A      F
      O   36.363  49.3783 1.1117 0.9948 1.1176 1.0000
     Na    6.851   6.4742 0.9308 0.9988 0.9324 0.9994
     Al   12.829  10.3298 1.0393 1.0067 1.0446 0.9883
     Si   43.160  33.3861 1.1293 0.9943 1.1359 1.0000
     Ca    0.796   0.4317 1.0347 1.0065 1.0279 1.0001
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  4.1574
```

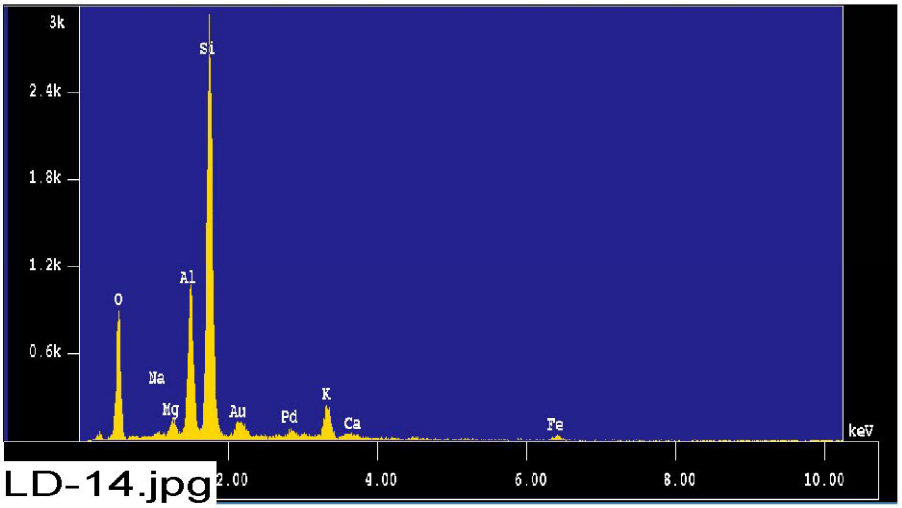

Figure D-70. Day-30, post-T1-sample-LD1 counting spectrum (EDS LD-14) on the large particle at the upper center of image Post-T1034 (see Figure D-68).

The results from the chemical composition analysis for EDS LD-14 are given in Table D-27.

Table D-27. The Chemical Compositions for EDS LD-14

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 14
 Comment   : Particle in latent dust sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.170E-09 A
             Stage Point : X=46.619 Y=67.410 Z=10.565
             Acq. Date   : Fri Jan 28 12:10:44 2005

 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   16.6818   0.0037     7614 /      37
  Mg K      Normal   1.03- 1.52    0.4320   0.0016      783 /     377
  Al K      Normal   1.26- 1.78    4.1712   0.0018     9024 /     864
  Si K      Normal   1.50- 2.07   11.7041   0.0035    25306 /     544
   K K      Normal   3.01- 3.86    4.1207   0.0033     2956 /      37
  Ca K      Normal   3.40- 4.30    0.2675   0.0057      306 /      42
  Fe K      Normal   6.04- 7.40    1.0424   0.0520      383 /      16
-----------------------------------------------------------------------
                              Chi_square =  6.5270

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   45.973  61.6192 1.2142 0.9856 1.2319 1.0000
    Mg    0.985   0.8687 1.0044 0.9922 1.0156 0.9968
    Al   10.049   7.9867 1.0615 0.9975 1.0729 0.9919
    Si   29.495  22.5196 1.1103 0.9852 1.1274 0.9996
     K   10.506   5.7615 1.1233 1.2330 0.9117 0.9992
    Ca    0.630   0.3372 1.0377 0.9973 1.0407 0.9998
    Fe    2.363   0.9072 0.9986 0.9914 1.0065 1.0008
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  2.2697
```

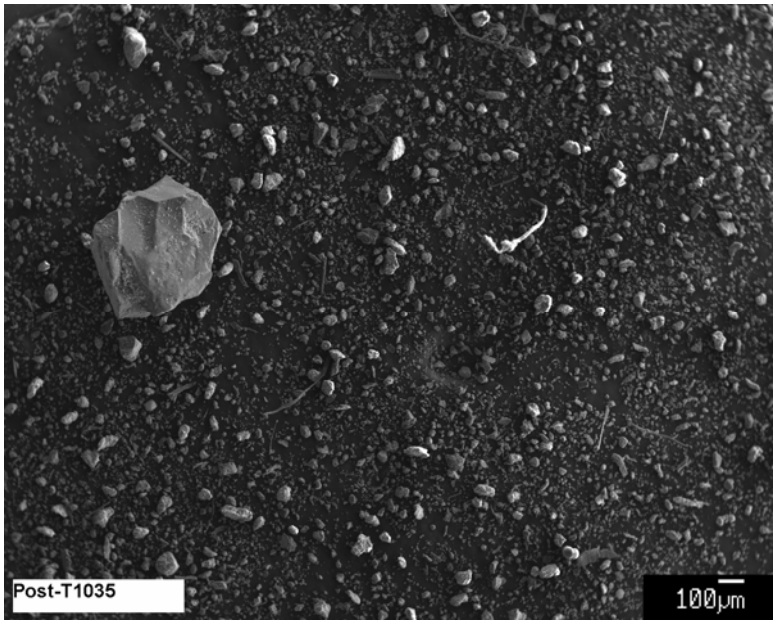

Figure D-71. Day-30, post-T1-sample-LD1 SEM-SE image (Post-T1035) magnified 40 times; overview of another area of the dust sample mounted on carbon tape.

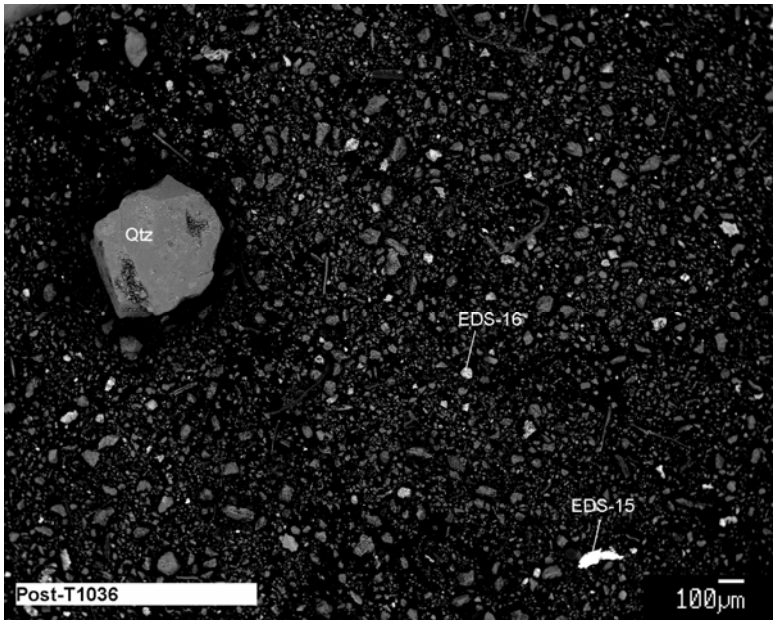

Figure D-72. Day-30, post-T1-sample-LD1 SEM-BSE image (Post-T1036) magnified 40 times on the same field as in image Post-T1035 (see Figure D-71).

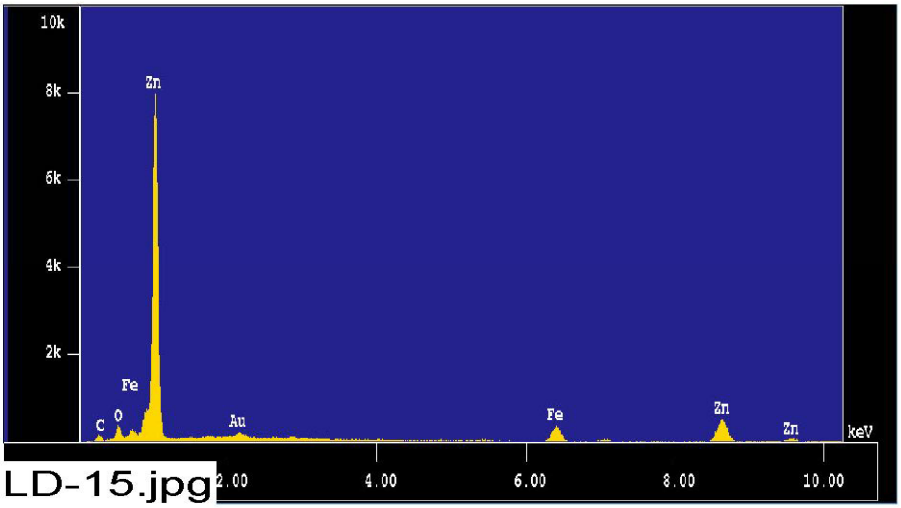

Figure D-73. Day-30, post-T1-sample-LD1 counting spectrum (EDS LD-15) on the bright particle in the lower right of image Post-T1036 (see Figure D-72).

The results from the chemical composition analysis for EDS LD-15 are given in Table D-28.

Table D-28. The Chemical Compositions for EDS LD-15

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 15
 Comment   : Brite particle in latent dust sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.169E-09 A
             Stage Point : X=50.691 Y=62.647 Z=10.565
             Acq. Date   : Fri Jan 28 12:26:15 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77    7.5209   0.0034     3430 /     186
  Si K      Normal   1.50- 2.07    0.1738   0.0012      375 /     160
  Cl K      Normal   2.34- 3.06    0.4364   0.0014      527 /     119
  Fe K      Normal   6.04- 7.40   10.6827   0.1340     3926 /      34
  Zn K      Normal   8.22-10.03   70.4669   0.0221     9280 /      26
-----------------------------------------------------------------------
                                Chi_square =  5.9022

 Element Mass%    Atomic%   ZAF      Z      A      F
     O    7.386  24.1083 0.8675 0.8226 1.0547 0.9998
    Si    0.293   0.5444 1.4880 0.8183 1.8185 1.0000
    Cl    0.513   0.7559 1.0388 0.8625 1.2045 0.9998
    Fe    9.186   8.5894 0.7596 0.8043 1.0084 0.9365
    Zn   82.622  66.0020 1.0357 1.0327 1.0029 1.0000
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.1321
```

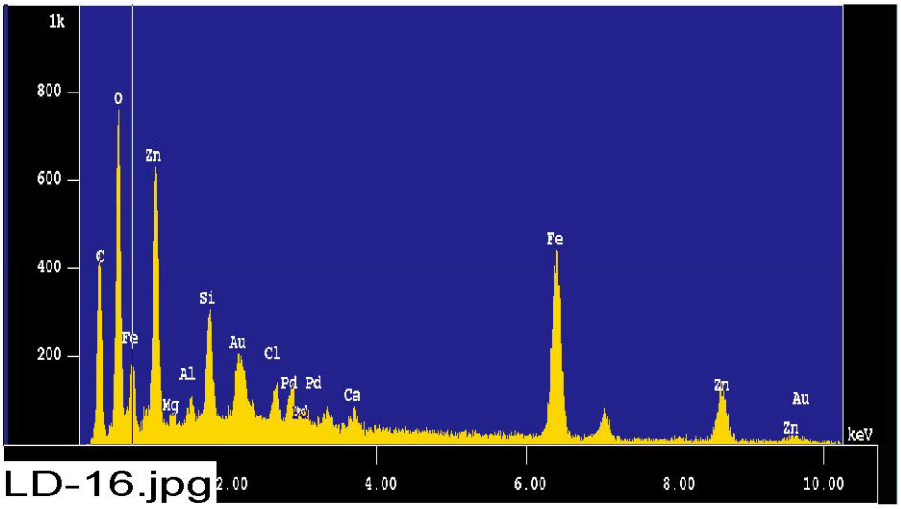

Figure D-74. Day-30, post-T1-sample-LD1 counting spectrum (EDS LD-16) on the round particle at slightly right of the center of image Post-T1036 (see Figure D-72).

The results from the chemical composition analysis for EDS LD-16 are given in Table D-29.

Table D-29. The Chemical Compositions for EDS LD-16

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 16
 Comment   : Brite particle in latent dust sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.168E-09 A
             Stage Point : X=50.484 Y=62.853 Z=10.565
             Acq. Date   : Fri Jan 28 12:31:06 2005

 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   17.1582   0.0039     7818 /     231
  Mg K      Normal   1.03- 1.52    0.1158   0.0012      210 /     354
  Al K      Normal   1.26- 1.78    0.2078   0.0007      449 /     142
  Si K      Normal   1.50- 2.07    1.0789   0.0014     2329 /     111
  Cl K      Normal   2.34- 3.06    1.0453   0.0013     1262 /      72
  Ca K      Normal   3.40- 4.30    0.4189   0.0066      478 /      40
  Fe K      Normal   6.04- 7.40   12.0769   0.1311     4434 /      17
  Zn K      Normal   8.22-10.03   16.3616   0.0116     2153 /      10
-----------------------------------------------------------------
                            Chi_square =  8.8330

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   30.426  60.3020 0.8300 0.8879 0.9350 0.9998
    Mg    0.466   0.6074 1.8827 0.8923 2.1073 1.0013
    Al    0.734   0.8626 1.6531 0.8966 1.8445 0.9995
    Si    3.145   3.5505 1.3645 0.8851 1.5419 0.9998
    Cl    2.349   2.1005 1.0516 0.9344 1.1261 0.9995
    Ca    0.815   0.6445 0.9103 0.8918 1.0245 0.9964
    Fe   22.085  12.5395 0.8560 0.8786 1.0040 0.9704
    Zn   39.980  19.3929 1.1438 1.1362 1.0066 1.0000
-----------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  2.1364
```

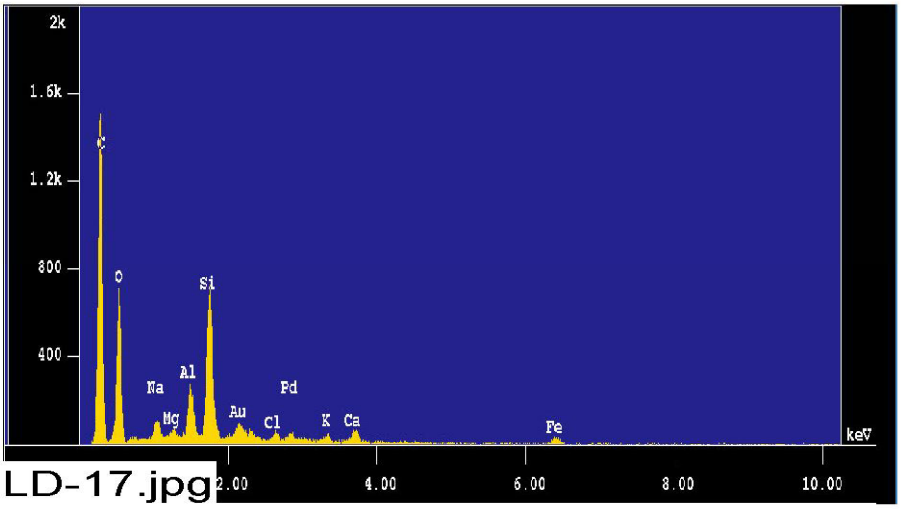

Figure D-75. Day-30, Post-T1-sample-LD1 counting spectrum (EDS LD-17) over an area of 425 × 425 µm, magnified 250 times. (C and Cl peaks are from the mounting tape).

The results from the chemical composition analysis from EDS LD-17 are given in Table D-30.

Table D-30. The Chemical Compositions for EDS LD-17

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 17
 Comment   : Area of latent dust sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #    : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.168E-09 A
             Stage Point : X=50.719 Y=62.405 Z=10.565
             Acq. Date   : Fri Jan 28 12:37:20 2005


 Element     Mode     ROI(KeV)    K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   14.6419   0.0034     6671 /     648
  Mg K      Normal   1.03- 1.52    0.1506   0.0012      273 /     146
  Al K      Normal   1.26- 1.78    0.9264   0.0010     2001 /     241
  Si K      Normal   1.50- 2.07    2.9558   0.0018     6380 /     135
  Ca K      Normal   3.40- 4.30    0.6744   0.0056      770 /      21
  Fe K      Normal   6.04- 7.40    1.0013   0.0459      368 /       4
   K K      Normal   3.01- 3.86    0.6405   0.0017      459 /      23
-----------------------------------------------------------------
                            Chi_square = 42.6433

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   65.858  79.3709 0.9080 0.9874 0.9196 1.0000
    Mg    0.831   0.6587 1.1135 0.9944 1.1208 0.9991
    Al    5.237   3.7421 1.1410 0.9998 1.1462 0.9956
    Si   16.317  11.2023 1.1144 0.9876 1.1286 0.9998
    Ca    3.338   1.6060 0.9992 1.0009 0.9991 0.9992
    Fe    4.950   1.7090 0.9979 0.9965 1.0007 1.0008
     K    3.470   1.7110 1.0936 1.2372 0.8885 0.9949
-----------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  4.9538
```

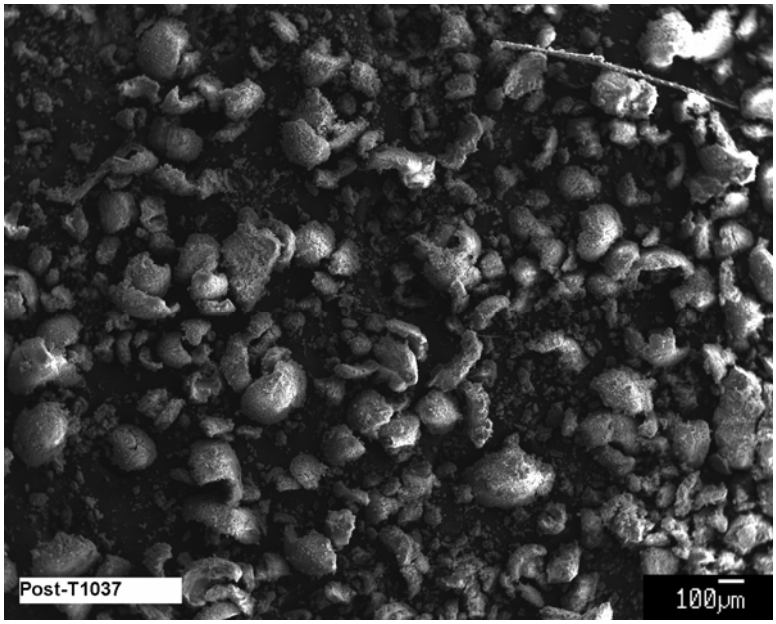

Figure D-76. Day-30, post-T1-sample-Sed1 SEM-SE image (Post-T1037) magnified 40 times; overview of particles.

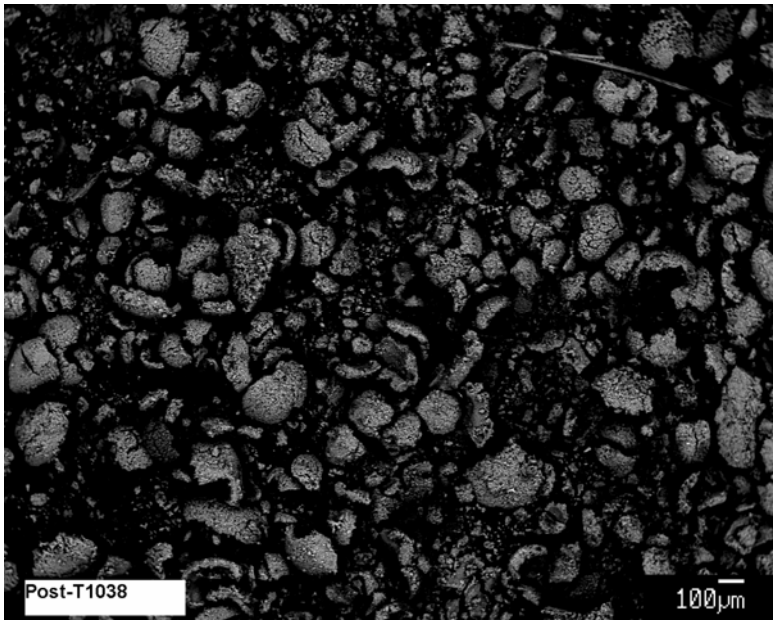

Figure D-77. Day-30, post-T1-sample-Sed1 SEM-BSE image (Post-T1038) magnified 40 times on the same particles, as shown in Figure D-76.

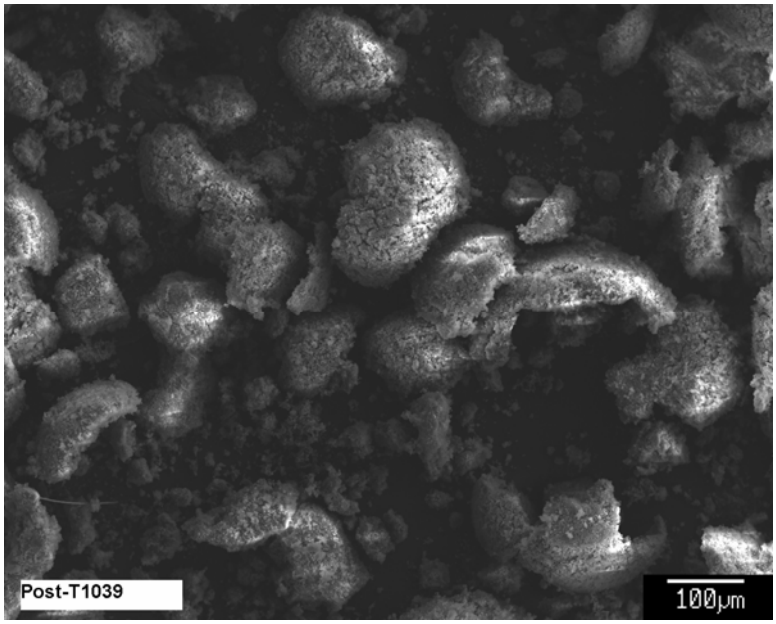

Figure D-78. Day-30, post-T1-sample-Sed1 SEM-SE image (Post-T1039) magnified 120 times; close-up of particles.

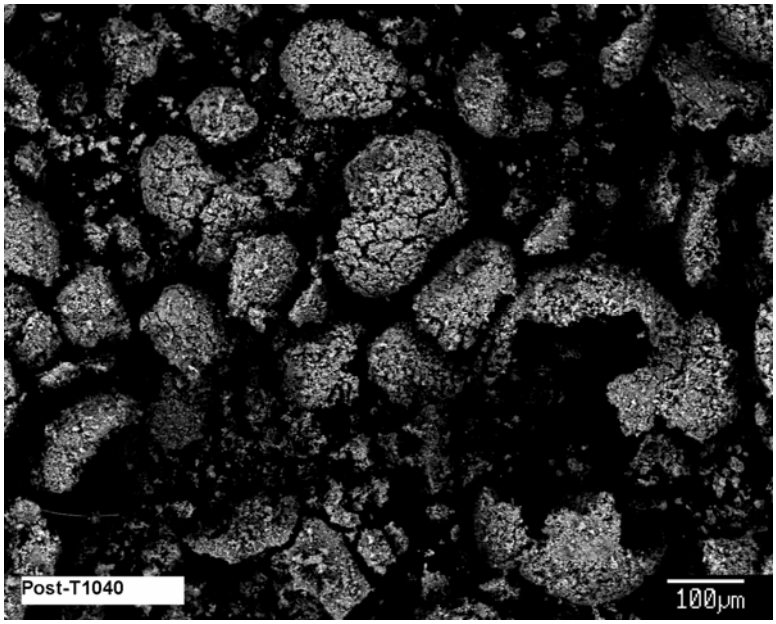

Figure D-79. Day-30, Post-T1-sample-Sed1 SEM-BSE image (Post-T1040) on the same field, as shown in Figure D-78.

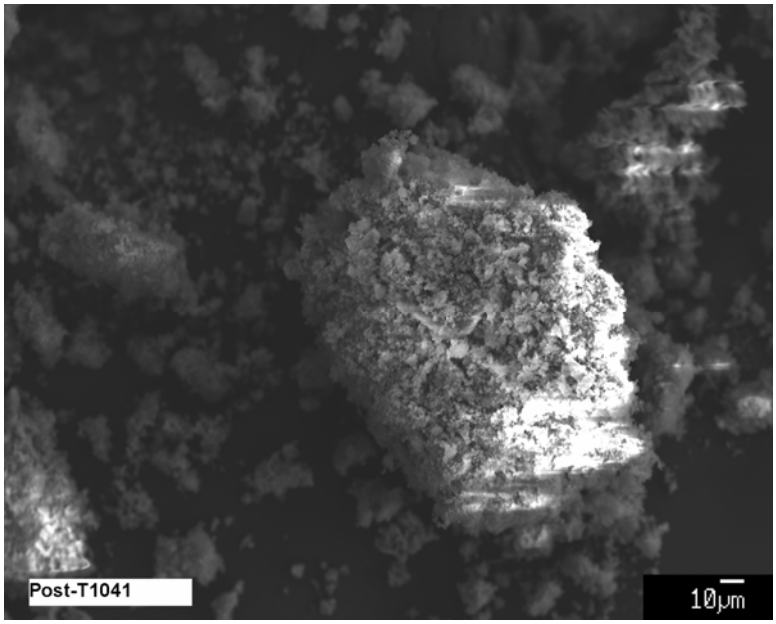

Figure D-80. Day-30, post-T1-sample-Sed1 SEM-SE image (Post-T1041) magnified 370 times on a single particle in image Post-T1-1040, as shown in Figure D-79.

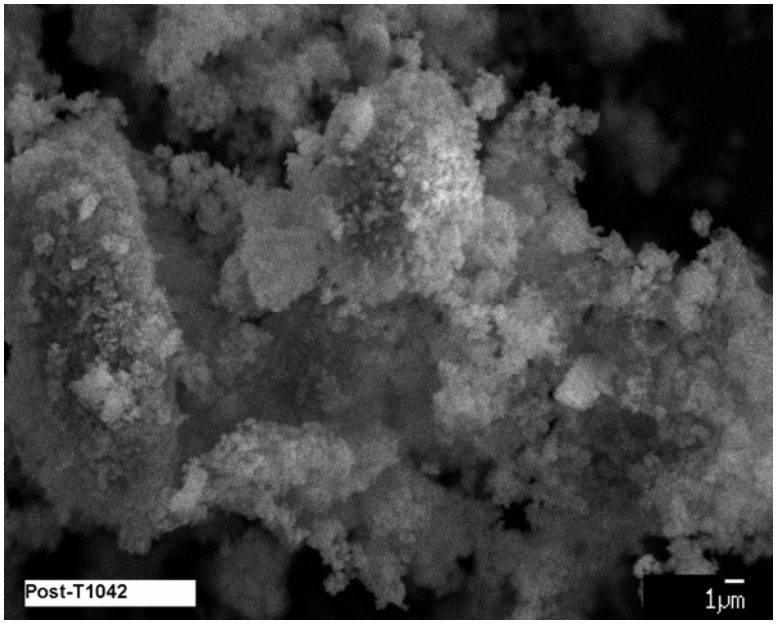

Figure D-81. Day-30, post-T1-sample-Sed1 SEM-SE image (Post-T1042) magnified 3000 times on the small particles in image Post-T1040, as shown in Figure D-79.

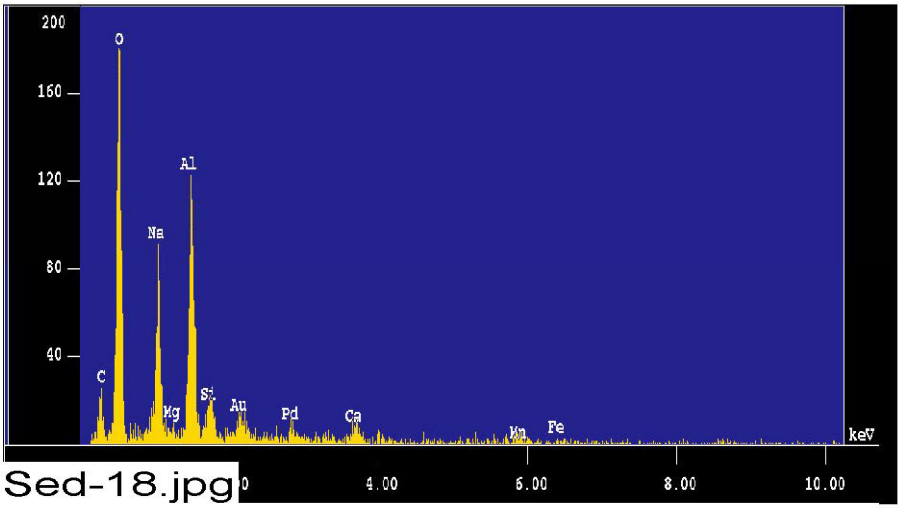

Figure D-82. Day-30, post-T1-sample-Sed1 counting spectrum (EDS SED-18) over the particles in an area (18 × 18 µm) in image Post-T1042 (see Figure D-81), magnified 6000 times.

The results from the chemical composition analysis for EDS SED-18 are given in Table D-31.

Table D-31. The Chemical Compositions for EDS SED-18

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 18
 Comment   : Pipe sediment sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 2.991E-10 A
             Stage Point : X=37.268 Y=67.741 Z=10.565
             Acq. Date   : Fri Jan 28 13:51:02 2005

 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   C K      Normal   0.09- 0.46    0.0000   0.0000        0 /      20
   O K      Normal   0.25- 0.77   14.2631   0.0018     1664 /      16
  Na K      Normal   0.83- 1.28    1.5969   0.0039      586 /       2
  Al K      Normal   1.26- 1.78    1.6726   0.0005      925 /      10
  Si K      Normal   1.50- 2.07    0.2688   0.0004      149 /      52
  Ca K      Normal   3.40- 4.30    0.3276   0.0021       96 /       3
  Mn K      Normal   5.53- 6.82    0.3310   0.0003       35 /       0
  Fe K      Normal   6.04- 7.40    0.0159   0.0120        1 /       1
-----------------------------------------------------------------------
                              Chi_square =  1.8808

 Element Mass%    Atomic%   ZAF      Z      A      F
     C    0.000   0.0000 3.9321 1.0376 3.7901 0.9999
     O   67.010  77.4509 0.7082 0.9896 0.7157 0.9999
    Na   12.316   9.9063 1.1626 0.9942 1.1684 1.0008
    Al   13.480   9.2382 1.2149 1.0024 1.2126 0.9995
    Si    2.226   1.4655 1.2481 0.9902 1.2604 0.9999
    Ca    2.141   0.9880 0.9852 1.0042 0.9820 0.9991
    Mn    2.722   0.9162 1.2395 1.2444 0.9961 1.0000
    Fe    0.106   0.0349 0.9982 1.0007 0.9967 1.0008
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  6.6339
```

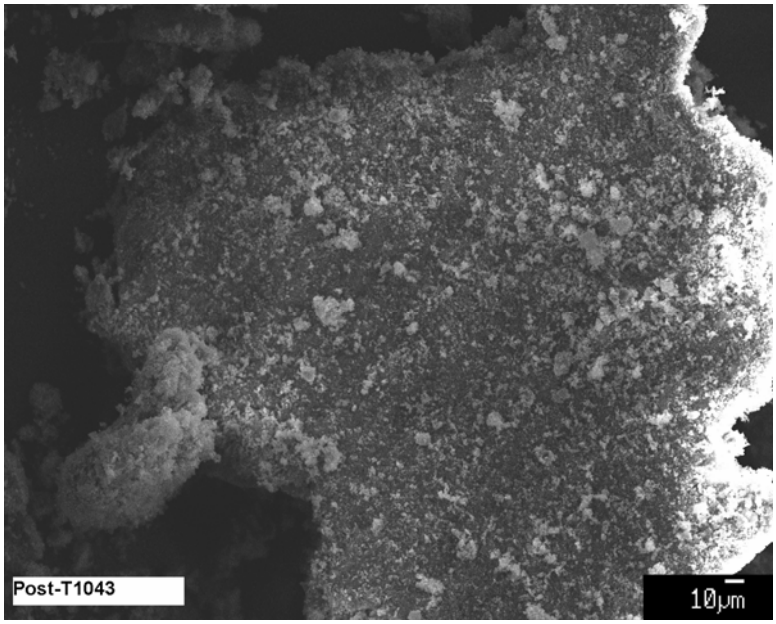

Figure D-83. Day-30, post-T1-sample-Sed1 SEM-SE image (Post-T1043) magnified 300 times on another particle in image Post-T1040, as shown in Figure D-79.

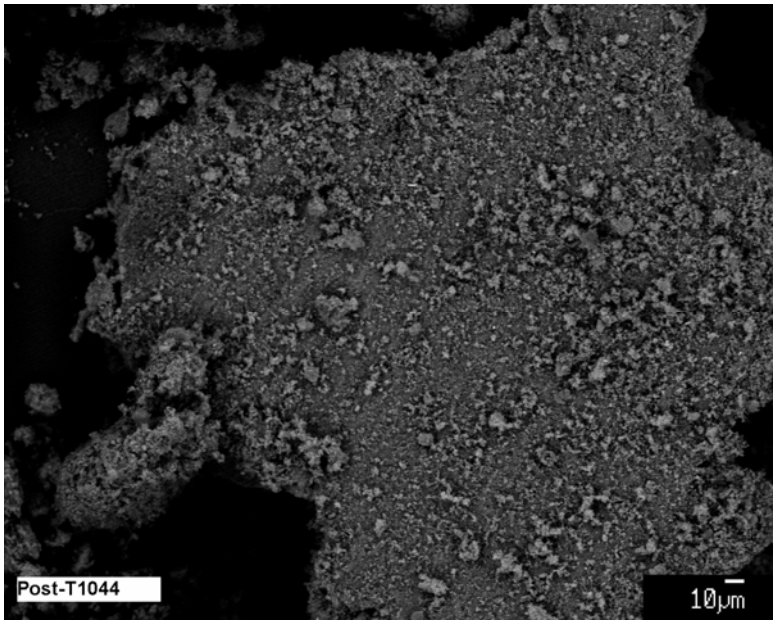

Figure D-84. Day-30, post-T1-sample-Sed1 SEM-BSE image (Post-T1044) magnified 300 times on the same particle in image Post-T1043, as shown in Figure D-83.

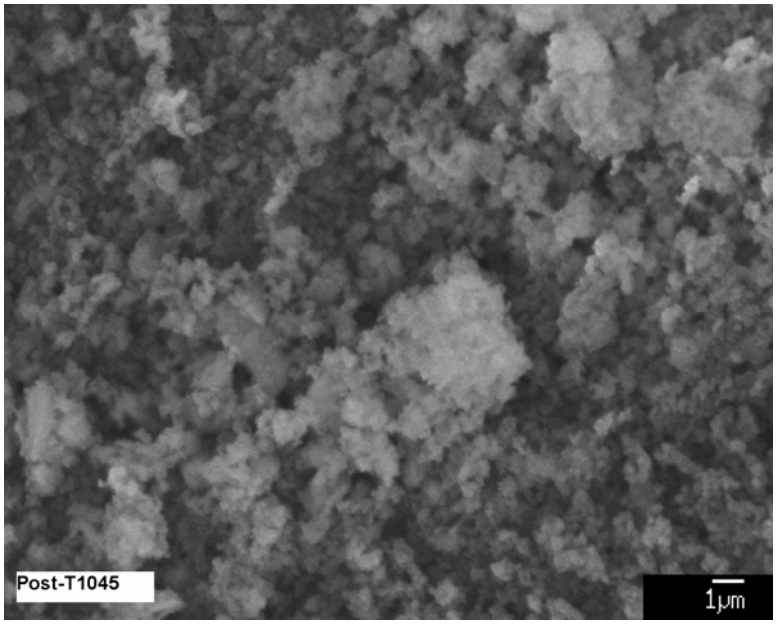

Figure D-85. Day-30, post-T1-sample-Sed1 SEM-SE image (Post-T1045) magnified 5000 times on the center particle in image Post-T1043, as shown in Figure D-83.

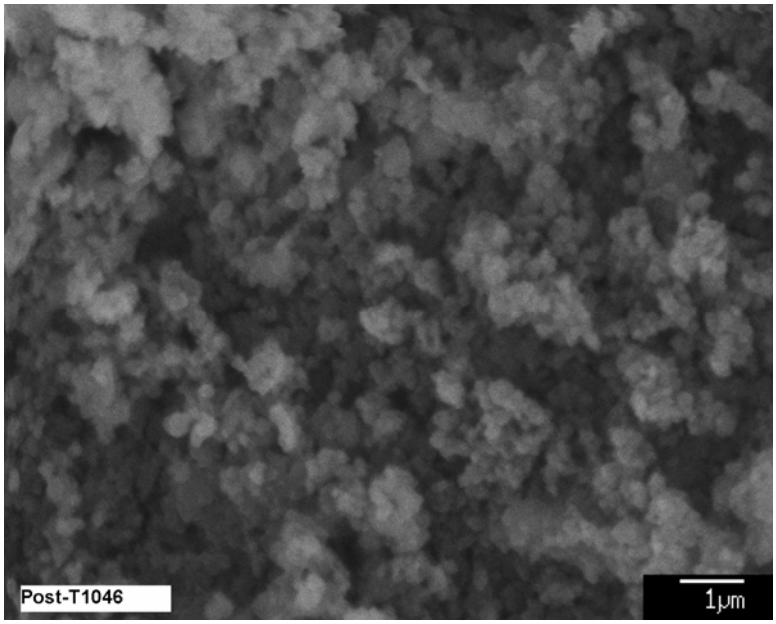

Figure D-86. Day-30, post-T1-sample-Sed1 SEM-SE image (Post-T1046) magnified 10,000 times on the same particle in image Post-T1043, as shown in Figure D-83.

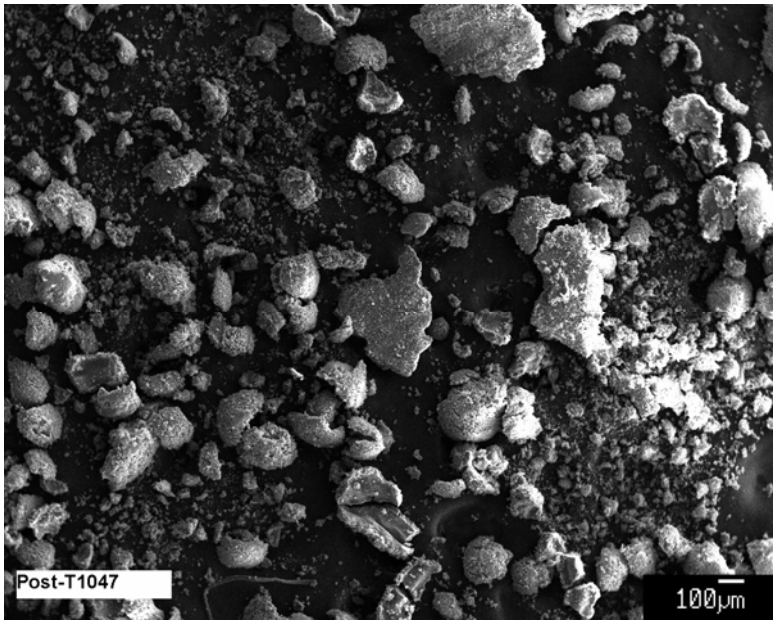

Figure D-87. Day-30, post-T1-sample-Sed1 SEM-SE image (Post-T1047) magnified 40 times; overview of the particles in images Post-T1043, -T1044, -T1045, and -T1046, as shown in Figure D-83 to Figure D-86.

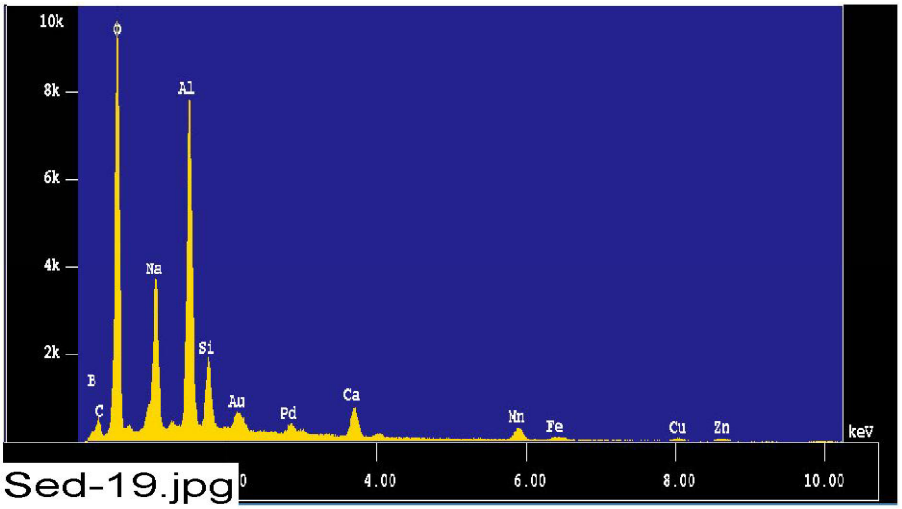

Figure D-88. Day-30, post-T1-sample-Sed1 counting spectrum (EDS SED-19) for the same field as in image Post-T1046 (see Figure D-86), magnified 10,000 times.

The results from the chemical composition analysis for EDS SED-19 are given in Table D-32.

Table D-32. The Chemical Compositions for EDS SED-19

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```
Group     : NRC
Sample    : PostT1_1-28-05  ID# : 19
Comment   : Pipe sediment sample
Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
            Live Time   : 100.000 sec    Aperture #     : 1
            Acc. Volt   : 15.0 KV        Probe Current : 5.884E-09 A
            Stage Point : X=36.914 Y=68.416 Z=10.565
            Acq. Date   : Fri Jan 28 14:08:16 2005
```

Element	Mode	ROI(KeV)	K-ratio(%)	+/-	Net/Background
O K	Normal	0.25- 0.77	40.2864	0.0134	92468 / 381
Na K	Normal	0.83- 1.28	3.1848	0.0412	22988 / 376
Mg K	Normal	1.03- 1.52	0.1428	0.0033	1302 / 4531
Al K	Normal	1.26- 1.78	6.1469	0.0046	66877 / 856
Si K	Normal	1.50- 2.07	1.3594	0.0034	14782 / 3944
Ca K	Normal	3.40- 4.30	1.5660	0.0181	9007 / 154
Mn K	Normal	5.53- 6.82	2.2207	0.0029	4681 / 76
Fe K	Normal	6.04- 7.40	0.3664	0.1051	678 / 58
Cu K	Normal	7.63- 9.27	1.2864	0.0090	1124 / 46
Zn K	Normal	8.22-10.03	1.5860	0.0125	1051 / 31

Chi_square = 31.9346

Element	Mass%	Atomic%	ZAF	Z	A	F
O	58.714	74.0315	0.7799	0.9730	0.8016	0.9999
Na	7.760	6.8088	1.3038	0.9771	1.3332	1.0008
Mg	0.346	0.2873	1.2969	0.9796	1.3248	0.9993
Al	14.542	10.8723	1.2659	0.9849	1.2861	0.9994
Si	3.264	2.3446	1.2849	0.9729	1.3209	0.9999
Ca	2.853	1.4357	0.9747	0.9853	0.9910	0.9982
Mn	5.018	1.8425	1.2091	1.2190	0.9990	0.9929
Fe	0.662	0.2392	0.9674	0.9799	0.9989	0.9883
Cu	3.053	0.9691	1.2698	1.2712	0.9989	1.0000
Zn	3.788	1.1689	1.2781	1.2801	0.9984	1.0000
Total	100.000	100.0000				

Normalization factor = 1.8688

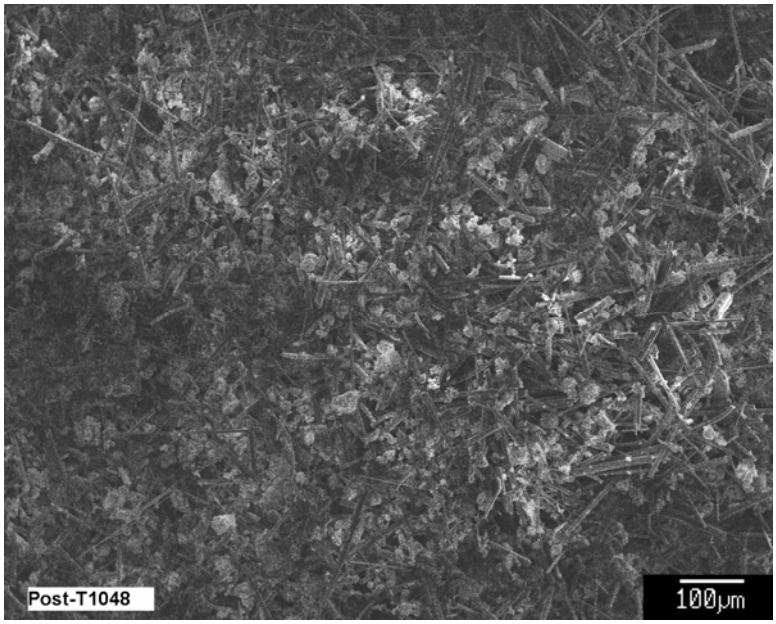

Figure D-89. Day-30, post-T1-sample-Sed2A SEM-SE image (Post-T1048) magnified 100 times; overview of tank-sediment sample Sed2A.

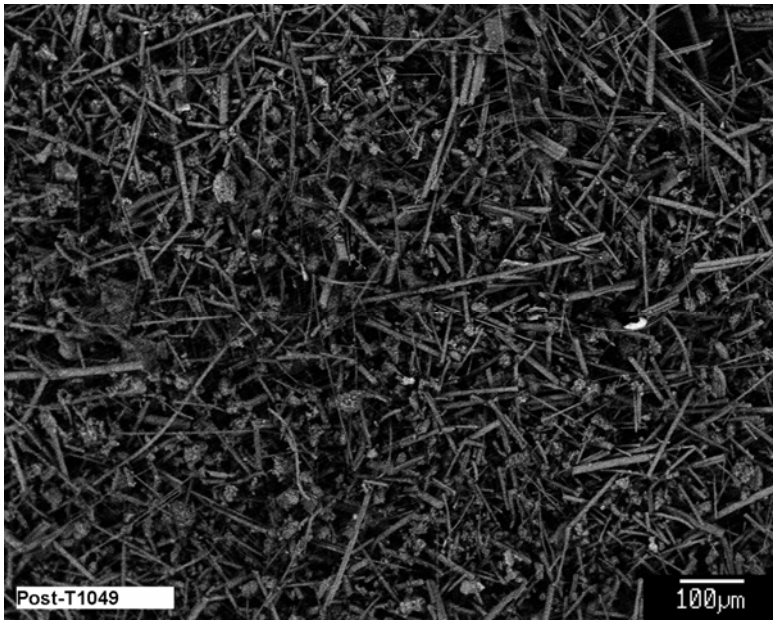

Figure D-90. Day-30, post-T1-sample-Sed2A SEM-BSE image (Post-T1049) on the same field as image Post-T1048, as shown in Figure D-89.

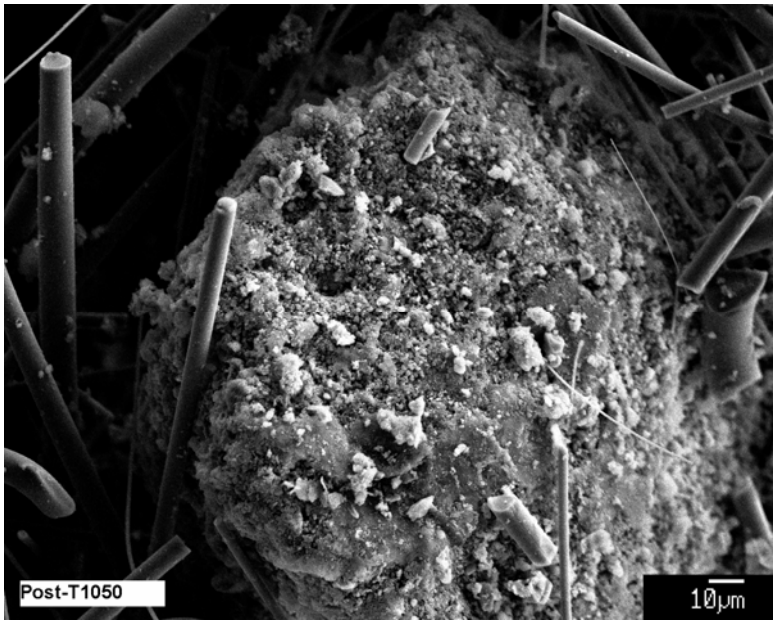

Figure D-91. Day-30, post-T1-sample-Sed2A SEM-SE image (Post-T1050) higher magnification of a representative large particle in image Post-T1049, as shown in Figure D-90.

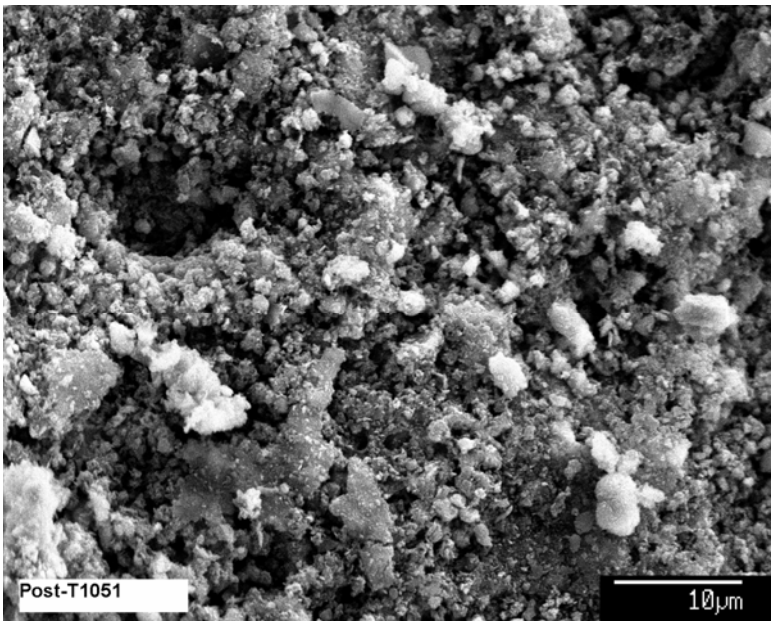

Figure D-92. Day-30, post-T1-sample-Sed2A SEM-SE image (Post-T1051) magnified 550 times on the same particle as in image Post-T1050 (see Figure D-91).

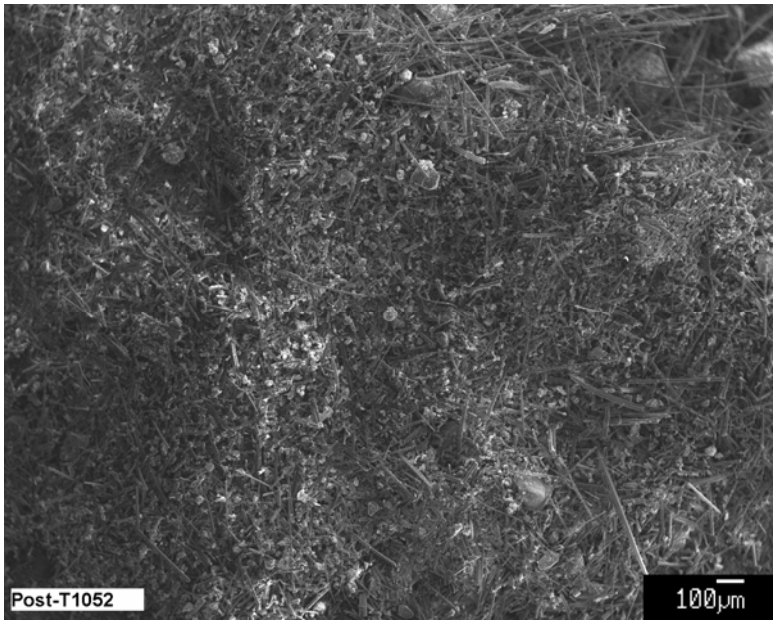

Figure D-93. Day-30, post-T1-sample-Sed2A SEM-SE image (Post-T1052) magnified 43 times; overview of tank-sediment sample Sed2A.

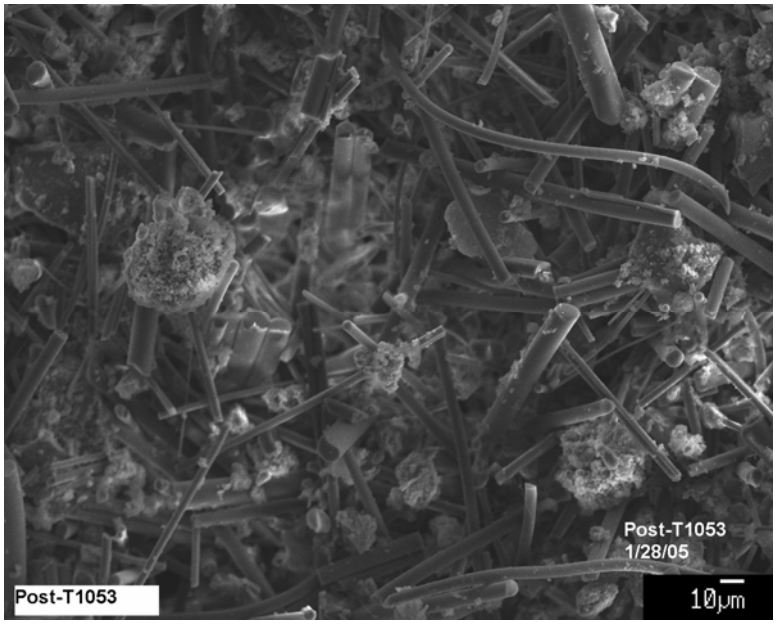

Figure D-94. Day-30, post-T1-sample-Sed2A SEM-SE image (Post-T1053) magnified 370 times on two large particles in image Post-T1052 (see Figure D-93).

Figure D-95. Day-30, post-T1-sample-Sed2A SEM-BSE image (Post-T1054) magnified 370 times on the same two particles as in image Post-T1053 (see Figure D-94).

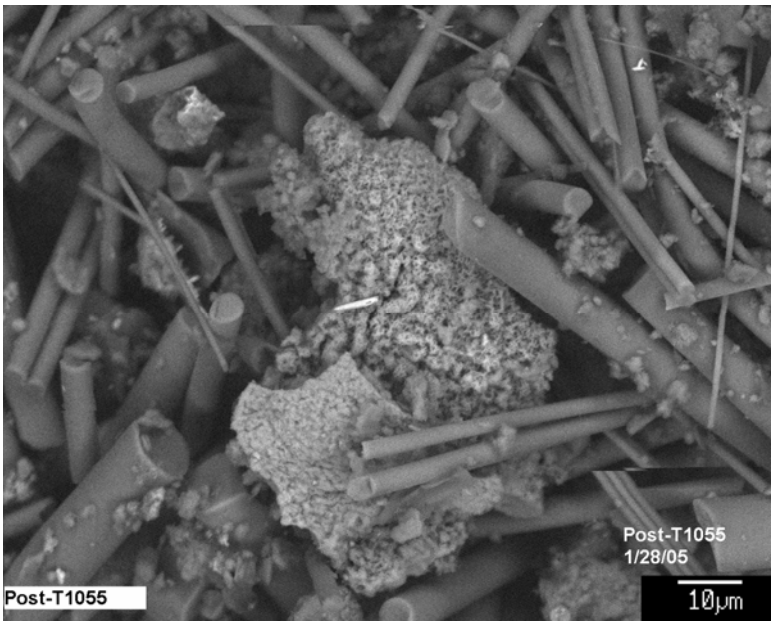

Figure D-96. Day-30, post-T1-sample-Sed2A SEM-SE image (Post-T1055) magnified 1000 times on fuzzy particle in image Post-T1054 (see Figure D-95).

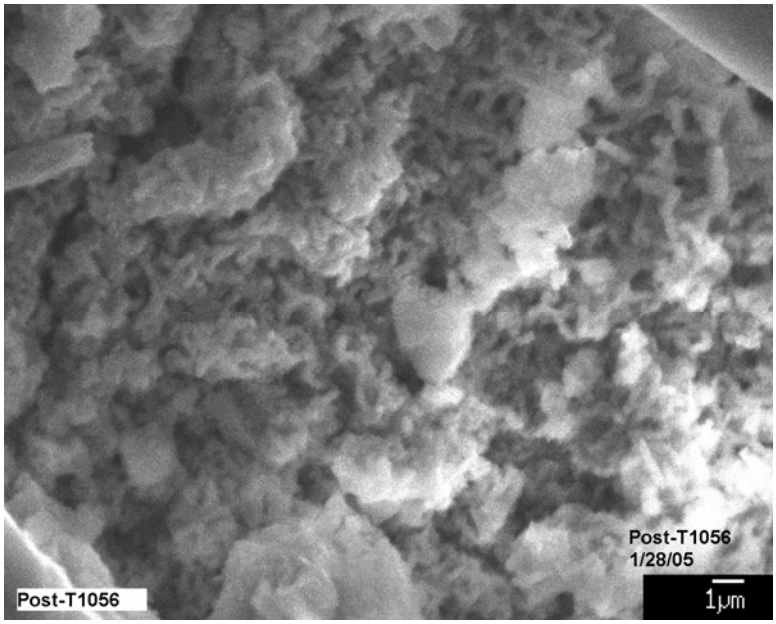

Figure D-97. Day-30, post-T1-sample-Sed2A SEM-SE image (Post-T1056) magnified 5000 times on the same particle as in image Post-T1055 (see Figure D-96).

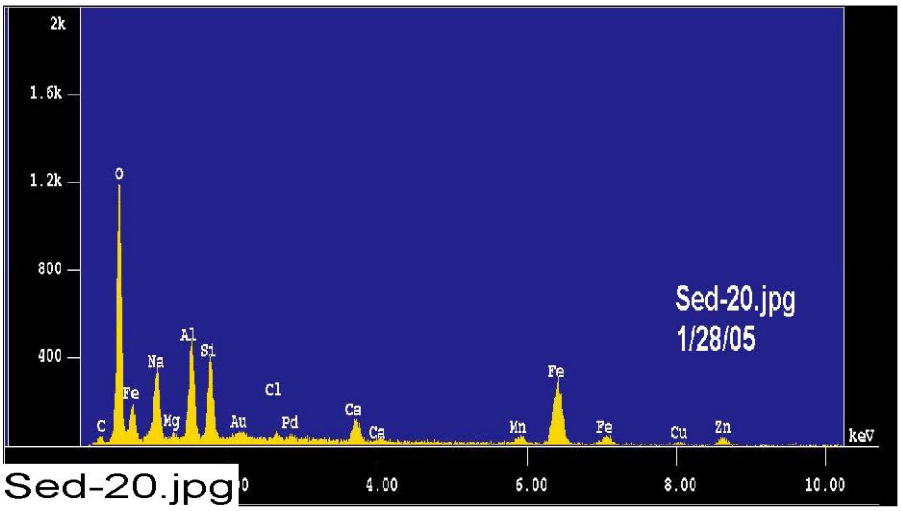

Figure D-98. Day-30, post-T1-sample-Sed2A counting spectrum (EDS SED-20) on the fuzzy particle, as shown in Figure D-97.

The results from the chemical composition analysis for EDS SED-20 are given in Table D-33.

Table D-33. The Chemical Compositions for EDS SED-20

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 20
 Comment   : Tank sediment sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.049E-09 A
             Stage Point : X=22.235 Y=61.110 Z=12.288
             Acq. Date   : Fri Jan 28 15:12:25 2005


 Element     Mode     ROI(KeV)    K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   27.8526   0.0049    11397 /      54
  Na K      Normal   0.83- 1.28    0.4496   0.0129      579 /      38
  Mg K      Normal   1.03- 1.52    0.1386   0.0011      225 /     354
  Al K      Normal   1.26- 1.78    2.0430   0.0012     3963 /     142
  Si K      Normal   1.50- 2.07    1.7540   0.0014     3400 /     276
  Cl K      Normal   2.34- 3.06    0.4256   0.0009      461 /      30
  Ca K      Normal   3.40- 4.30    1.2765   0.0072     1309 /      20
  Fe K      Normal   6.04- 7.40    9.3292   0.1066     3077 /      14
  Zn K      Normal   8.22-10.03    5.3859   0.0070      637 /       4
  Mn K      Normal   5.53- 6.82    1.2839   0.0012      482 /      13
  Cu K      Normal   7.63- 9.27    1.2101   0.0038      189 /       7
-----------------------------------------------------------------------
                                Chi_square =  4.8801

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   46.310  70.7546 0.8015 0.9337 0.8586 0.9999
    Na    1.569   1.6684 1.6827 0.9371 1.7934 1.0013
    Mg    0.443   0.4449 1.5394 0.9392 1.6380 1.0006
    Al    6.045   5.4760 1.4264 0.9441 1.5121 0.9992
    Si    4.679   4.0727 1.2861 0.9322 1.3799 0.9999
    Cl    0.939   0.6471 1.0632 0.9853 1.0802 0.9989
    Ca    2.492   1.5198 0.9412 0.9418 1.0035 0.9959
    Fe   17.787   7.7854 0.9191 0.9325 1.0011 0.9846
    Zn   13.617   5.0918 1.2188 1.2124 1.0053 1.0000
    Mn    3.069   1.3655 1.1523 1.1611 1.0018 0.9906
    Cu    3.051   1.1737 1.2154 1.2056 1.0081 1.0000
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  2.0743
```

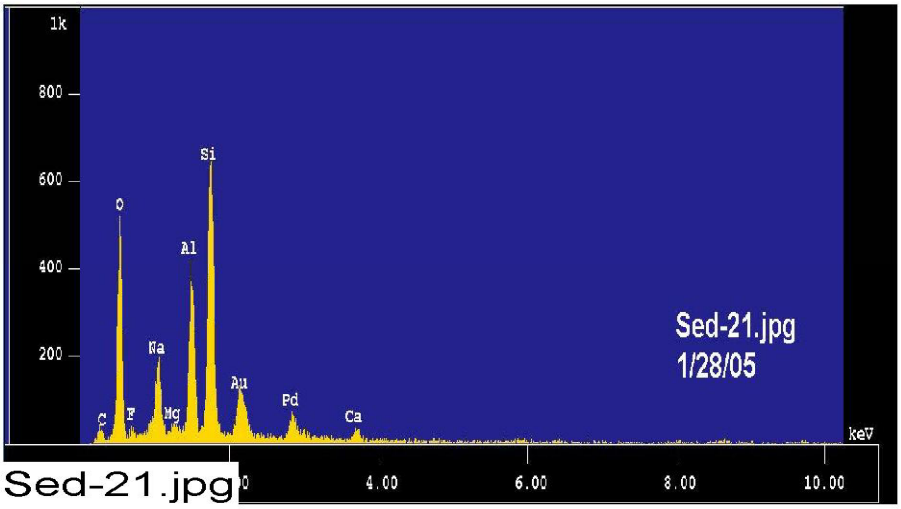

Figure D-99. Day-30, post-T1-sample-Sed2A counting spectrum (EDS SED-21) on another particle of tank-sediment sample Sed2A.

The results from the chemical composition analysis for EDS SED-21 are given in Table D-34.

Table D-34. The Chemical Compositions for EDS SED-21

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 21
 Comment   : Tank sediment sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 4.347E-10 A
             Stage Point : X=21.632 Y=61.902 Z=12.288
             Acq. Date   : Fri Jan 28 15:17:22 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   26.3138   0.0029     4462 /      40
  Na K      Normal   0.83- 1.28    2.3020   0.0068     1228 /      32
  Al K      Normal   1.26- 1.78    4.1307   0.0011     3320 /     234
  Si K      Normal   1.50- 2.07    7.5148   0.0017     6037 /     198
  Ca K      Normal   3.40- 4.30    0.7705   0.0040      327 /      10
   F K      Normal   0.46- 0.87    2.8319   0.0019      274 /      60
-----------------------------------------------------------------------
                              Chi_square =  5.2691

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   47.350  57.4238 0.8368 0.9899 0.8455 0.9997
    Na    5.724   4.8309 1.1563 0.9943 1.1623 1.0005
    Al   10.135   7.2883 1.1410 1.0024 1.1435 0.9954
    Si   18.840  13.0151 1.1658 0.9902 1.1774 1.0000
    Ca    1.659   0.8029 1.0010 1.0037 0.9972 1.0001
     F   16.292  16.6389 2.6752 1.0987 2.4353 0.9998
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  2.1505
```

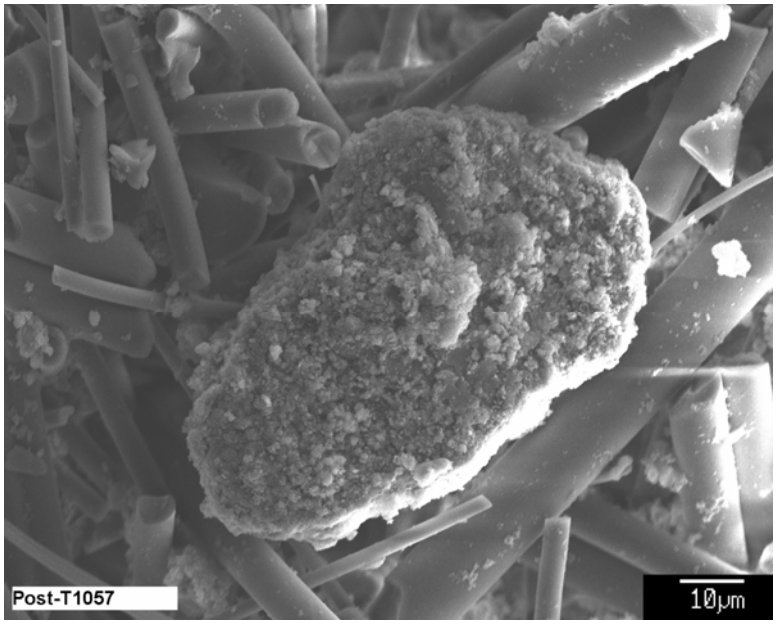

Figure D-100. Day-30, post-T1-sample-Sed2A SEM-SE image (Post-T1057) magnified 1000 times on the particle analyzed in the counting spectrum (EDS SED-21), as shown in Figure D-99.

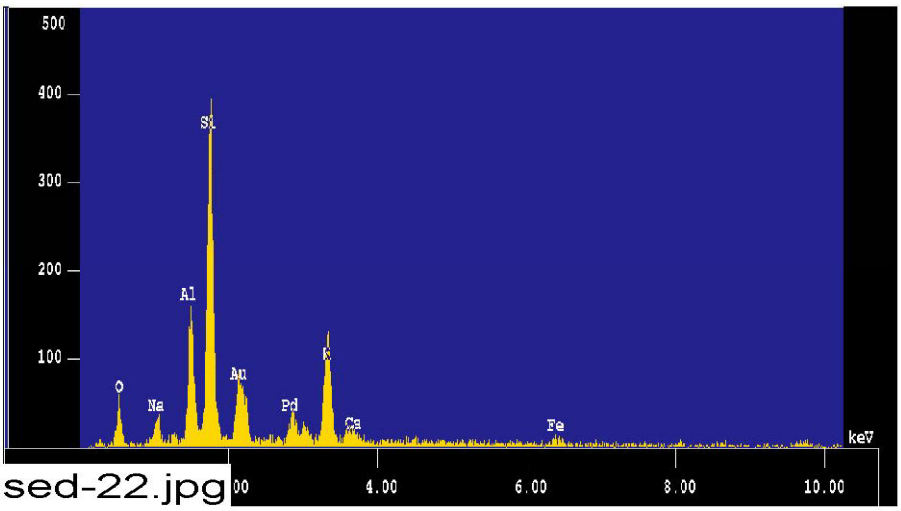

Figure D-101. Day-30, post-T1-sample-Sed2A counting spectrum (EDS SED-22) on a large round particle of K-feldspar, probably from the concrete sample.

The results from the chemical composition analysis for EDS SED-22 are given in Table D-35.

Table D-35. The Chemical Compositions for EDS SED-22

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 22
 Comment   : Tank sediment sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 4.322E-10 A
             Stage Point : X=21.652 Y=61.673 Z=12.288
             Acq. Date   : Fri Jan 28 15:23:18 2005

 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77    2.6175   0.0010      441 /       7
  Na K      Normal   0.83- 1.28    0.3307   0.0029      175 /       8
  Al K      Normal   1.26- 1.78    1.5862   0.0007     1268 /     129
  Si K      Normal   1.50- 2.07    4.1906   0.0013     3347 /      93
  Ca K      Normal   3.40- 4.30    0.2405   0.0034      102 /      23
   K K      Normal   3.01- 3.86    5.7503   0.0022     1524 /      17
  Fe K      Normal   6.04- 7.40    0.6338   0.0299       86 /       6
-----------------------------------------------------------------------
                              Chi_square =  1.1162

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   26.266  42.2610 1.8669 0.9646 1.9353 1.0000
    Na    1.927   2.1575 1.0839 0.9681 1.1192 1.0003
    Al    9.032   8.6170 1.0593 0.9753 1.0936 0.9932
    Si   24.485  22.4414 1.0870 0.9631 1.1300 0.9988
    Ca    1.391   0.8934 1.0759 0.9732 1.1057 0.9998
     K   33.547  22.0848 1.0854 1.2037 0.9028 0.9987
    Fe    3.351   1.5448 0.9837 0.9647 1.0189 1.0008
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  5.3752
```

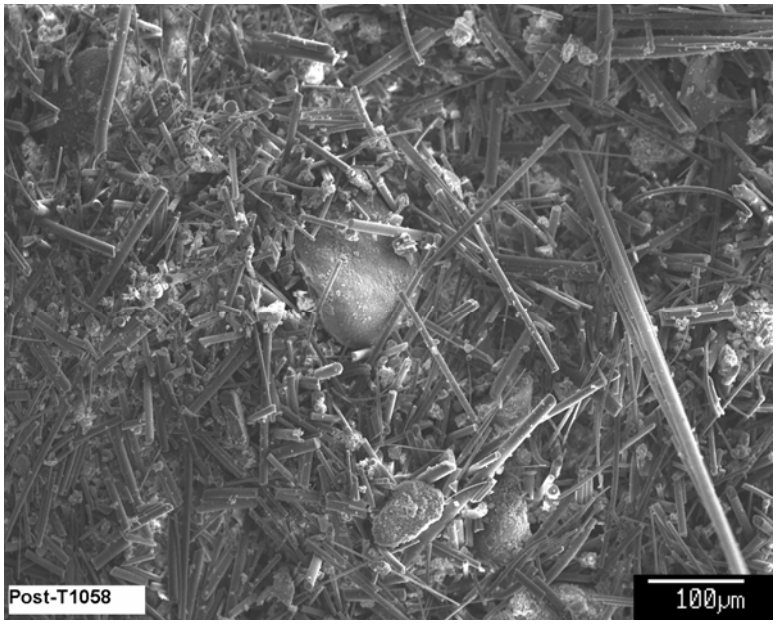

Figure D-102. Day-30, post-T1-sample-Sed2A SEM-SE image (Post-T1058) of the high-Z particles analyzed in EDS counting spectra EDS-21 and -22, magnified 150 times, as shown in Figure D-99 and Figure D-101.

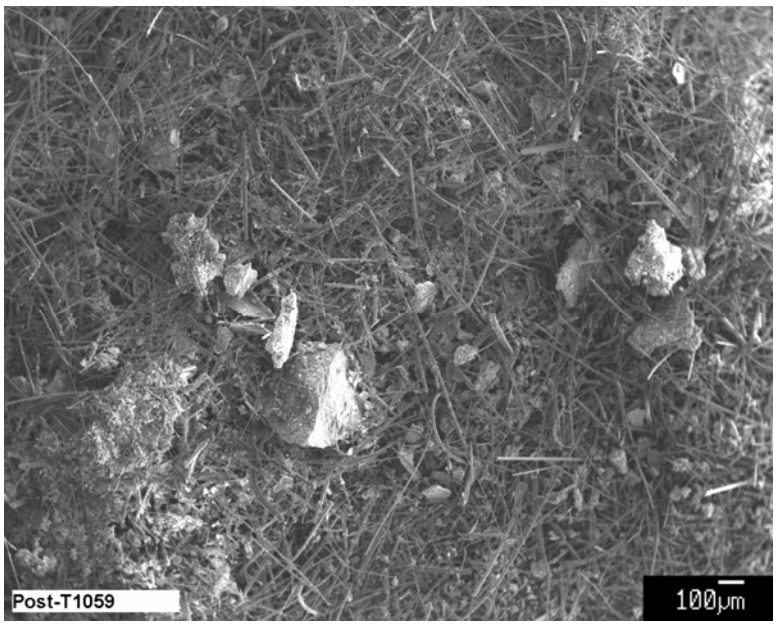

Figure D-103. Day-30, post-T1-sample-Sed2B SEM-SE image (Post-T1059) magnified 40 times; overview of large particles in tank-sediment sample Sed2B.

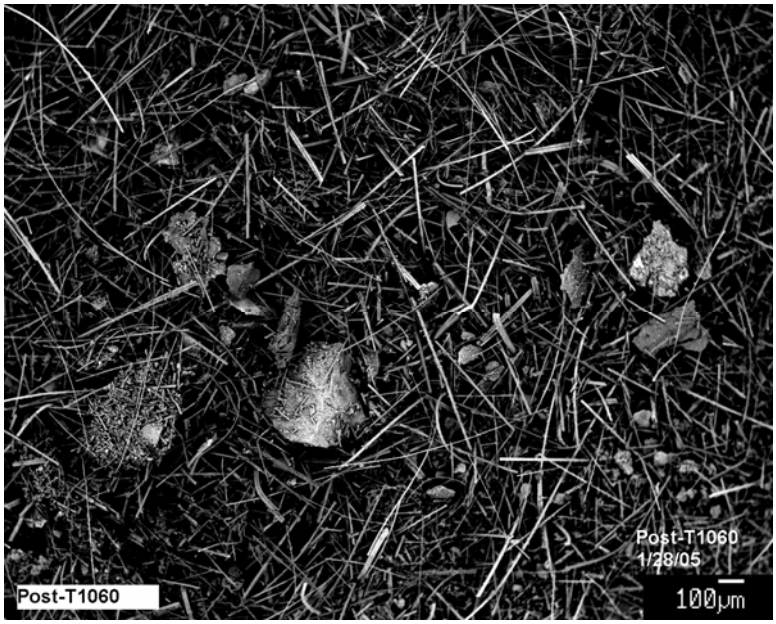

Figure D-104. Day-30, post-T1-sample-Sed2B SEM-BSE image (Post-T1060) magnified 40 times on the same particles shown above.

Figure D-105. Day-30, post-T1-sample-Sed2B SEM-BSE image (Post-T1060annotated) magnified 40 times on the same particles as in image Post-T1060 (see Figure D-104).

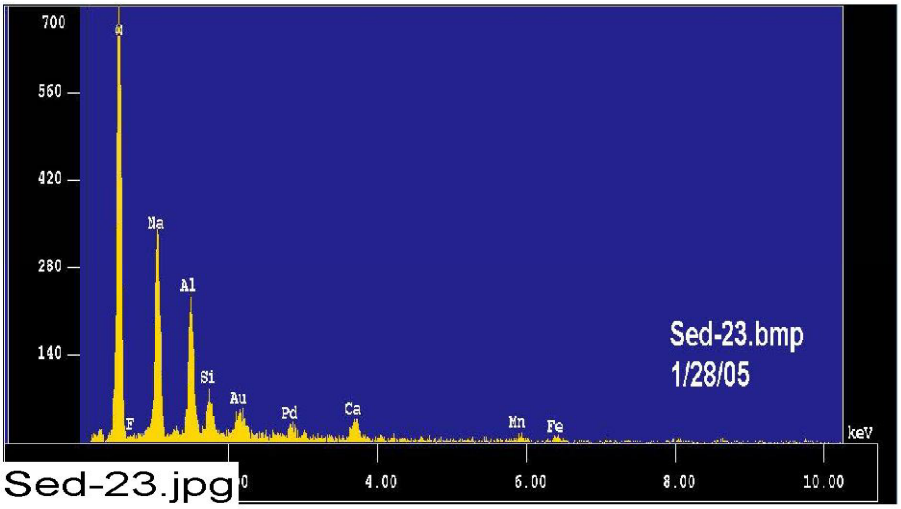

Figure D-106. Day-30, post-T1-sample-Sed2B counting spectrum (EDS SED-23) on the plate, as shown in Figure D-105. This sample shows O>Na>Al, which is similar to the filtrate composition from January 18, 2005.

The results from the chemical composition analysis for EDS SED-23 are given in Table D-36.

Table D-36. The Chemical Compositions for EDS SED-23

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 23
 Comment   : Tank sediment sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 4.184E-10 A
             Stage Point : X= 8.337 Y=63.713 Z=12.288
             Acq. Date   : Fri Jan 28 15:41:44 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   41.2748   0.0035     6737 /      16
  Na K      Normal   0.83- 1.28    5.3562   0.0081     2749 /      16
  Al K      Normal   1.26- 1.78    2.5107   0.0008     1942 /      34
  Si K      Normal   1.50- 2.07    0.6362   0.0007      492 /     115
  Ca K      Normal   3.40- 4.30    0.9001   0.0041      368 /       7
  Mn K      Normal   5.53- 6.82    0.7900   0.0006      118 /       2
  Fe K      Normal   6.04- 7.40    0.8879   0.0277      117 /       4
-----------------------------------------------------------------------
                              Chi_square =  6.1401

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   67.967  78.3590 0.6757 0.9879 0.6840 0.9999
    Na   15.696  12.5931 1.2024 0.9924 1.2102 1.0012
    Al    7.758   5.3038 1.2680 1.0006 1.2677 0.9996
    Si    1.894   1.2441 1.2218 0.9885 1.2360 0.9999
    Ca    2.149   0.9891 0.9798 1.0024 0.9788 0.9987
    Mn    2.380   0.7992 1.2364 1.2421 0.9954 1.0000
    Fe    2.155   0.7117 0.9958 0.9989 0.9961 1.0008
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  2.4371
```

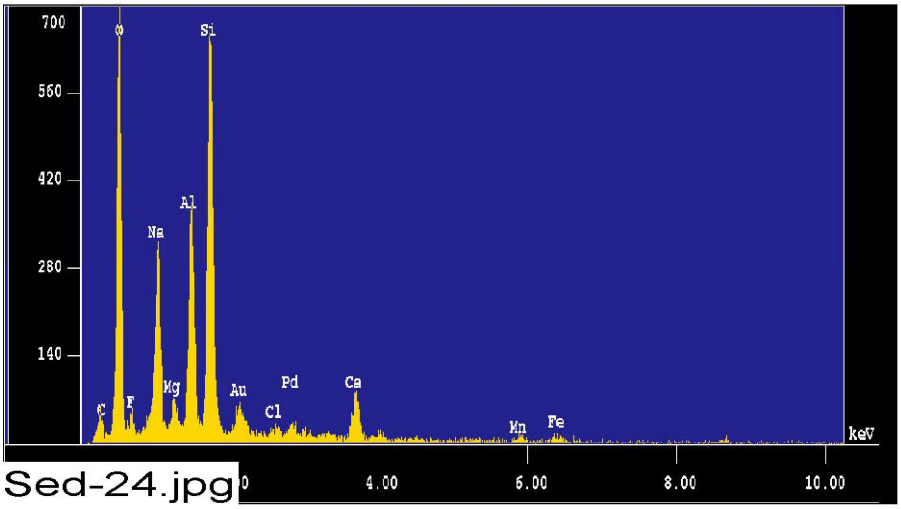

Figure D-107. Day-30, post-T1-sample-Sed2B counting spectrum (EDS SED-24) for the particles on the plate in image Post-T1060 (see Figure D-105).

The results from the chemical composition analysis for EDS SED-24 are given in Table D-37.

Table D-37. The Chemical Compositions for EDS SED-24

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 24
 Comment   : Tank sediment sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #    : 1
             Acc. Volt   : 15.0 KV        Probe Current : 4.195E-10 A
             Stage Point : X= 8.337 Y=63.713 Z=12.288
             Acq. Date   : Fri Jan 28 15:46:01 2005


 Element     Mode     ROI(KeV)    K-ratio(%)  +/-    Net/Background
   C K      Normal   0.09- 0.46    0.0000    0.0000        0 /      58
   O K      Normal   0.25- 0.77   39.6299    0.0037     6485 /      38
   F K      Normal   0.46- 0.87    2.0252    0.0029      189 /      72
  Na K      Normal   0.83- 1.28    4.3170    0.0083     2222 /      39
  Mg K      Normal   1.03- 1.52    0.6122    0.0011      398 /     292
  Al K      Normal   1.26- 1.78    4.0630    0.0011     3152 /     226
  Si K      Normal   1.50- 2.07    7.5171    0.0017     5827 /     185
  Ca K      Normal   3.40- 4.30    2.4193    0.0055      992 /      14
  Mn K      Normal   5.53- 6.82    1.1727    0.0007      176 /       6
  Fe K      Normal   6.04- 7.40    0.7872    0.0314      104 /       4
-----------------------------------------------------------------------
                              Chi_square =  4.2987

 Element Mass%    Atomic%   ZAF      Z      A      F
     C    0.000   0.0000 4.7675 1.0337 4.6124 0.9999
     O   52.424  64.0771 0.8428 0.9859 0.8551 0.9998
     F    9.581   9.8616 3.0142 1.0942 2.7551 0.9998
    Na    8.097   6.8877 1.1951 0.9902 1.2060 1.0007
    Mg    1.139   0.9165 1.1859 0.9928 1.1954 0.9992
    Al    7.634   5.5326 1.1971 0.9983 1.2031 0.9968
    Si   13.858   9.6491 1.1746 0.9861 1.1913 0.9999
    Ca    3.759   1.8341 0.9900 0.9993 0.9915 0.9992
    Mn    2.277   0.8106 1.2373 1.2374 0.9999 1.0000
    Fe    1.230   0.4306 0.9953 0.9950 0.9996 1.0008
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.5695
```

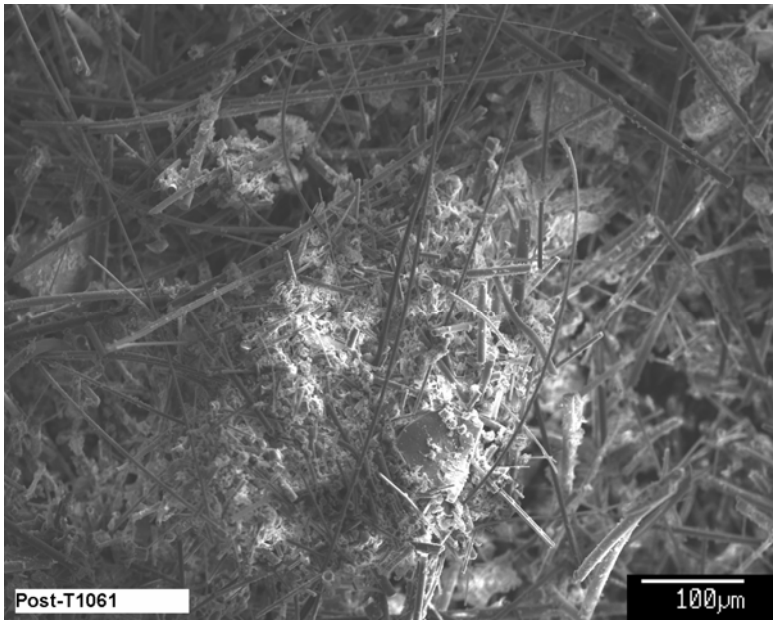

Figure D-108. Day-30, post-T1-sample-Sed2B SEM-SE image (Post-T1061) magnified 160 times on the particles and fibers at left side of image Post-T1059 (see Figure D-103).

Figure D-109. Day-30, post-T1-sample-Sed2B SEM-BSE image (Post-T1062) magnified 160 times on the same field as in image Post-T1061 (see Figure D-108).

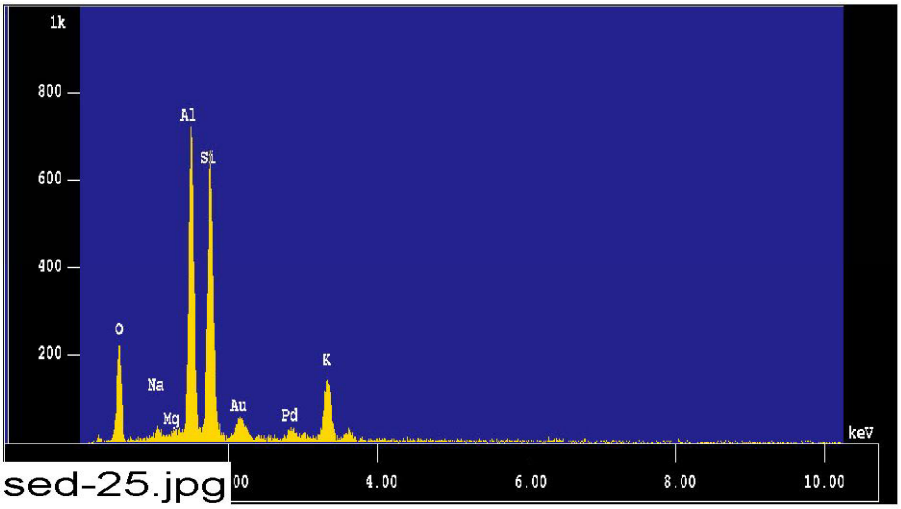

Figure D-110. Day-30, post-T1-sample-Sed2B counting spectrum (EDS SED-25) on the particle in agglomerate image Post-T1062 (see Figure D-109).

The results from the chemical composition analysis for EDS SED-25 are given in Table D-38.

Table D-38. The Chemical Compositions for EDS SED-25

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 25
 Comment   : Tank sediment sample
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #    : 1
             Acc. Volt   : 15.0 KV        Probe Current : 4.259E-10 A
             Stage Point : X= 9.289 Y=64.031 Z=12.288
             Acq. Date   : Fri Jan 28 15:57:48 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   12.2389   0.0019     2033 /      14
  Al K      Normal   1.26- 1.78    7.7756   0.0014     6123 /     206
  Si K      Normal   1.50- 2.07    7.3272   0.0017     5767 /     346
   K K      Normal   3.01- 3.86    7.2242   0.0024     1886 /      15
  Na K      Normal   0.83- 1.28    0.3054   0.0033      160 /      25
  Mg K      Normal   1.03- 1.52    0.1299   0.0008       86 /     228
-----------------------------------------------------------------------
                              Chi_square =  3.9525

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   40.610  56.4293 1.4063 0.9807 1.4340 1.0000
    Al   19.030  15.6793 1.0373 0.9923 1.0508 0.9948
    Si   20.371  16.1251 1.1784 0.9800 1.2031 0.9994
     K   18.942  10.7696 1.1113 1.2263 0.9062 1.0000
    Na    0.747   0.7224 1.0369 0.9846 1.0534 0.9998
    Mg    0.300   0.2743 0.9792 0.9871 0.9962 0.9959
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  2.3594
```

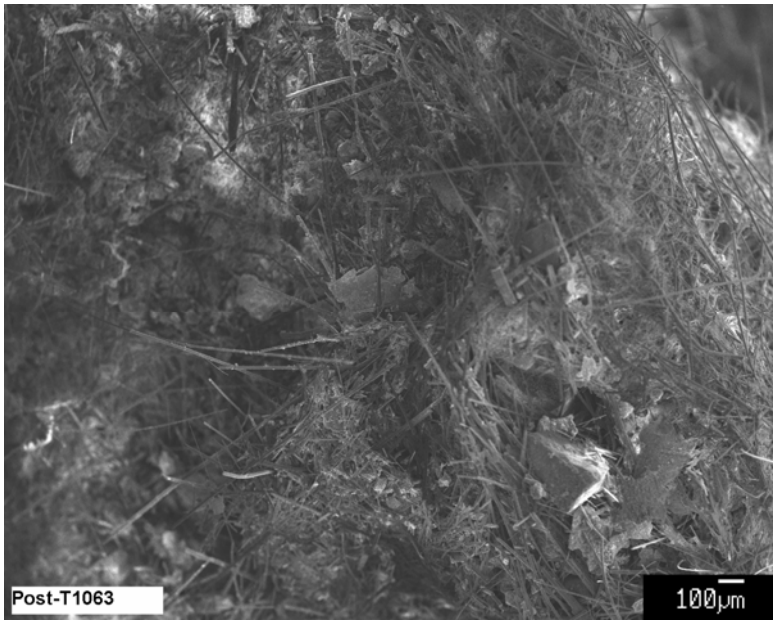

Figure D-111. Day-30, post-T1-sample-P1 SEM-SE image (Post-T1063) magnified 40 times; overview of the large particles present in the pump-suction-debris sample.

Figure D-112. Day-30, post-T1-sample-P1 SEM-BSE image (Post-T1064) magnified 40 times on the same large particles as in image Post-T1063 (see Figure D-111).

Figure D-113. Day-30, post-T1-sample-P1 SEM-SE image (Post-T1064 annotated) annotating the EDS locations.

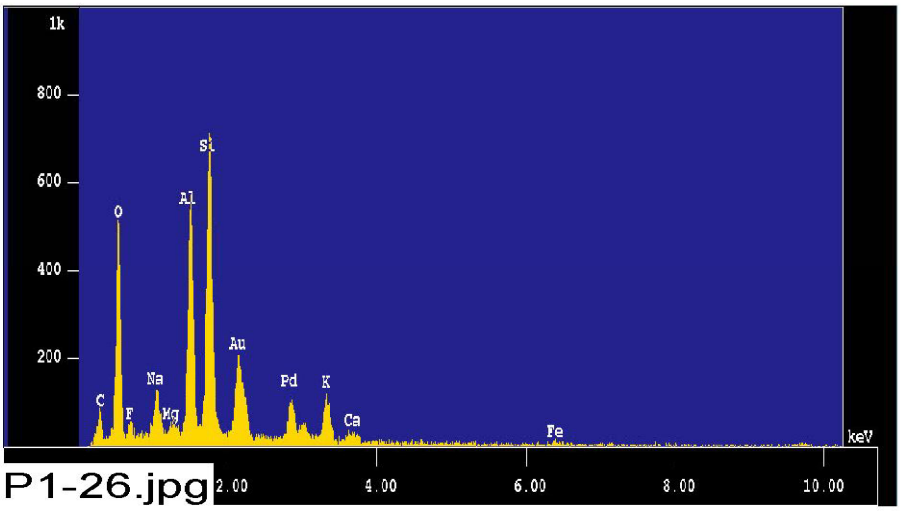

Figure D-114. Day-30, post-T1-sample-P1 counting spectrum (EDS P1-26) on the triangular large particle in image Post-T1064 (see Figure D-113).

The results from the chemical composition analysis for EDS P1-26 are given in Table D-39.

Table D-39. The Chemical Compositions for EDS P1-26

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 26
 Comment   : Pump Suction Debris
 Condition : Full Scale  : 20Kev(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 4.196E-10 A
             Stage Point : X=70.335 Y=64.112 Z=12.288
             Acq. Date   : Fri Jan 28 16:14:09 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   C K      Normal   0.09- 0.46    1.4540   0.0003      353 /      59
   O K      Normal   0.25- 0.77   28.7309   0.0030     4703 /      46
   F K      Normal   0.46- 0.87    5.1768   0.0022      484 /      72
  Na K      Normal   0.83- 1.28    1.5083   0.0060      776 /      42
  Al K      Normal   1.26- 1.78    5.9468   0.0013     4614 /     226
  Si K      Normal   1.50- 2.07    7.8631   0.0018     6097 /     299
   K K      Normal   3.01- 3.86    5.2345   0.0023     1347 /      32
  Fe K      Normal   6.04- 7.40    0.8985   0.0331      119 /       6
-----------------------------------------------------------------
                              Chi_square =  4.0233

 Element Mass%    Atomic%   ZAF      Z      A      F
     C    8.303  13.0283 4.2517 1.0269 4.1405 1.0000
     O   40.921  48.2017 1.0604 0.9794 1.0829 0.9997
     F   18.488  18.3398 2.6588 1.0871 2.4460 0.9999
    Na    2.433   1.9946 1.2011 0.9839 1.2198 1.0008
    Al    8.989   6.2784 1.1254 0.9920 1.1380 0.9969
    Si   12.026   8.0693 1.1386 0.9799 1.1623 0.9997
     K    7.644   3.6842 1.0872 1.2279 0.8855 0.9999
    Fe    1.196   0.4036 0.9910 0.9898 1.0005 1.0008
-----------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.3432
```

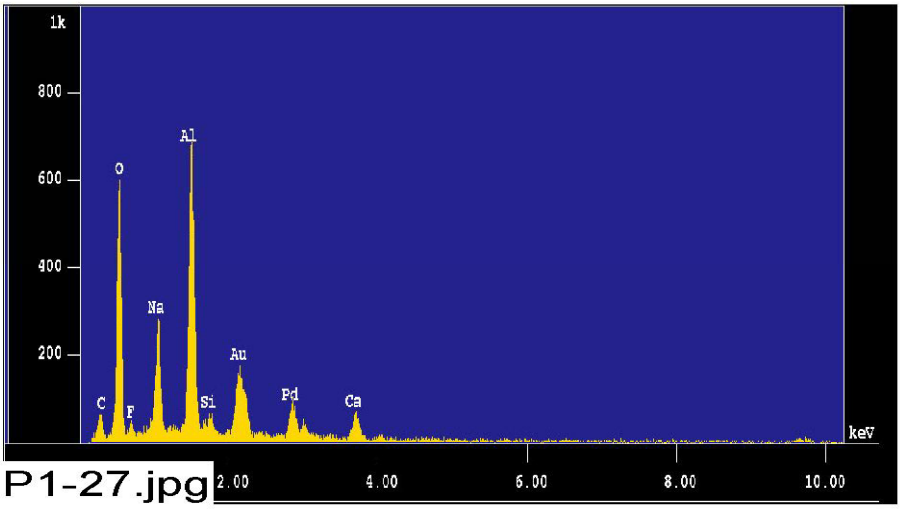

Figure D-115. Day-30, post-T1-sample-P1 counting spectrum (EDS P1-27) on the flat particle at lower right corner of image Post-T1064 (see Figure D-113).

The results from the chemical composition analysis for EDS P1-27 are given in Table D-40.

Table D-40. The Chemical Compositions for EDS P1-27

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 27
 Comment   : pump suction screen debris
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #    : 1
             Acc. Volt   : 15.0 KV        Probe Current : 4.189E-10 A
             Stage Point : X=70.335 Y=64.112 Z=12.288
             Acq. Date   : Fri Jan 28 16:20:03 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   C K      Normal   0.09- 0.46    0.2744   0.0004       67 /      46
   O K      Normal   0.25- 0.77   32.5575   0.0032     5320 /      48
   F K      Normal   0.46- 0.87    3.9728   0.0020      371 /      58
  Na K      Normal   0.83- 1.28    3.8472   0.0077     1977 /      28
  Al K      Normal   1.26- 1.78    7.4580   0.0014     5777 /      38
  Si K      Normal   1.50- 2.07    0.2973   0.0007      230 /     367
  Ca K      Normal   3.40- 4.30    1.8105   0.0052      741 /      12
-----------------------------------------------------------------------
                              Chi_square =  6.2495

 Element Mass%    Atomic%   ZAF      Z      A      F
      C    2.094   3.2545 4.0445 1.0324 3.9179 1.0000
      O   48.264  56.3066 0.7857 0.9847 0.7982 0.9997
      F   20.048  19.6968 2.6747 1.0930 2.4476 0.9998
     Na    8.725   7.0835 1.2020 0.9892 1.2143 1.0007
     Al   16.804  11.6242 1.1942 0.9974 1.1975 0.9998
     Si    0.711   0.4725 1.2673 0.9853 1.2863 0.9999
     Ca    3.354   1.5620 0.9819 0.9992 0.9826 1.0001
-----------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.8867
```

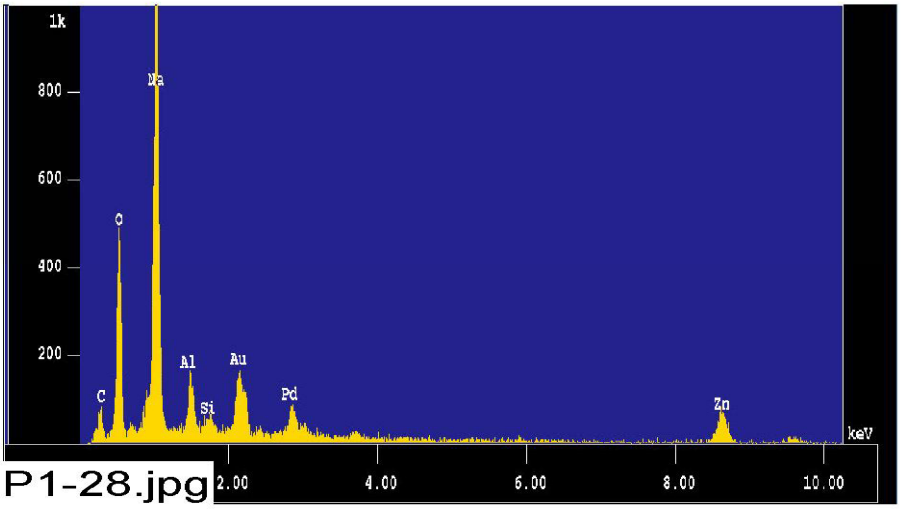

Figure D-116. Day-30, post-T1-sample-P1 counting spectrum (EDS P1-28) on bright particle in the center of image Post-T1064 (see Figure D-113).

The results from the chemical composition analysis for EDS P1-28 are given in Table D-41.

Table D-41. The Chemical Compositions for EDS P1-28

```
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 Group     : NRC
 Sample    : PostT1_1-28-05  ID# : 28
 Comment   : pump suction screen debris
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 100.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 4.194E-10 A
             Stage Point : X=70.335 Y=64.112 Z=12.288
             Acq. Date   : Fri Jan 28 16:24:11 2005

 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   27.2716   0.0030     4462 /      58
  Na K      Normal   0.83- 1.28    0.0000   0.0000        0 /      43
  Al K      Normal   1.26- 1.78    1.4018   0.0008     1087 /      45
  Zn K      Normal   8.22-10.03   26.4466   0.0088     1250 /       6
  Si K      Normal   1.50- 2.07    0.2317   0.0007      180 /      96
   C K      Normal   0.09- 0.46    1.2827   0.0003      311 /      52
-------------------------------------------------------------------
                              Chi_square =  4.4939

 Element Mass%    Atomic%   ZAF      Z      A      F
     O   38.917  59.7633 0.9217 0.9084 1.0148 0.9999
    Na    0.000   0.0000 1.7609 0.9116 1.9289 1.0015
    Al    3.598   3.2767 1.6582 0.9183 1.8058 0.9999
    Zn   47.937  18.0168 1.1708 1.1742 0.9971 1.0000
    Si    0.502   0.4394 1.4004 0.9067 1.5446 1.0000
     C    9.046  18.5038 4.5552 0.9529 4.7807 1.0000
-------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.5482
```

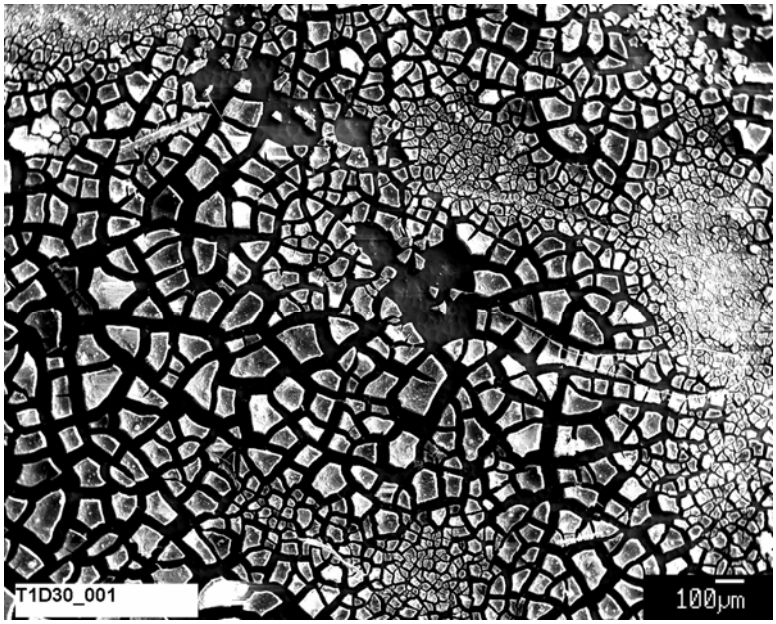

Figure D-117. Day-30, high-volume sample Microprobe image (T1D30_001) magnified 40 times; overview of the filtrate.

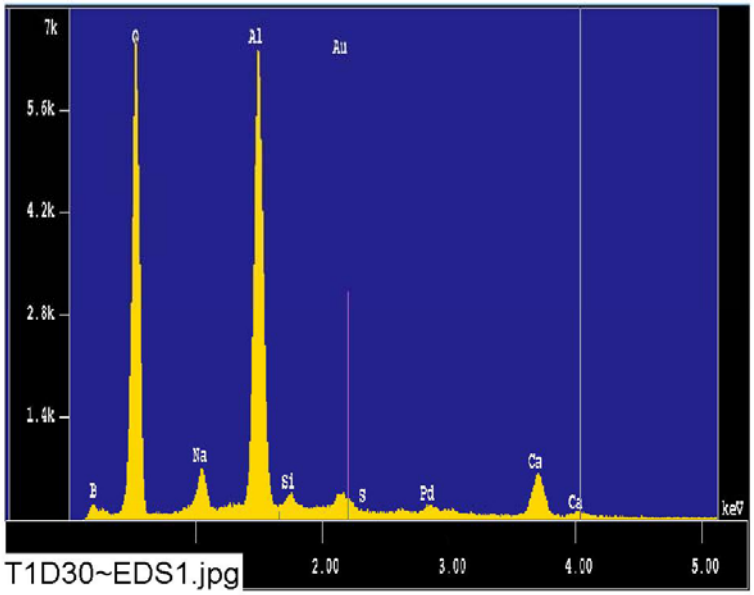

Figure D-118. Day-30, high-volume sample counting spectrum (T1D30~EDS1) for the filtrate.

The results from the chemical composition analysis for EDS (T1D30~EDS1) are given in Table D-42.

Table D-42. The Chemical Compositions for EDS (T1D30-EDS1)

```
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 Group     : NRC
 Sample    : T1D30_EDS1  ID# : 1
 Comment   : filtrate
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   :  60.000 sec    Aperture #    : 2
             Acc. Volt   : 15.0 KV        Probe Current : 2.869E-08 A
             Stage Point : X=51.618 Y=62.980 Z=10.097
             Acq. Date   : Fri Feb 25 10:17:16 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   59.9054   0.0095    53380 /     140
  Al K      Normal   1.26- 1.78   13.0861   0.0041    55272 /     259
  Si K      Normal   1.50- 2.07    0.3594   0.0017     1517 /    3145
  Ca K      Normal   3.40- 4.30    3.3380   0.0154     7454 /      63
  Na K      Normal   0.83- 1.28    1.5755   0.0137     4415 /     156
   B K      Normal   0.00- 0.36    2.8524   0.0005     1058 /      52
-------------------------------------------------------------------
                              Chi_square = 105.5553

 Element Mass%    Atomic%   ZAF      Z      A      F
      O   57.362  55.9594 0.9173 0.9628 0.9527 1.0000
     Al   14.240   8.2372 1.0424 0.9762 1.0680 0.9998
     Si    0.425   0.2363 1.1334 0.9646 1.1751 0.9999
     Ca    3.311   1.2893 0.9501 0.9801 0.9693 1.0001
     Na    1.736   1.1785 1.0555 0.9678 1.0900 1.0006
      B   22.927  33.0993 7.6998 1.1177 6.8889 1.0000
-------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  1.0439
```

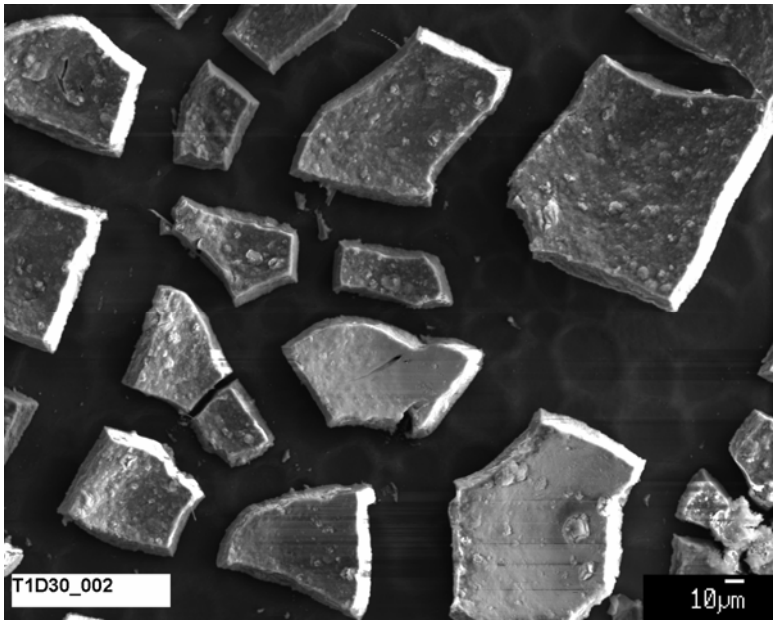

Figure D-119. Day-30, high-volume sample microprobe image (T1D30_002) magnified 300 times, close-up of the filter.

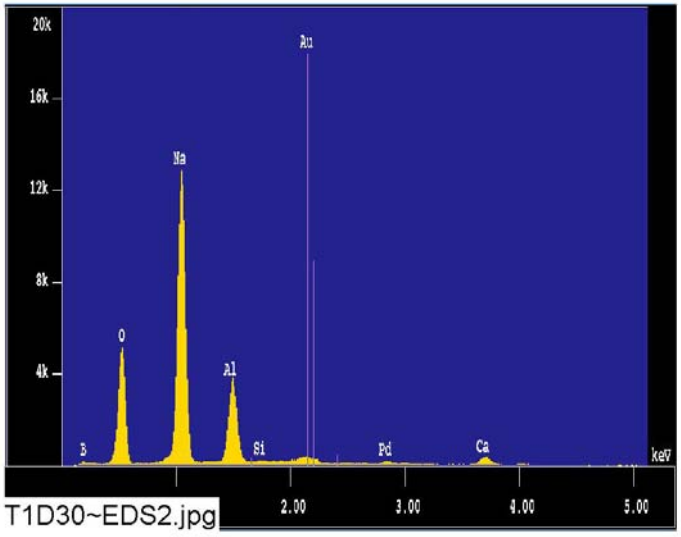

Figure D-120. Day-30, high-volume sample counting spectrum (T1D30~EDS2) on the filter, as shown in Figure D-119.

The results from the chemical composition analysis for EDS (T1D30-EDS2) are given in Table D-43.

Table D-43. The Chemical Compositions for EDS (T1D30-EDS2)

```
Feb 25 10:36 2005  /tmp/eds_pout.log Page 1


 Group     : NRC
 Sample    : T1D30_EDS2  ID# : 2
 Comment   : filtrate
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   :  60.000 sec    Aperture #    : 2
             Acc. Volt   : 15.0 KV        Probe Current : 2.841E-08 A
             Stage Point : X=51.946 Y=63.301 Z=10.071
             Acq. Date   : Fri Feb 25 10:32:31 2005


 Element     Mode     ROI(KeV)   K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77   49.2514   0.0089    43458 /     178
  Al K      Normal   1.26- 1.78    7.4252   0.0032    31056 /     234
  Si K      Normal   1.50- 2.07    0.1899   0.0016      794 /    1939
  Ca K      Normal   3.40- 4.30    1.9646   0.0133     4344 /      84
  Na K      Normal   0.83- 1.28   37.3248   0.0465   103570 /     196
   B K      Normal   0.00- 0.36    2.1713   0.0005      797 /      62
-------------------------------------------------------------------
                              Chi_square = 63.9091

 Element Mass%    Atomic%   ZAF      Z      A      F
      O   39.105  40.6471 0.8807 0.9629 0.9147 0.9999
     Al    8.360   5.1523 1.2488 0.9759 1.2797 0.9999
     Si    0.207   0.1224 1.2075 0.9643 1.2523 1.0000
     Ca    1.696   0.7035 0.9573 0.9790 0.9778 1.0001
     Na   30.078  21.7569 0.8938 0.9676 0.9227 1.0011
      B   20.555  31.6177 10.4997 1.1180 9.3919 1.0000
-------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  0.9016
```