Appendix D2

ESEM and SEM/EDS Data for Test #2, Day-30 Fiberglass in High- and Low-Flow Zones

Figures

Tables

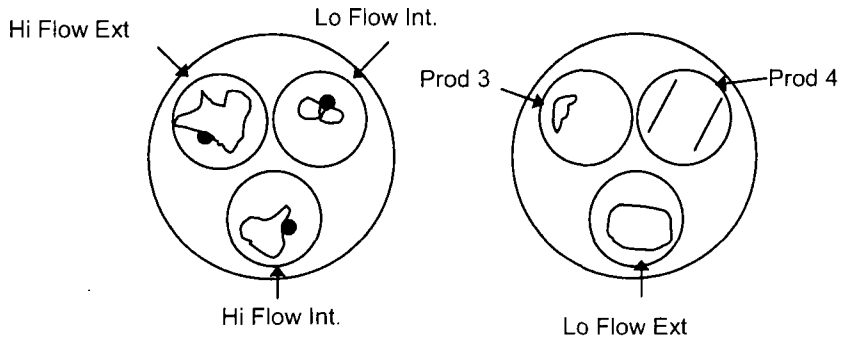
The debris accumulated on fiberglass in the ICET tests is of great interest because it may contribute to additional head loss during recirculation of the coolant following a LOCA. To evaluate the potential for debris accumulation, fiberglass samples submerged in high- and low-flow zones in the tank were examined by ESEM and SEM/EDS.

The fiberglass samples examined in this appendix were extracted on the date Test #2 was terminated (March 7, 2005). Both exterior and interior locations on the fiberglass samples were examined. Microprobe SEM was used to examine the fiberglass samples after they were air dried at room temperature and then coated with gold/palladium. In addition to microprobe SEM, ESEM was used to analyze the wet fiberglass samples without any coating. ESEM was performed under a low-vacuum condition (80 Pa) to minimize any modification of the fiberglass that could occur through the drying process. Microprobe SEM/EDS and ESEM results of Test #2, Day-30 high- and low-flow fiberglass samples were obtained on March 7 and March 9, 2005, respectively. Accompanying EDS results provide a semiquantitative elemental analysis of the debris deposited on the fiberglass.

Transcribed Laboratory Log

Microprobe laboratory session from March 7, 2005

T2D30 Samples—NRC



Conditions: 15-kV, 1-nA beam current, Aperture = 2

Sample: Low-Flow Exterior

Image:	T2D30_LoFlo014	43 ×	Overview SE image	Figure D2-1
	T2D30_LoFlo015	500 ×	SE near center	Figure D2-2
	T2D30_LoFlo016	1500 ×	SE image on same area	Figure D2-3

Sample: High-Flow Exterior

Image:	T2D30_HiFlo017	40 ×	Overview SE image	Figure D2-4
	T2D30_HiFlo018	230 ×	Center of image 017	Figure D2-5
	T2D30_HiFlo019	1000 ×	Lower right of image 018	Figure D2-6
	T2D30_HiFlo020	700 ×	New area	Figure D2-7
EDS:	T2D30EDS13		Film on high-flow fiberglass	Figure D2-8

Sample: High-Flow Interior

Image:	T2D30_HiFlo021	40 ×	SE image overview	Figure D2-9
	T2D30_HiFlo022	180 ×	SE image near center of 021 image	Figure D2-10
	T2D30_HiFlo023	1000 ×	Same area	Figure D2-11

EDS:	T2D30EDS14		Film on fiberglass Hi Flow interior	Figure D2-12
Image:	T2D30_HiFlo024	500 ×	SE on different area of sample	Figure D2-13

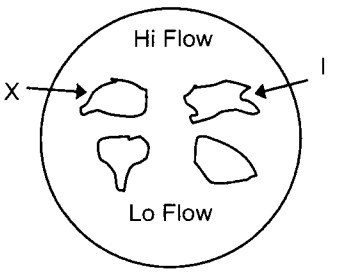
Sample: Low-Flow Interior

Image:	T2D30_LoFlo025	350 ×	On possible bacteria or Ca Phosphate	Figure D2-14
EDS:	T2D30EDS15		Globular cluster from image 025	Figure D2-15
Image:	T2D30_LoFlo026	800 ×	Different area	Figure D2-16

Transcribed Laboratory Log

ESEM Laboratory session from March 8, 2005

T2D30 Low-Vacuum SEM



Conditions: 20-kV, 12-mm Working Distance, 80 Pa pressure

Sample: High-Flow Interior

Image:	T2D30HI1	150 ×	Overview	Figure D2-17
	T2D30HI2	1000 ×		Figure D2-18

Sample: High-Flow Exterior

Image:	T2D30HX3	150 ×	Overview	Figure D2-19
	T2D30HX4	1000 ×		Figure D2-20

Sample: Low-Flow Exterior

Image:	T2D30LX5	150 ×		Figure D2-21

	T2D30LX6	1000 ×	On debris	Figure D2-22

Sample: Low-Flow Interior

Image:	T2D30LI7	150 ×	Figure D2-23
	T2D30LI8	1000 ×	Figure D2-24

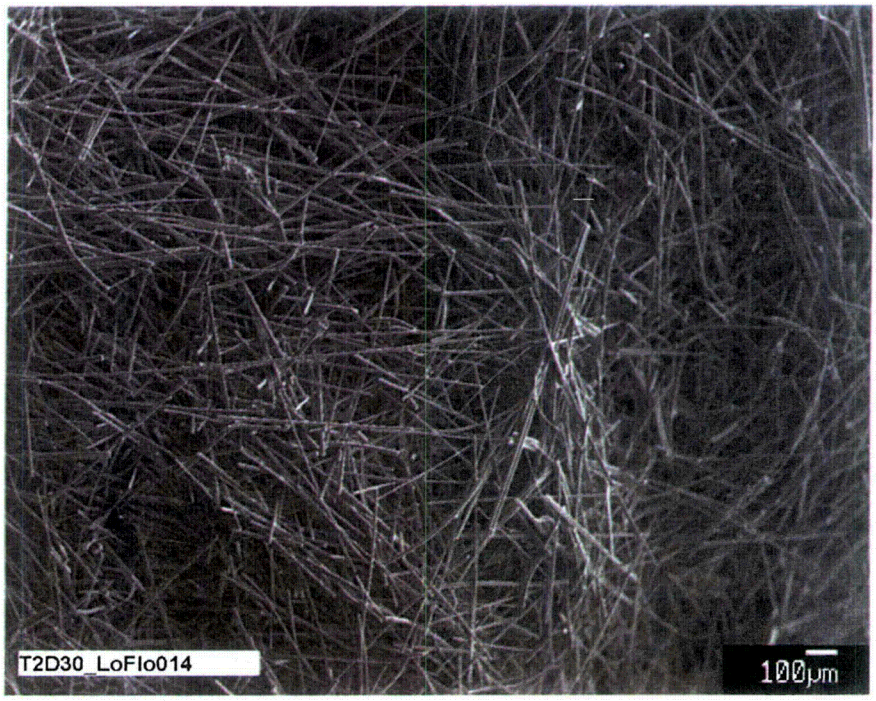


Figure D2-1. SEM image for a Test #2, Day-30 low-flow exterior fiberglass sample. (T2D30_LoFlo014)

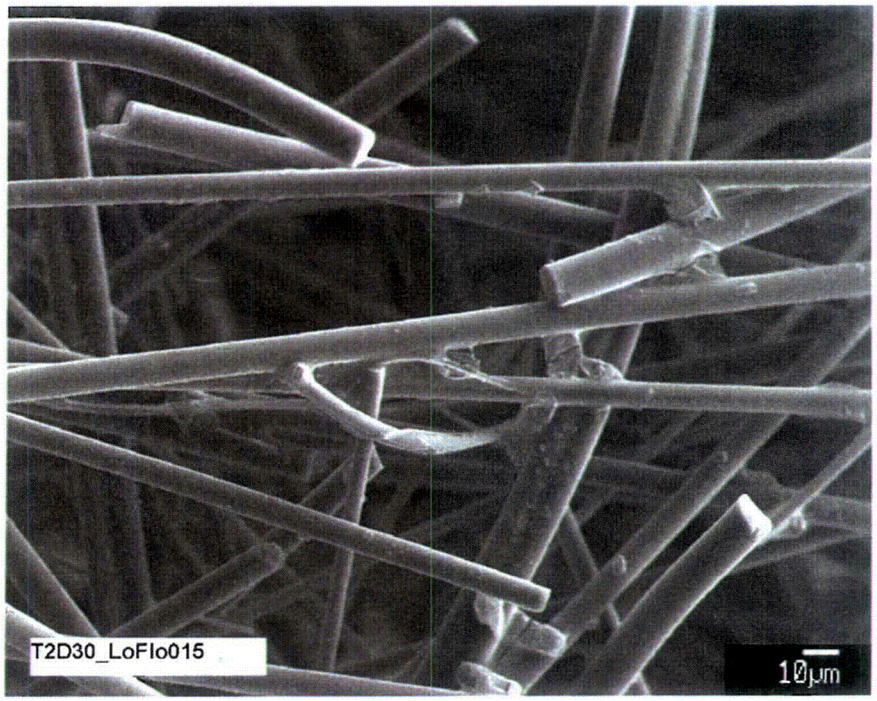


Figure D2-2. SEM image of a higher magnification for a Test #2, Day-30 low-flow exterior fiberglass sample. (T2D30_LoFlo015)

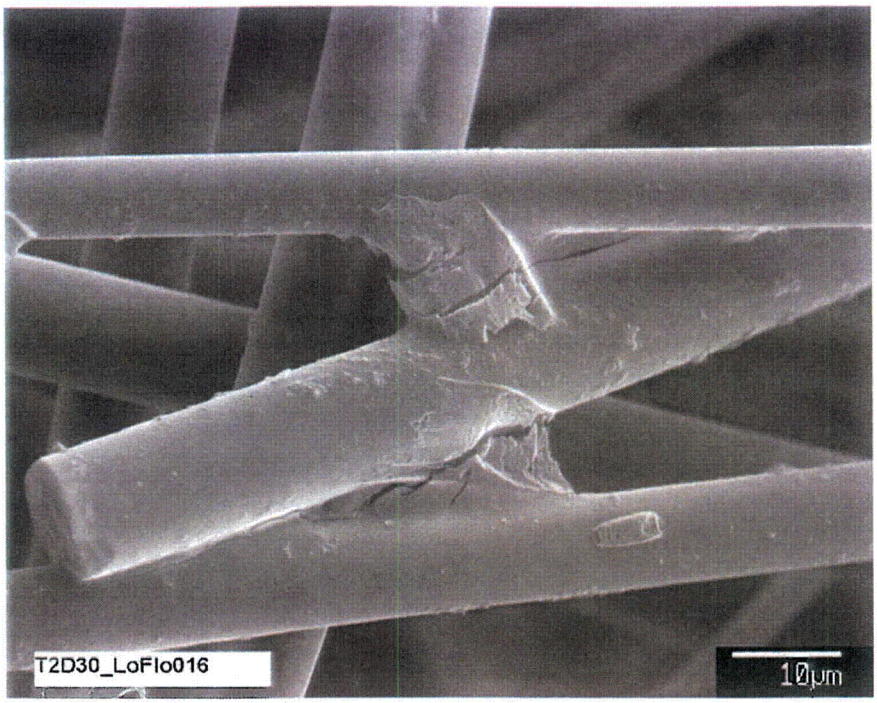


Figure D2-3. SEM image of a higher magnification for a Test #2, Day-30 low-flow exterior fiberglass sample. (T2D30_LoFlo016)

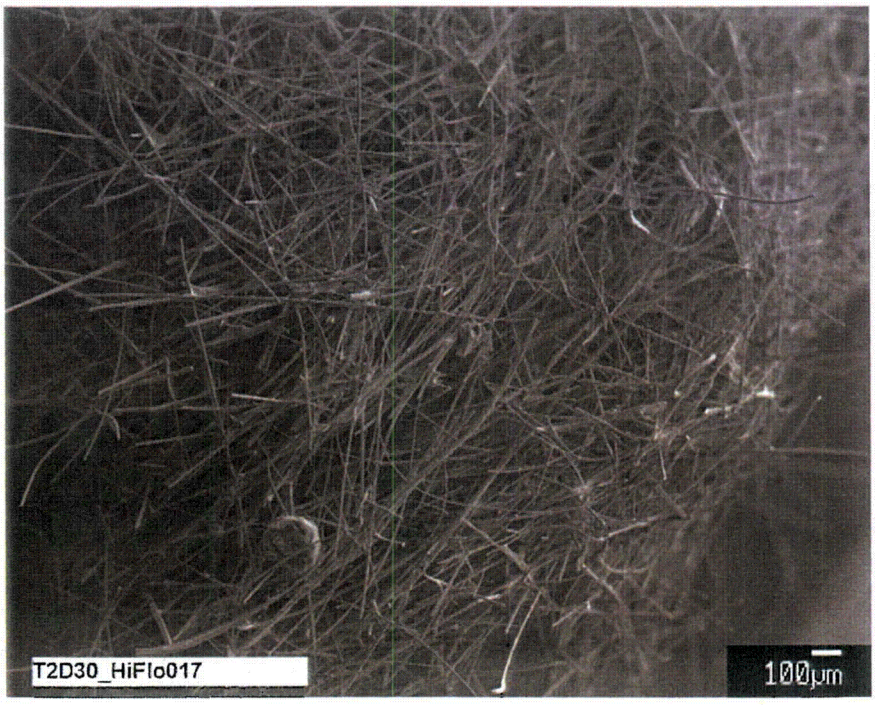


Figure D2-4. SEM image for a Test #2, Day-30 high-flow exterior fiberglass sample. (T2D30_HiFlo017)

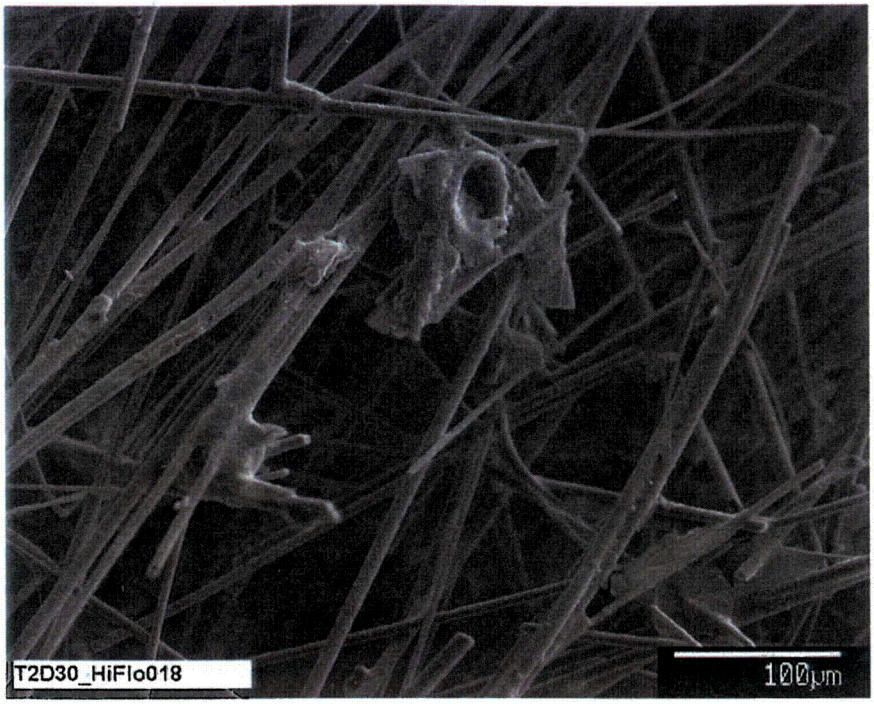


Figure D2-5. SEM image for a Test #2, Day-30 high-flow exterior fiberglass sample. (T2D30_HiFlo018)

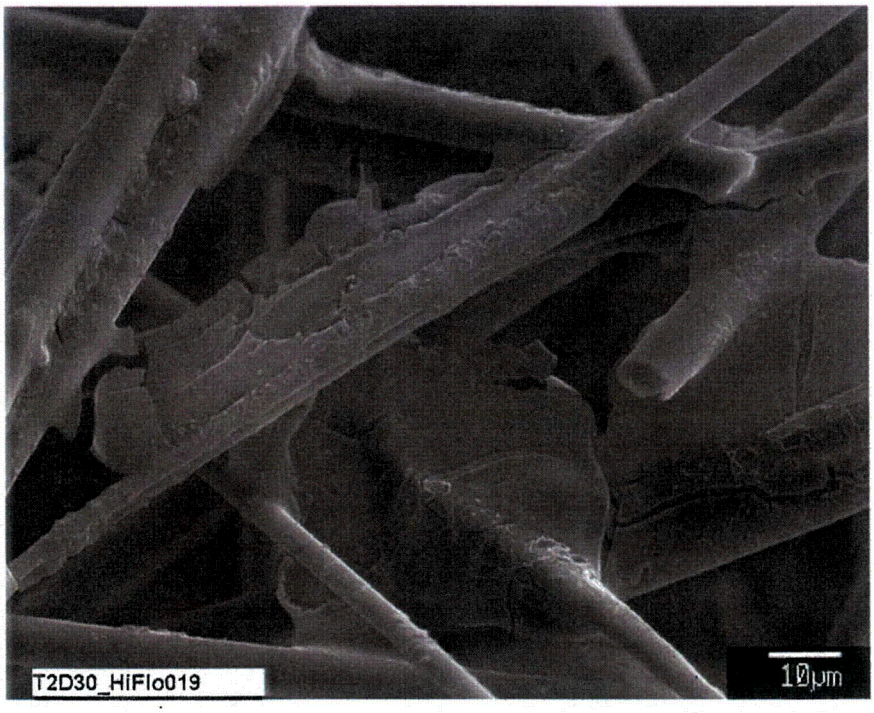


Figure D2-6. SEM image of a higher magnification for a Test #2, Day-30 high-flow exterior fiberglass sample. (T2D30_HiFlo019)

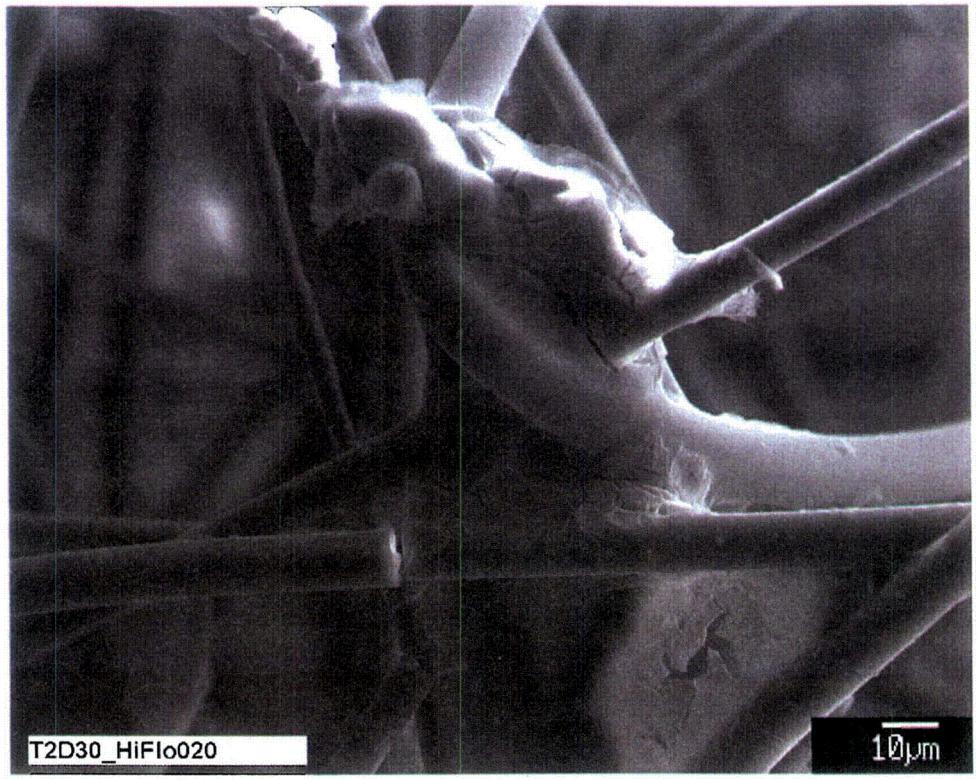


Figure D2-7. SEM image of a higher magnification for a Test #2, Day-30 high-flow exterior fiberglass sample. (T2D30_HiFlo020)

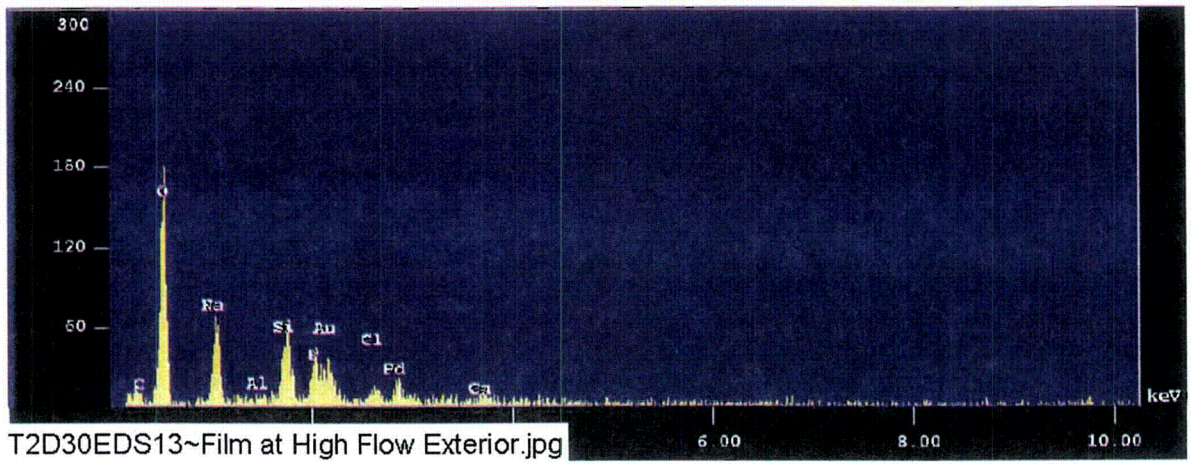


Figure D2-8. EDS counting spectrum for the film deposits or growth on fiberglass, as shown in Figure D2-7. (T2D30EDS13~Film at High Flow Exterior)

The results from the chemical composition analysis for T2D30EDS13 are given in Table D2-1.

Table D2-1. The Chemical Composition for T2D30EDS13 (Figure D2-8)

Mar 7 17:24 2005 /tmp/eds_pout.log Page 1

Group : NRC
Sample : T2D30 ID# : 13
Comment : film on HiFlow fiberglass
Condition : Full Scale : 20KeV(10eV/ch,2Kch)
Live Time : 60.000 sec Aperture # : 1
Acc. Volt : 20.0 KV Probe Current : 3.247E-10 A
Stage Point : X=48.137 Y=56.660 Z=10.558
Acq. Date : Mon Mar 7 17:20:30 2005

Element	Mode	ROI(KeV)	K-ratio(%)	+/-	Net/Background
C K	Normal	0.09- 0.46	0.0000	0.0000	0 / 15
O K	Normal	0.25- 0.77	22.7584	0.0029	1420 / 8
Na K	Normal	0.81- 1.27	2.3831	0.0008	576 / 4
Si K	Normal	1.50- 2.05	1.2480	0.0002	522 / 18
P K	Normal	1.75- 2.38	1.3516	0.0016	300 / 34
Cl K	Normal	2.34- 3.06	0.4706	0.0004	143 / 5
Ca K	Normal	3.39- 4.30	0.4212	0.0006	103 / 3

Chi_square = 2.5421

Element	Mass%	Atomic%	ZAF	Z	A	F
C	0.000	0.0000	6.0057	1.0404	5.7730	0.9999
O	68.212	77.9670	0.7076	0.9928	0.7128	1.0000
Na	15.750	12.5283	1.5604	1.0448	1.4934	1.0001
Si	7.284	4.7427	1.3779	0.9953	1.3873	0.9980
P	4.750	2.8046	0.8298	1.1782	0.7048	0.9993
Cl	2.197	1.1335	1.1025	1.0478	1.0529	0.9993
Ca	1.806	0.8239	1.0120	1.0156	0.9965	1.0000
Total	100.000	100.0000				

Normalization factor = 4.2357

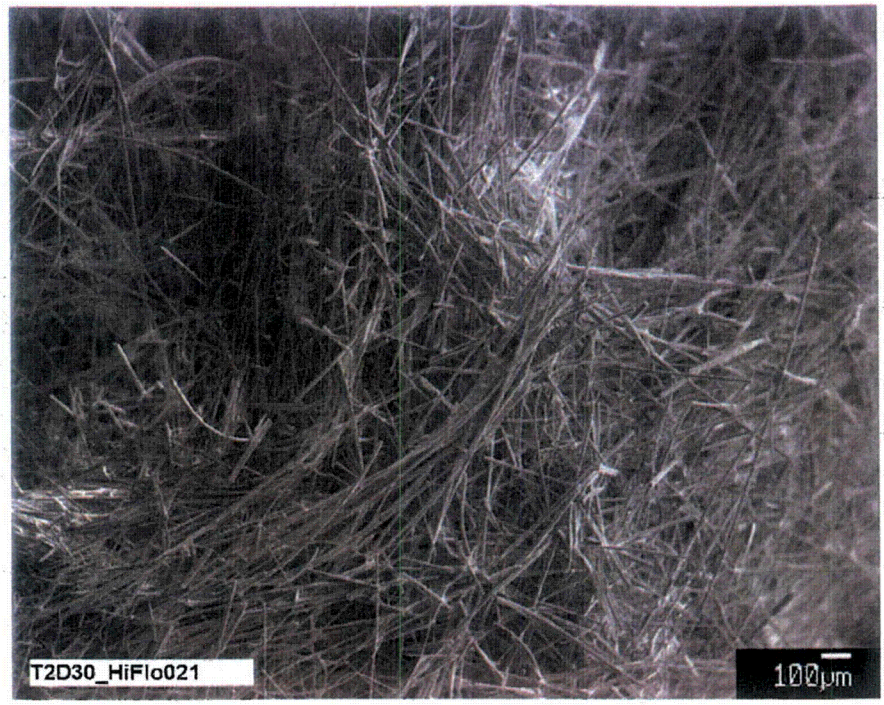


Figure D2-9. SEM image for a Test #2, Day-30 high-flow interior fiberglass sample. (T2D30_HiFlo021)

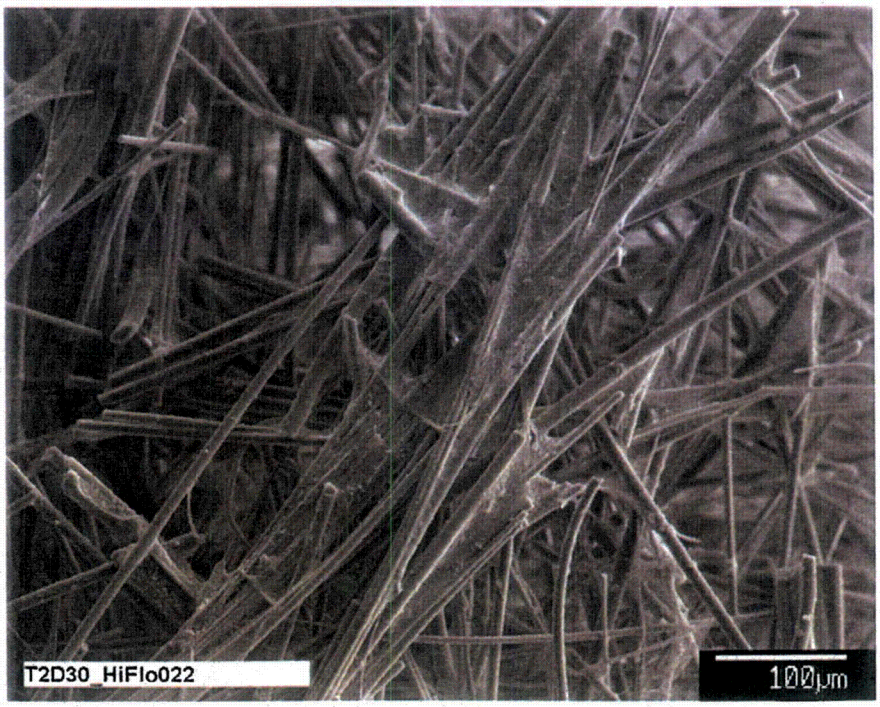


Figure D2-10. SEM image for a Test #2, Day-30 high-flow interior fiberglass sample. (T2D30_HiFlo022)

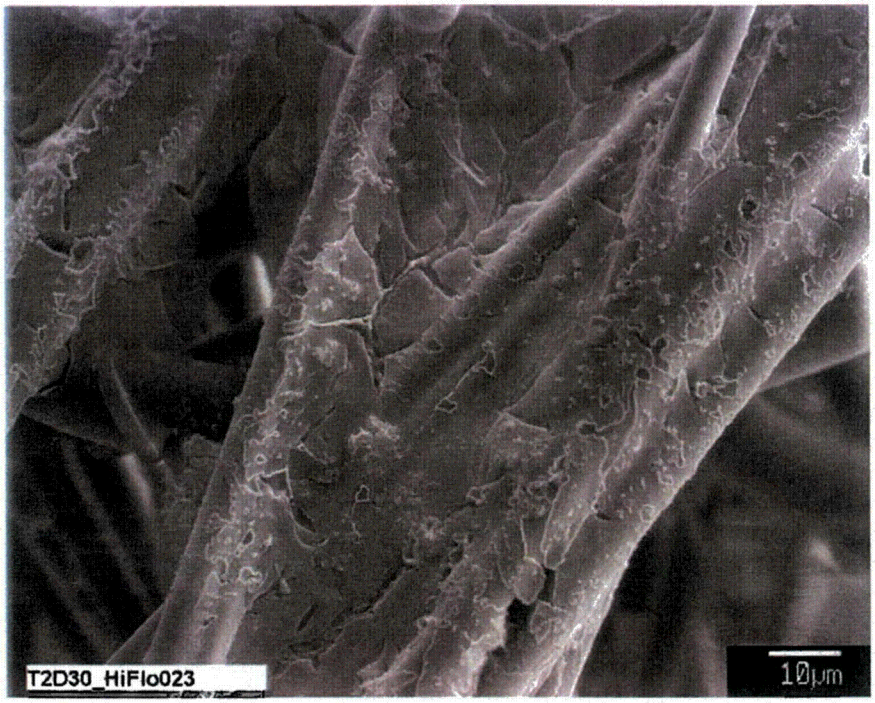


Figure D2-11. SEM image at 1000× magnification for a Test #2, Day-30 high-flow interior fiberglass sample. (T2D30_HiFlo023)

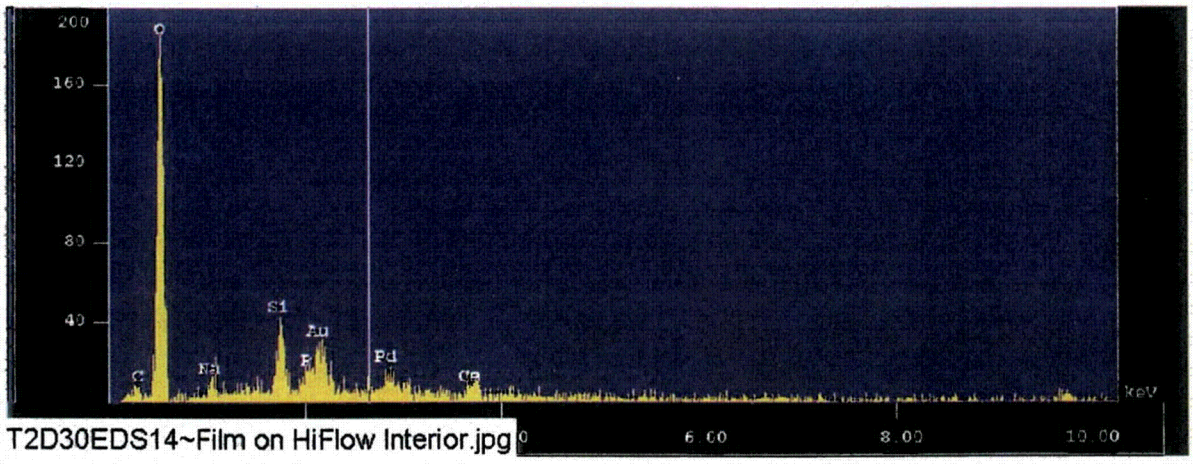


Figure D2-12. EDS counting spectrum for the film deposits or growth on fiberglass, as shown in Figure D2-11. (T2D30EDS14~Film on HiFlow Interior)

The results from the chemical composition analysis for T2D30EDS14 are given in Table D2-2.

Table D2-2. The Chemical Composition for T2D30EDS~14 (Figure D2-12)

Mar 7 17:37 2005 /tmp/eds_pout.log Page 1

Group : NRC
Sample : T2D30 ID# : 14
Comment : film on hi flow fiberglass interior
Condition : Full Scale : 20KeV(10eV/ch,2Kch)
Live Time : 60.000 sec Aperture # : 1
Acc. Volt : 20.0 KV Probe Current : 3.155E-10 A
Stage Point : X=43.227 Y=69.357 Z=10.558
Acq. Date : Mon Mar 7 17:34:53 2005

Element	Mode	ROI(KeV)	K-ratio(%)	+/-	Net/Background
C K	Normal	0.09- 0.46	0.0000	0.0000	0 / 18
O K	Normal	0.25- 0.77	23.9534	0.0029	1452 / 6
Na K	Normal	0.81- 1.27	0.4162	0.0004	98 / 4
Si K	Normal	1.50- 2.05	0.7810	0.0002	317 / 14
P K	Normal	1.75- 2.38	0.2529	0.0013	55 / 26
Ca K	Normal	3.39- 4.30	0.4296	0.0005	102 / 5

Chi_square = 3.6593

Element	Mass%	Atomic%	ZAF	Z	A	F
C	0.000	0.0000	3.8510	1.0451	3.6851	0.9999
O	85.150	90.8939	0.5770	0.9974	0.5785	1.0000
Na	4.620	3.4320	1.8017	1.0498	1.7160	1.0002
Si	6.368	3.8722	1.3235	1.0003	1.3239	0.9994
P	1.246	0.6870	0.7999	1.1842	0.6756	0.9999
Ca	2.616	1.1148	0.9886	1.0213	0.9680	1.0000
Total	100.000	100.0000				

Normalization factor = 6.1604

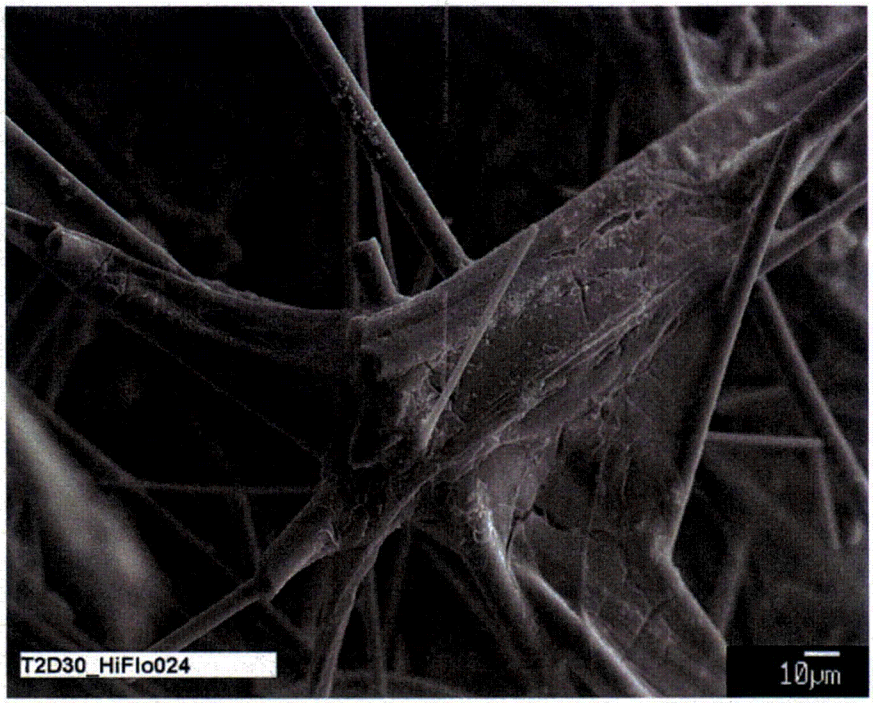


Figure D2-13. SEM image of a higher magnification for a Test #2, Day-30 high-flow interior fiberglass sample. (T2D30_HiFlo024)

Figure D2-14. SEM image for a Test #2, Day-30 low-flow interior fiberglass sample. (T2D30_LoFlo025)

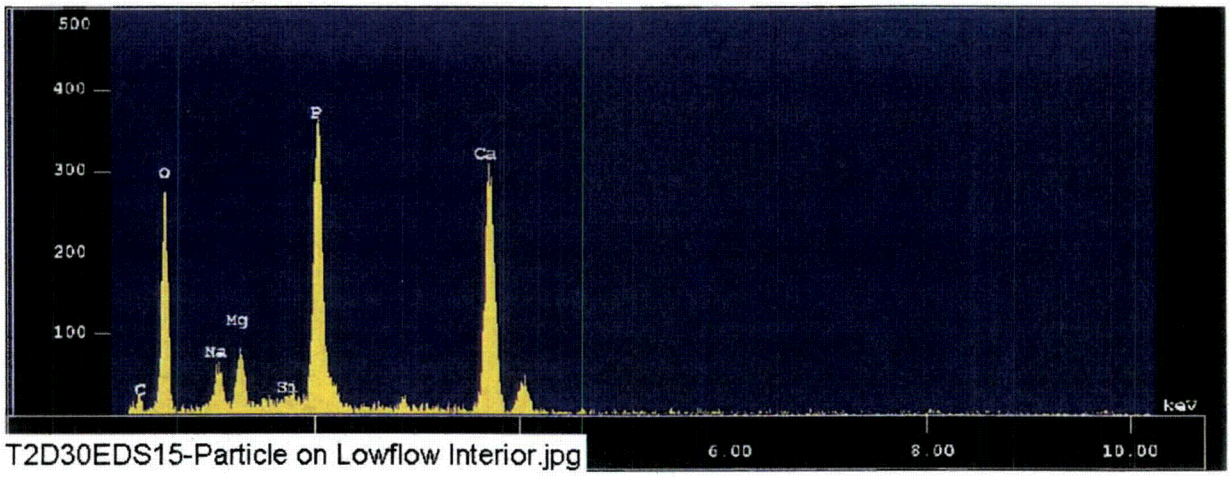


Figure D2-15. EDS counting spectrum for the particulate deposits or growth on fiberglass, as shown in Figure D2-14. (T2D30EDS15-Particle on Lowflow Interior)

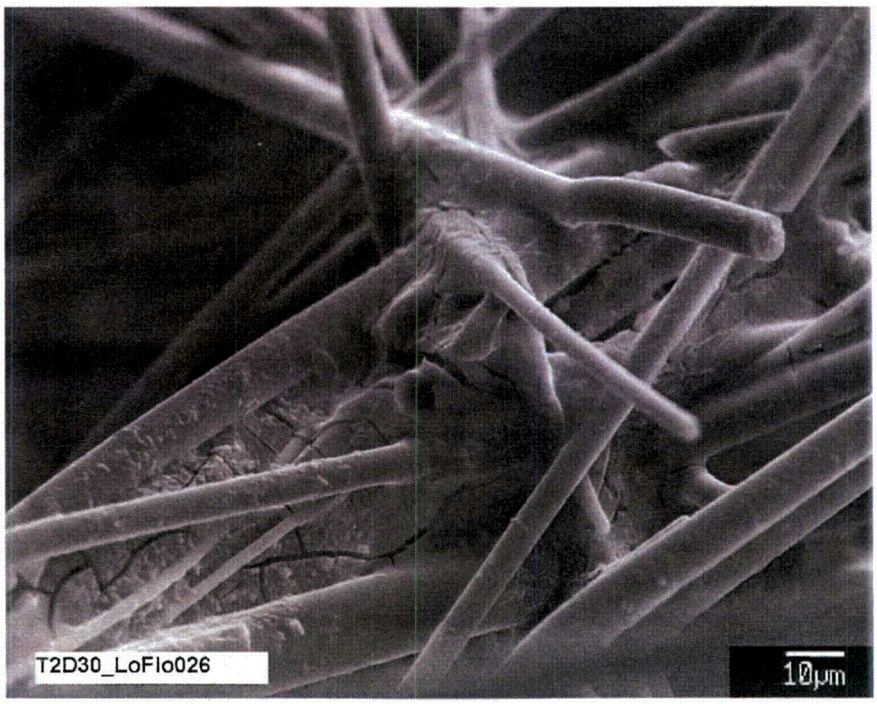


Figure D2-16. SEM image of a higher magnification for a Test #2, Day-30 low-flow interior fiberglass sample. (T2D30_LoFlo026)

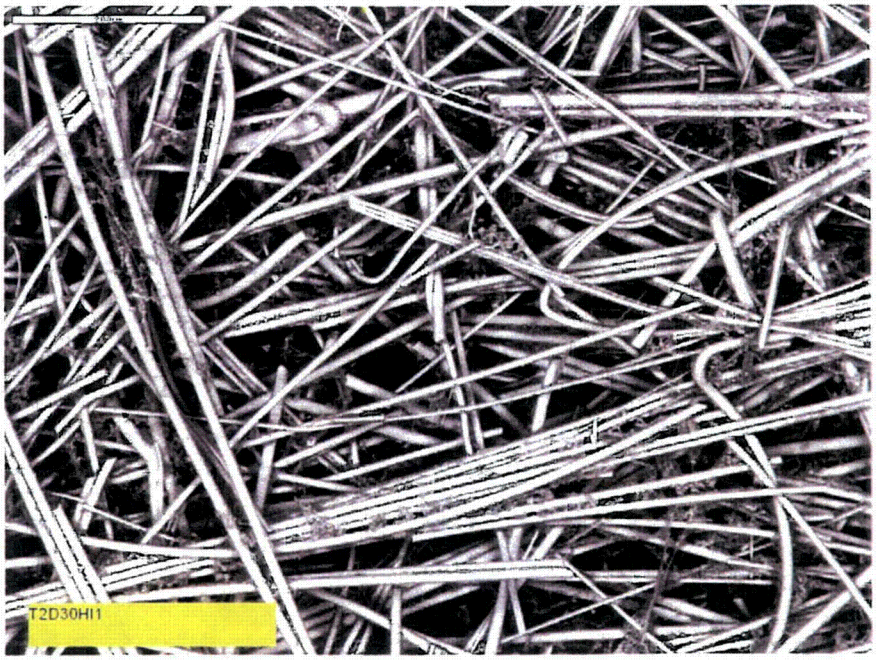


Figure D2-17. ESEM image for a Test #2, Day-30 high-flow interior fiberglass sample. It seems the interior fiberglass is cleaner than exterior fiberglass. (T2D30HI1)

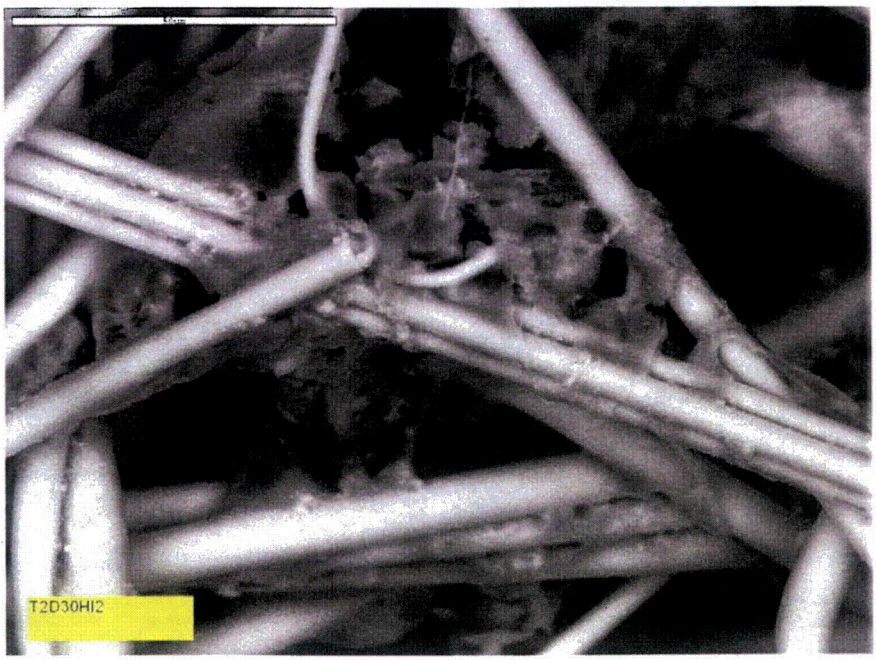


Figure D2-18. ESEM image of a higher magnification for a Test #2, Day-30 high-flow interior fiberglass sample. (T2D30HI2)

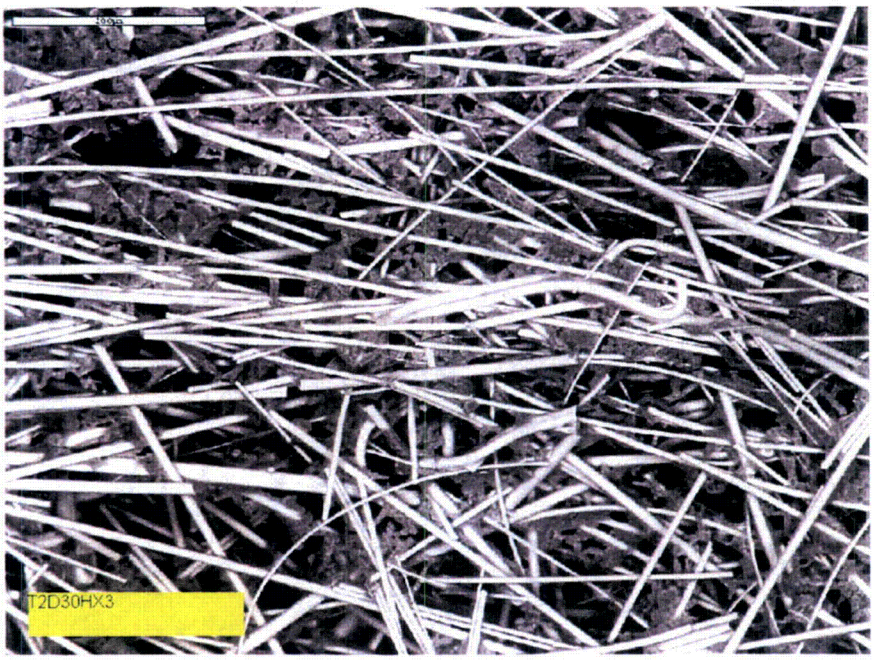


Figure D2-19. ESEM image for a Test #2, Day-30 high-flow exterior fiberglass sample. (T2D30HX3)

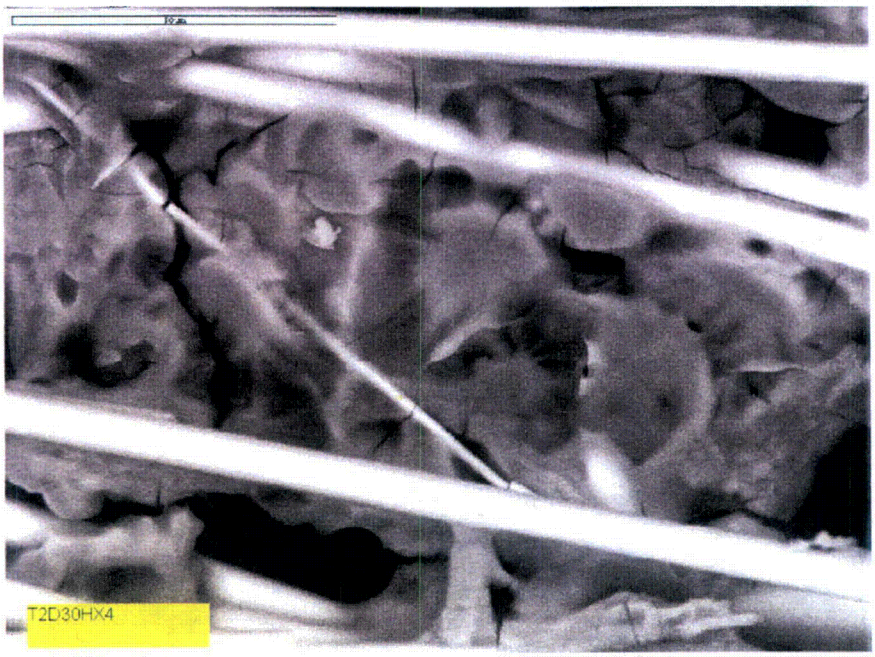


Figure D2-20. ESEM image of a higher magnification for a Test #2, Day-30 high-flow exterior fiberglass sample. (T2D30HX4)

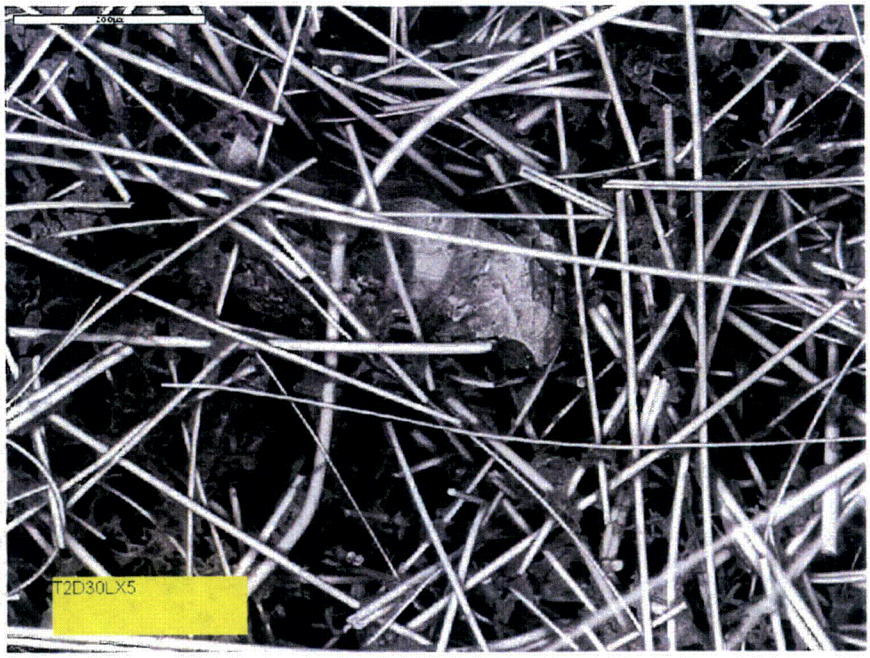


Figure D2-21. ESEM image for a Test #2, Day-30 low-flow exterior fiberglass sample. (T2D30LX5)

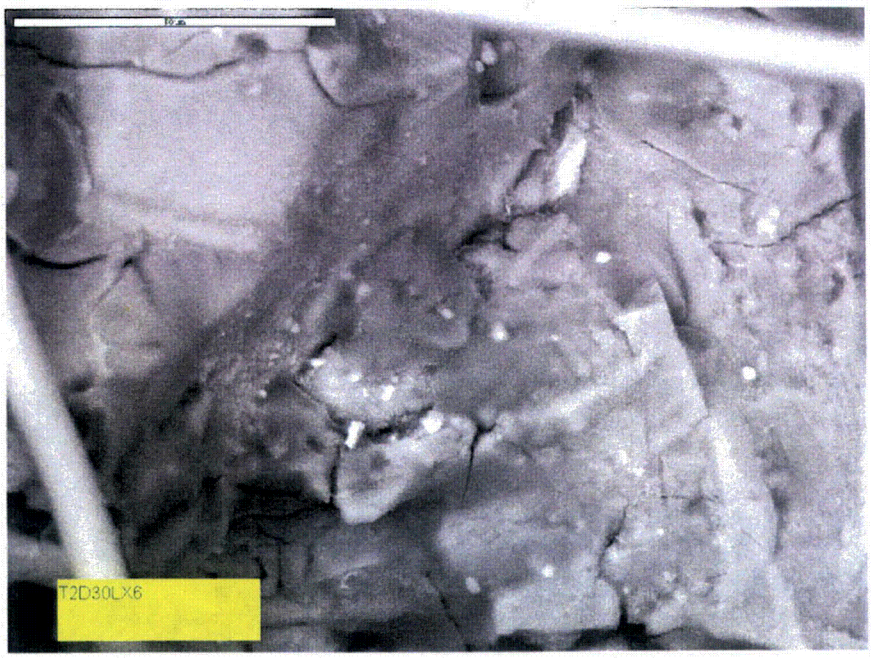


Figure D2-22. ESEM image of a higher magnification for a Test #2, Day-30 low-flow exterior fiberglass sample. (T2D30LX6)

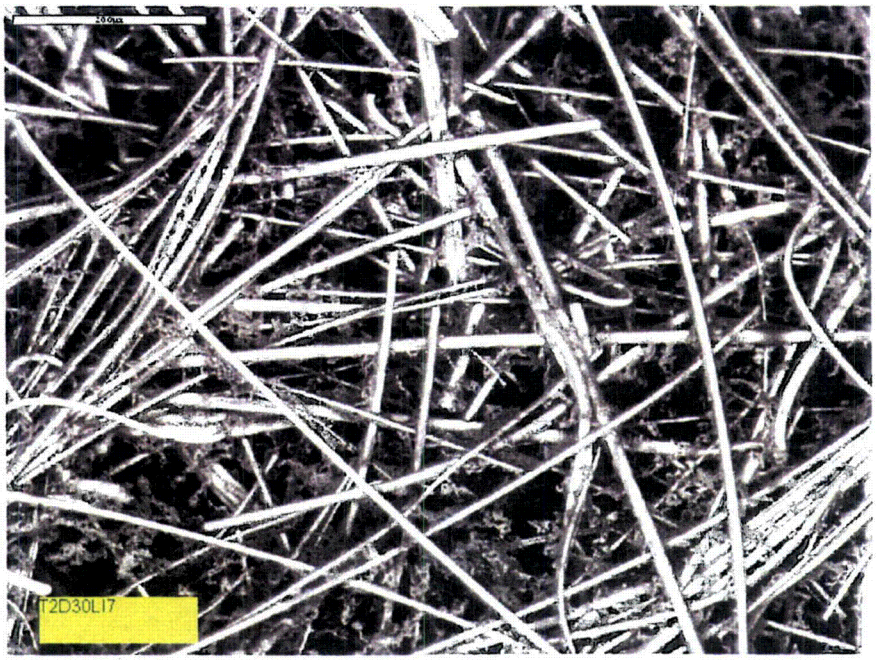


Figure D2-23. ESEM image for a Test #2, Day-30 low-flow interior fiberglass sample. (T2D30LI7)

Figure D2-24. ESEM image of a higher magnification for a Test #2, Day-30 low-flow interior fiberglass sample. (T2D30LI8)

Appendix D3

ESEM and SEM/EDS Data for Test #2, Day-30 Drain Collar Fiberglass

Figures

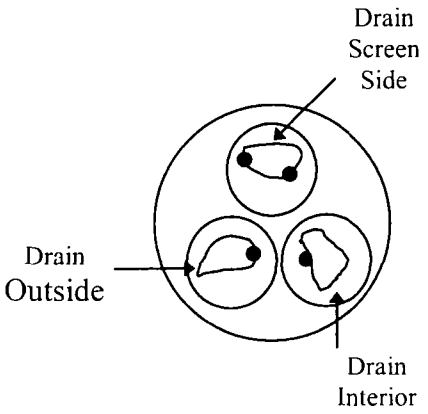
Tables

Chemical deposits accumulated on fiberglass during ICET testing are of great interest because they may cause additional head loss during recirculation of the coolant following a LOCA. The drain collar placed in the test tank represents an area of higher flow velocity, where water continually flows through any accumulated debris. This condition of continual water flow is similar to that found on the face of a recirculation sump screen, so it is important to examine the fiberglass samples recovered from the drain collar via ESEM and SEM/EDS and compare the results with similar examinations of fiberglass from alternative flow regimes.

Fiberglass samples from the drain collar were extracted on the date that Test #2 was shut down (March 7, 2005). Samples located at the outside exterior (away from the drain screen), the inside exterior (next to the drain screen), and the interior of the collar were examined. Microprobe SEM was used to examine the fiberglass samples after they were dried in air at room temperature and coated with carbon. In addition to microprobe SEM, ESEM was used to analyze the wet fiberglass samples. ESEM was performed without any required coating under a low-vacuum condition (80 Pa) to minimize any modification of the sample that might occur through the drying process. Microprobe SEM/EDS and ESEM results of the Test #2, Day-30 drain collar fiberglass samples were obtained on March 9, 2005.

Transcribed Laboratory Log

Microprobe laboratory session from March 9, 2005
T2D30 samples from fiberglass drain collar



Conditions: 15-kV, 1-nA beam current, Aperture=2
Note: Bold spots on sketch denote carbon glue used to secure the samples.

Sample: Drain Screenside

Image:	T2D30_DrainScreen029	150 ×	SE	Figure D3-1
	T2D30_DrainScreen030	150 ×	BSE	Figure D3-2
	T2D30_DrainScreen031	90 ×	SE	Figure D3-3
	T2D30_DrainScreen032	1000×	SE	Figure D3-4
EDS:	T2D30EDS16		Center of image 032	Figure D3-5
	T2D30EDS17		Film on fiberglass	Figure D3-6

Sample: Drain Outside

Image:	T2D30_DrainOutside033	90 ×	SE	Figure D3-7
	T2D30_DrainOutside034	150 ×	SE same area	Figure D3-8
	T2D30_DrainOutside035	150 ×	BSE same area	Figure D3-9
	T2D30_DrainOutside036	1000 ×	SE same area	Figure D3-10
EDS:	T2D30EDS18		Particles on fiberglass, high C content	Figure D3-11
	T2D30EDS19		Particle on fiberglass, high C content	Figure D3-12

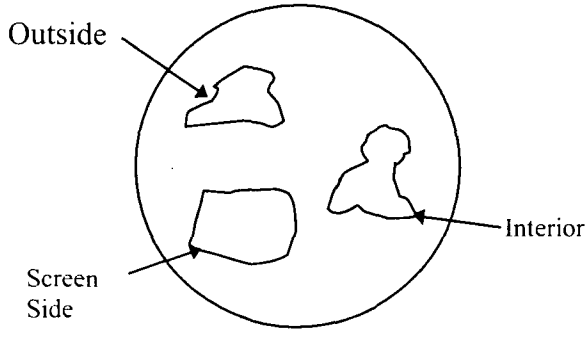
Note: *Very difficult to get EDS spectrum of particles. The particles are very thin and react under the beam. EDS18 and EDS19 are simply replicates at slightly different sample locations.

Sample: Drain Interior

Image:	T2D30_DrainInt037	90 ×	SE	Figure D3-13
	T2D30_DrainInt038	150 ×	SE new area	Figure D3-14
	T2D30_DrainInt039	1000 ×	SE same area	Figure D3-15
	T2D30_DrainInt040	150 ×	BSE same area	Figure D3-16
EDS:	T2D30EDS20		Particles on fiberglass	Figure D3-17

Transcribed Laboratory Log

ESEM laboratory session from March 9, 2005
T2D30 NRC - Fiberglass on Drain Collar ESEM



Conditions: 20-kV, 12-mm Working Distance, 80 Pa pressure

Outside Sample

Image:	T2D30DO1	150 ×	BSE Overview	Figure D3-18
	T2D30DO2	1000 ×	Same area	Figure D3-19
	T2D30DO3	90 ×	Same area	Figure D3-20

Screen-Side Sample

Image:	T2D30DS4	90 ×	Overview	Figure D3-21
	T2D30DS5	150 ×	Same area	Figure D3-22
	T2D30DS6	1000 ×	Same area as above	Figure D3-23

Interior Sample

Image:	T2D30DI7	90 ×	1st area	Figure D3-24
	T2D30DI8	150 ×	Different area	Figure D3-25
	T2D30DI9	1000 ×	Same as above	Figure D3-26

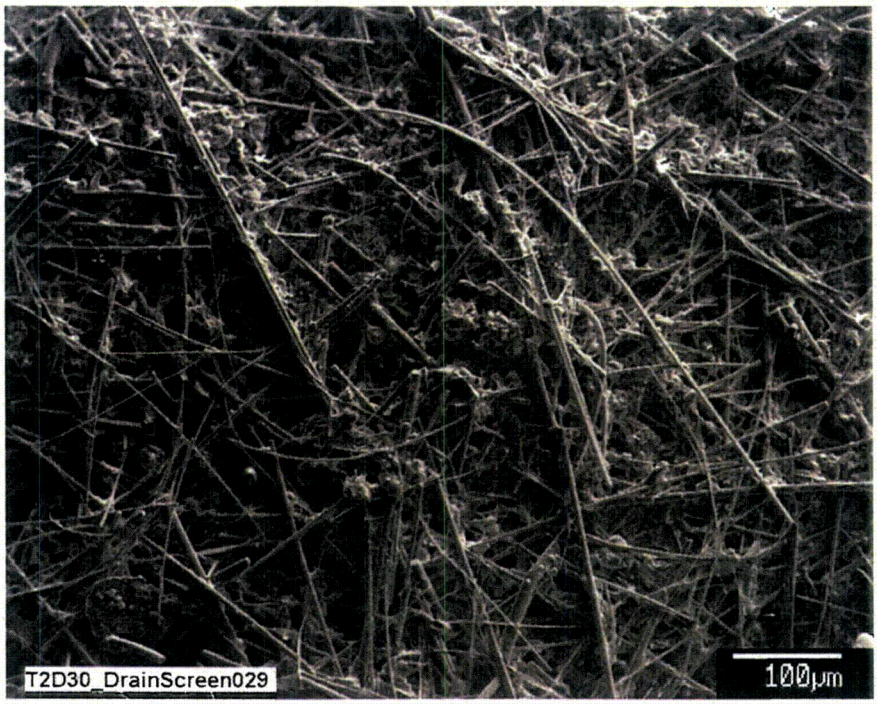


Figure D3-1. SEM image for a Test #2, Day-30 fiberglass sample on the drain collar next to the drain screen. (T2D30_DrainScreen029)

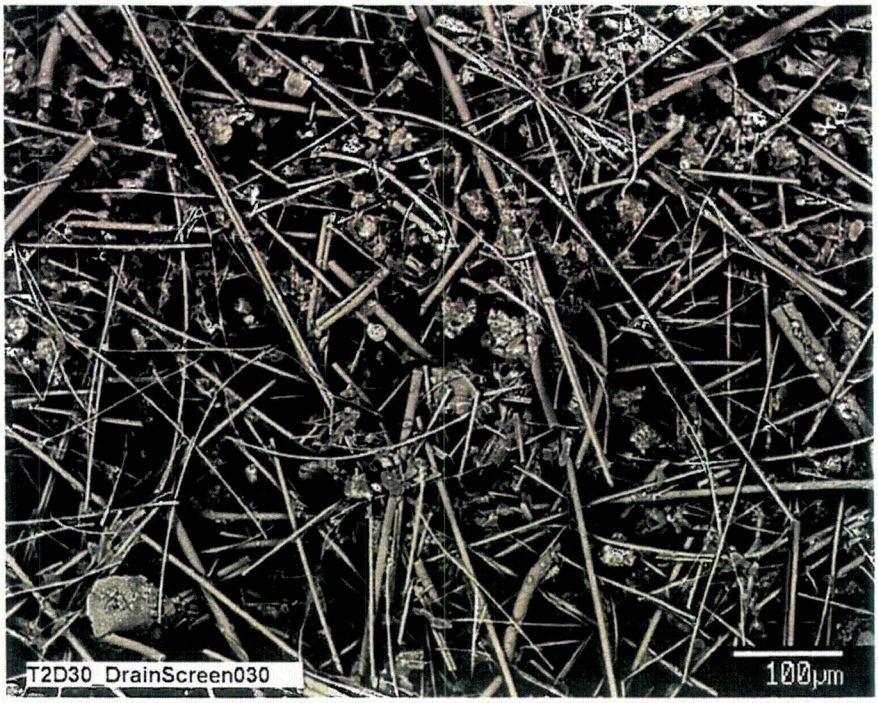


Figure D3-2. Backscattered SEM image for a Test #2, Day-30 fiberglass sample on the drain collar next to the drain screen, illustrating that deposits have a similar atomic number to fiberglass. (T2D30_DrainScreen030)

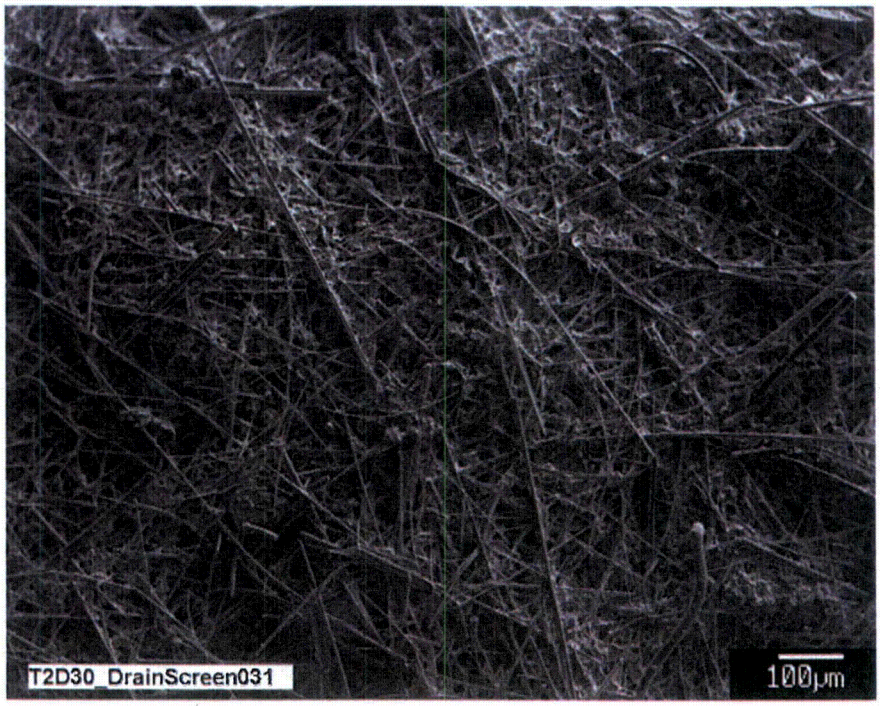


Figure D3-3. SEM image for a Test #2, Day-30 fiberglass sample on the drain collar next to the drain screen. (T2D30_DrainScreen031)

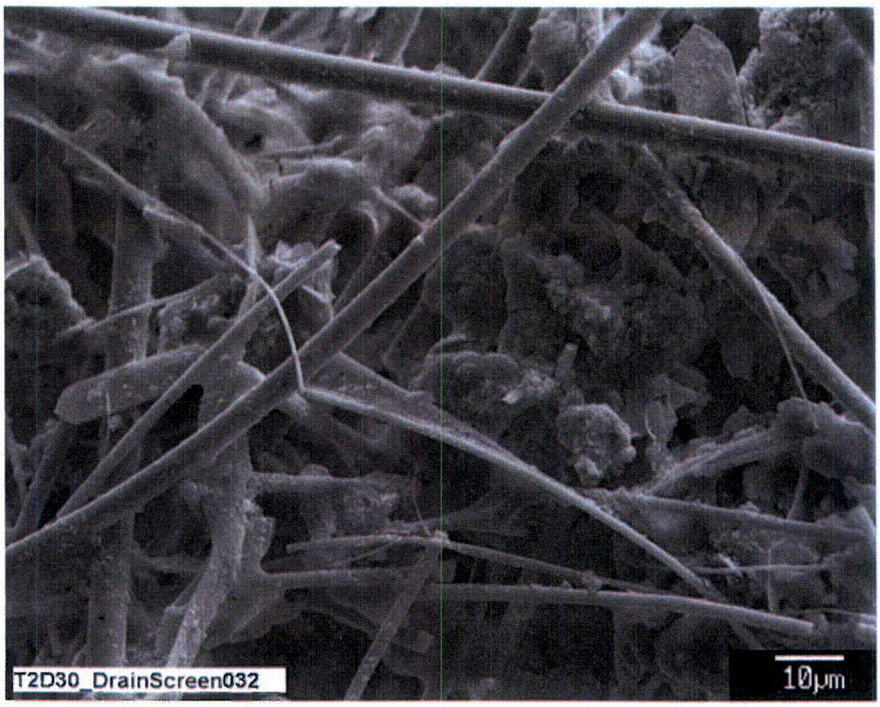


Figure D3-4. SEM image at 1000× magnification for a Test #2, Day-30 fiberglass sample on the drain collar next to the drain screen. (T2D30_DrainScreen032)

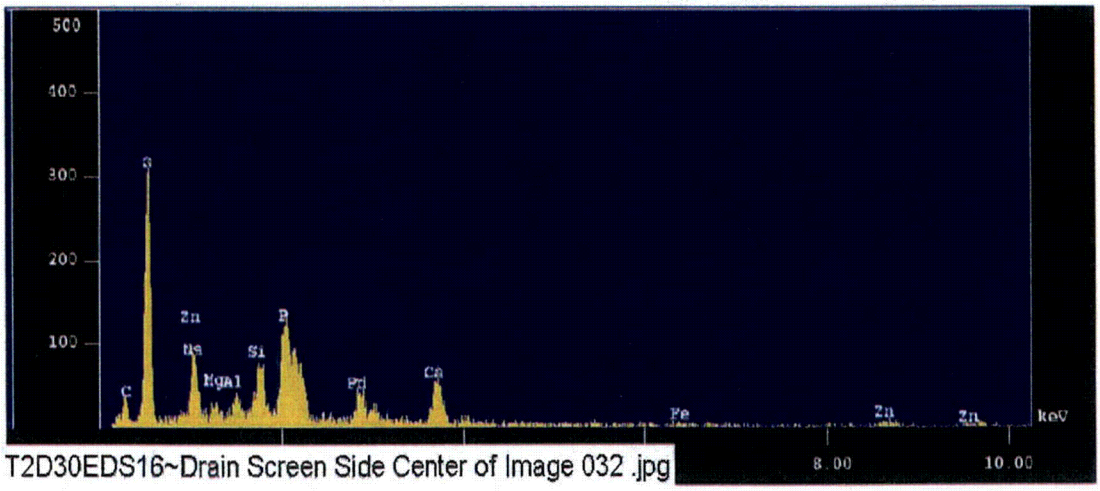


Figure D3-5. EDS counting spectrum for the center of the image shown in Figure D3-4. (T2D30EDS16~Drain Screen Side Center of Image 032)

The results from the chemical composition analysis for T2D30EDS16 are given in Table D3-1.

Table D3-1. The Chemical Composition for T2D30EDS16 (Figure D3-5)

Mar 9 17:18 2005 /tmp/eds_pout.log Page 1

Group : NRC
Sample : T2D30 ID# : 16
Comment : drain screen side
Condition : Full Scale : 20KeV(10eV/ch,2Kch)
Live Time : 60.000 sec Aperture # : 1
Acc. Volt : 15.0 KV Probe Current : 1.004E-09 A
Stage Point : X=75.582 Y=53.863 Z=10.627
Acq. Date : Wed Mar 9 16:16:45 2005

Element	Mode	ROI(KeV)	K-ratio(%)	+/-	Net/Background
C K	Normal	0.09- 0.46	0.0000	0.0000	0 / 27
O K	Normal	0.25- 0.77	88.9796	0.0022	2775 / 22
Na K	Normal	0.83- 1.28	2.1316	0.0068	209 / 19
Al K	Normal	1.26- 1.78	1.4306	0.0004	211 / 53
Si K	Normal	1.50- 2.07	3.5171	0.0007	520 / 73
P K	Normal	1.75- 2.38	13.8624	0.0024	1032 / 44
Ca K	Normal	3.40- 4.30	9.2372	0.0047	722 / 7
Zn K	Normal	8.22-10.03	10.8880	0.0035	98 / 3

Chi_square = 2.8663

Element	Mass%	Atomic%	ZAF	Z	A	F
C	0.000	0.0000	4.3367	1.0203	4.2504	0.9999
O	65.359	81.5376	0.9412	0.9731	0.9672	1.0000
Na	2.262	1.9637	1.3596	0.9772	1.3894	1.0013
Al	1.422	1.0518	1.2735	0.9851	1.2952	0.9981
Si	3.163	2.2478	1.1523	0.9730	1.1881	0.9968
P	9.891	6.3735	0.9142	1.1728	0.7798	0.9996
Ca	7.056	3.5137	0.9787	0.9855	0.9933	0.9998
Zn	10.847	3.3119	1.2765	1.2799	0.9973	1.0000
Total	100.000	100.0000				

Normalization factor = 0.7805

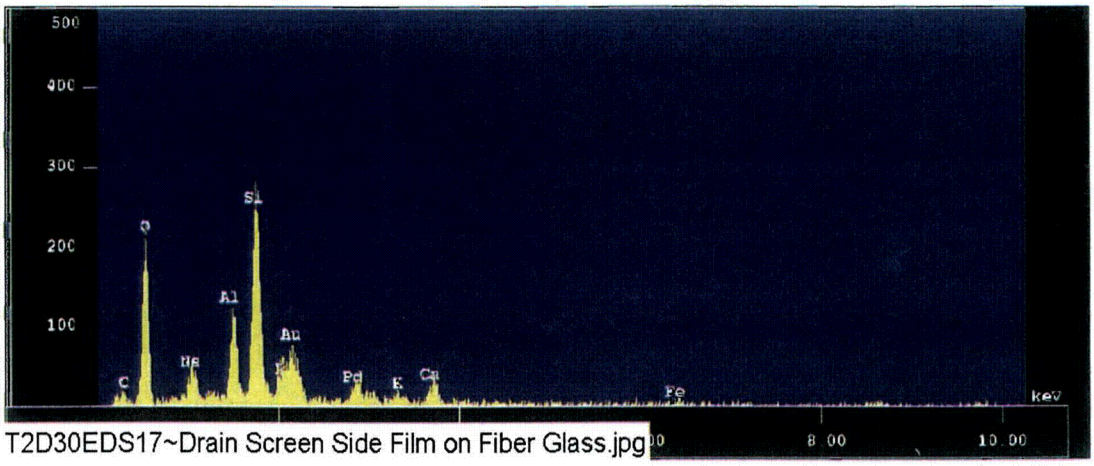


Figure D3-6. EDS counting spectrum for the film between fibers shown in Figure D3-4. The film is rich in silicon, oxygen, aluminum, sodium, and calcium. (T2D30EDS17~Drain Screen Side Film on Fiber Glass)

The results from the chemical composition analysis for T2D30EDS17 are given in Table D3-2.

Table D3-2. The Chemical Composition for T2D30EDS17 (Figure D3-6)

Mar 9 17:20 2005 /tmp/eds_pout.log Page 1

Group : NRC
Sample : T2D30 ID# : 17
Comment : film on fiberglass
Condition : Full Scale : 20KeV(10eV/ch,2Kch)
Live Time : 60.000 sec Aperture # : 1
Acc. Volt : 15.0 KV Probe Current : 1.001E-09 A
Stage Point : X=75.684 Y=53.977 Z=10.627
Acq. Date : Wed Mar 9 16:21:30 2005

Element	Mode	ROI(KeV)	K-ratio(%)	+/-	Net/Background
O K	Normal	0.25- 0.77	7.9629	0.0018	1866 / 12
Na K	Normal	0.83- 1.28	0.4017	0.0037	296 / 15
Al K	Normal	1.26- 1.78	0.8589	0.0006	954 / 93
Si K	Normal	1.50- 2.07	2.1743	0.0011	2413 / 84
P K	Normal	1.75- 2.38	0.6172	0.0018	345 / 129
Ca K	Normal	3.40- 4.30	0.6433	0.0037	378 / 6
Fe K	Normal	6.04- 7.40	0.0946	0.0232	18 / 2

Chi_square = 2.9399

Element	Mass%	Atomic%	ZAF	Z	A	F
O	59.959	73.0617	0.9746	0.9921	0.9824	1.0000
Na	3.492	2.9608	1.1249	0.9964	1.1283	1.0006
Al	7.333	5.2984	1.1051	1.0045	1.1064	0.9944
Si	18.694	12.9763	1.1128	0.9923	1.1231	0.9986
P	4.794	3.0176	1.0055	1.1961	0.8408	0.9998
Ca	4.994	2.4289	1.0048	1.0056	0.9992	1.0000
Fe	0.734	0.2562	1.0038	1.0013	1.0018	1.0008
Total	100.000	100.0000				

Normalization factor = 7.7260

Figure D3-7. SEM image for a Test #2, Day-30 exterior fiberglass sample on the drain collar (away from the drain screen) showing deposits or growth on fiberglass. (T2D30_DrainOutside033)

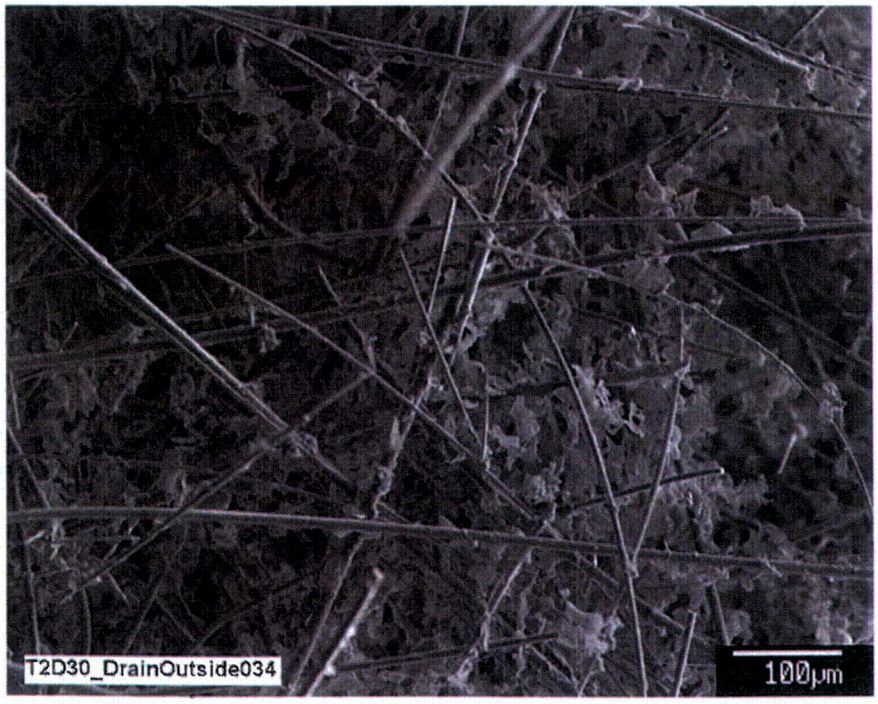


Figure D3-8. SEM image for a Test #2, Day-30 exterior fiberglass sample on the drain collar showing deposits or growth on fiberglass. (T2D30_DrainOutside034)

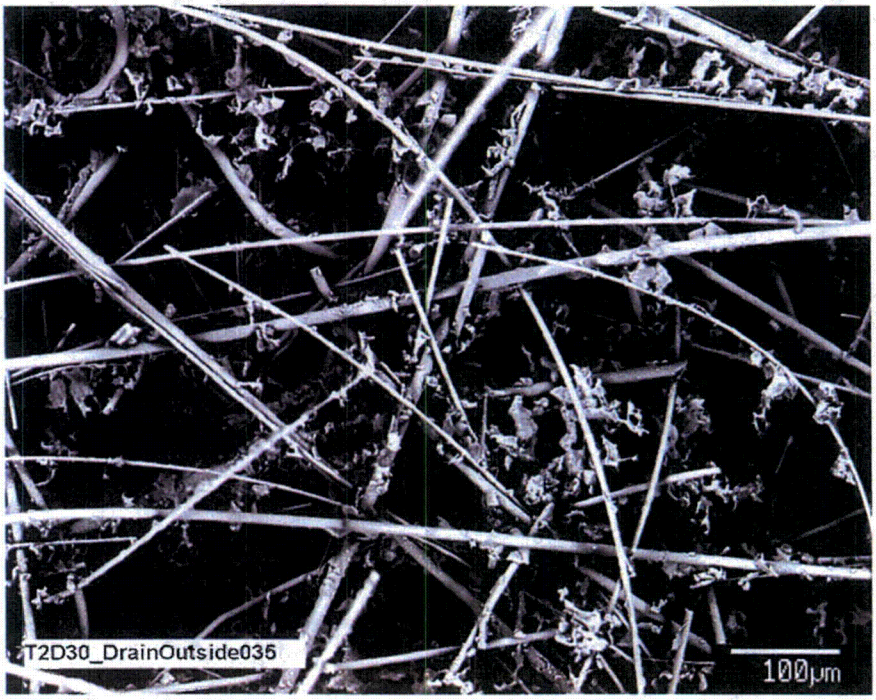


Figure D3-9. Backscattered SEM image for a Test #2, Day-30 exterior fiberglass sample on the drain collar. (T2D30_DrainOutside035)

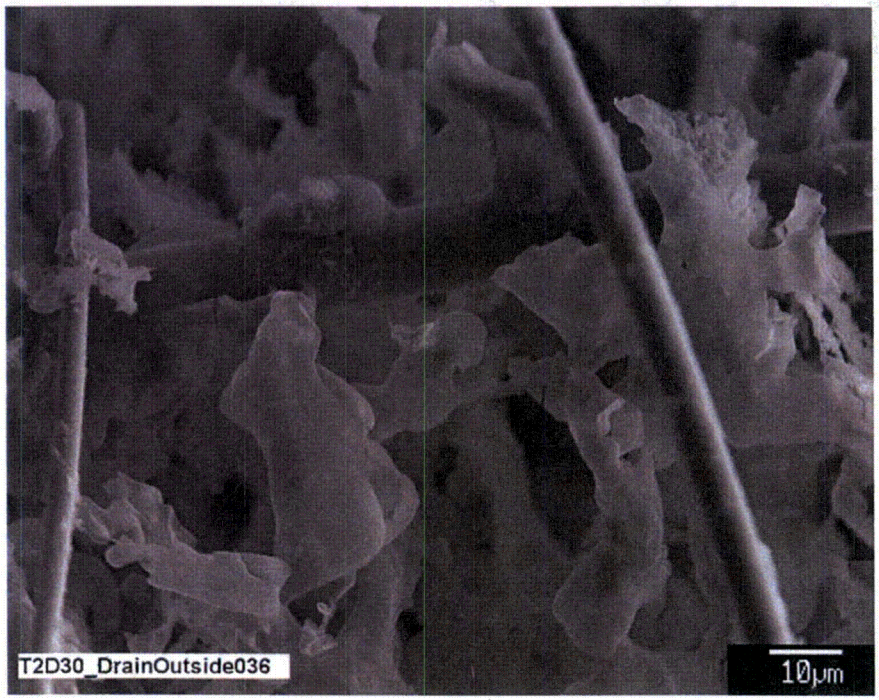


Figure D3-10. SEM image at a higher magnification for a Test #2, Day-30 exterior fiberglass sample on the drain collar showing deposits or growth on fiberglass. (T2D30_DrainOutside 036)

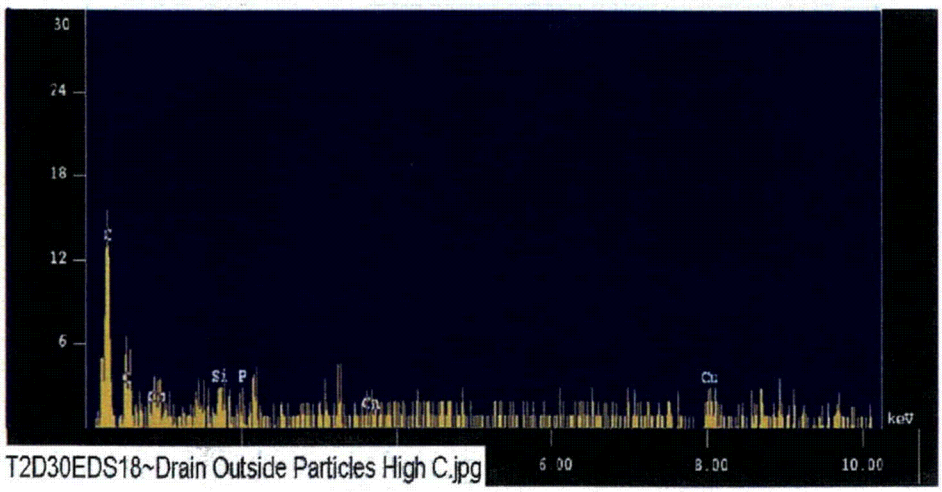


Figure D3-11. EDS counting spectrum for deposits or growth on fiberglass. The deposits contain a significant amount of carbon. (T2D30EDS18~Drain Outside Particles High C)

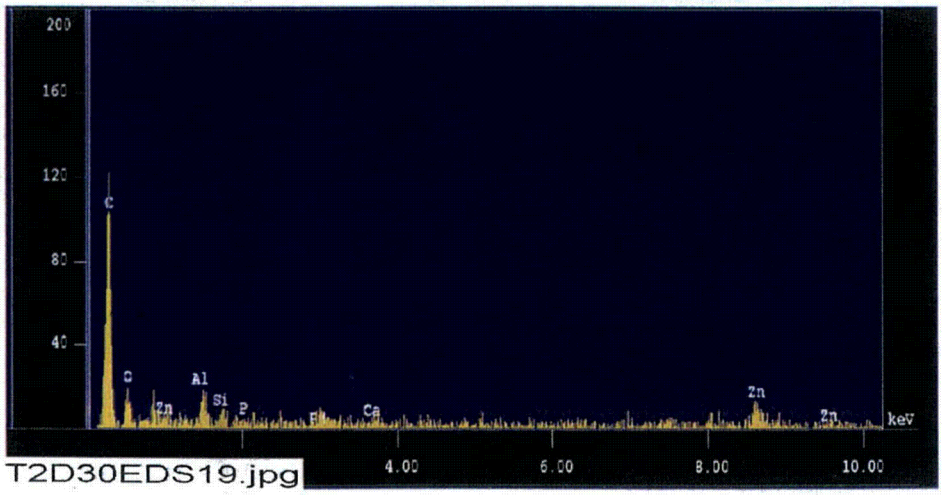


Figure D3-12. EDS counting spectrum for a deposit or growth on fiberglass. The deposit contains a significant amount of carbon. (T2D30EDS19)

The results from the chemical composition analysis for T2D30EDS19 are given in Table D3-3.

Table D3-3. The Chemical Composition for T2D30EDS19 (Figure D3-12)

```
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 Group     : NRC
 Sample    : T2D30  ID# : 19
 Comment   : particles on fiberglass
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 120.000 sec    Aperture #     : 1
             Acc. Volt   : 15.0 KV        Probe Current : 9.749E-09 A
             Stage Point : X=81.088 Y=63.027 Z=10.627
             Acq. Date   : Wed Mar  9 16:55:59 2005


 Element     Mode     ROI(KeV)    K-ratio(%)  +/-    Net/Background
   C K      Normal   0.09- 0.46    0.1138   0.0002      771 /       2
   O K      Normal   0.25- 0.77    0.0359   0.0006      164 /      44
  Al K      Normal   1.26- 1.78    0.0048   0.0002      104 /       6
  Si K      Normal   1.50- 2.07    0.0033   0.0003       71 /      11
  Zn K      Normal   8.22-10.03    0.1099   0.0036      145 /       2
  Ca K      Normal   3.40- 4.30    0.0038   0.0018       44 /       4
-------------------------------------------------------------------
                              Chi_square =  3.5725

 Element Mass%    Atomic%   ZAF      Z      A      F
     C   59.630  79.7022 2.7985 0.9722 2.8786 1.0000
     O   12.718  12.7615 1.8946 0.9274 2.0429 1.0000
    Al    1.176   0.6998 1.3104 0.9398 1.3945 0.9998
    Si    0.710   0.4060 1.1613 0.9286 1.2506 1.0000
    Zn   25.102   6.1648 1.2204 1.2263 0.9952 1.0000
    Ca    0.664   0.2658 0.9225 0.9421 0.9800 0.9991
-------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  187.2003
```

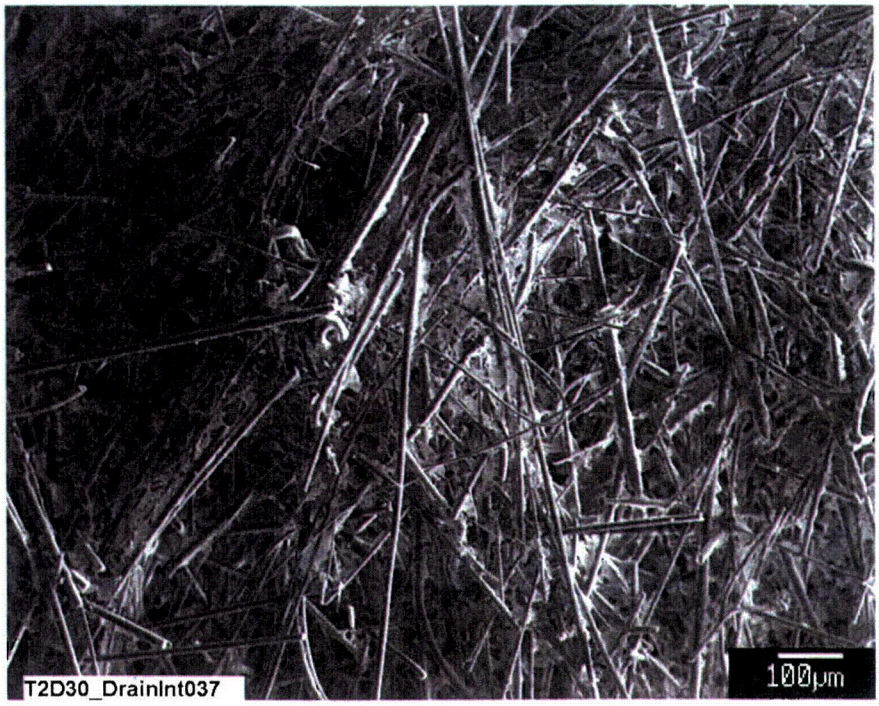


Figure D3-13. SEM image for a Test #2, Day-30 interior fiberglass sample on the drain collar. Image shows deposits or growth on fiberglass. (T2D30_DrainInt037)

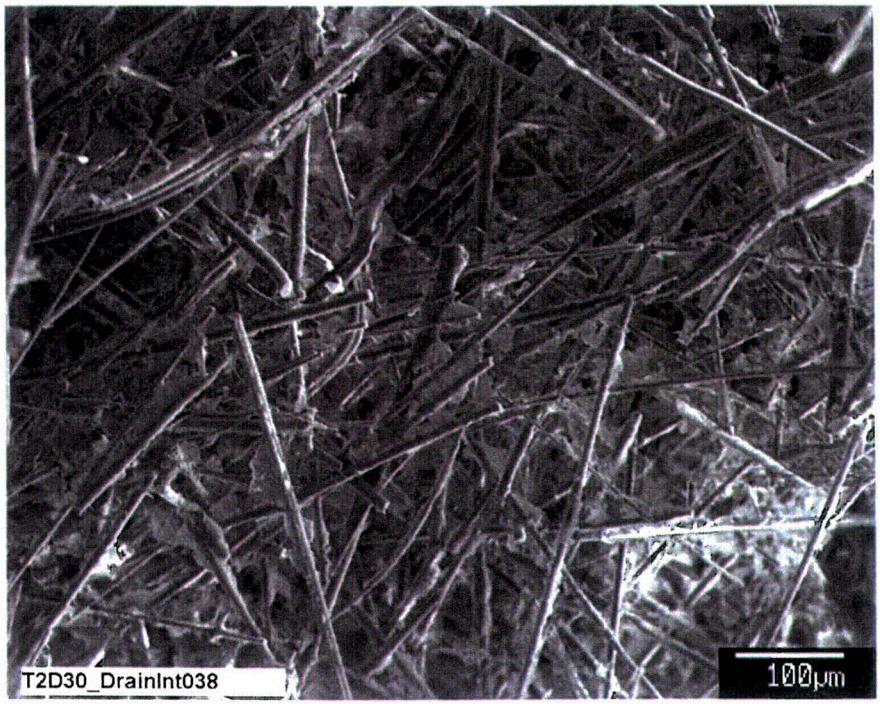


Figure D3-14. SEM image for a Test #2, Day-30 interior fiberglass sample on the drain collar. Image shows deposits or growth on fiberglass. (T2D30_DrainInt038)

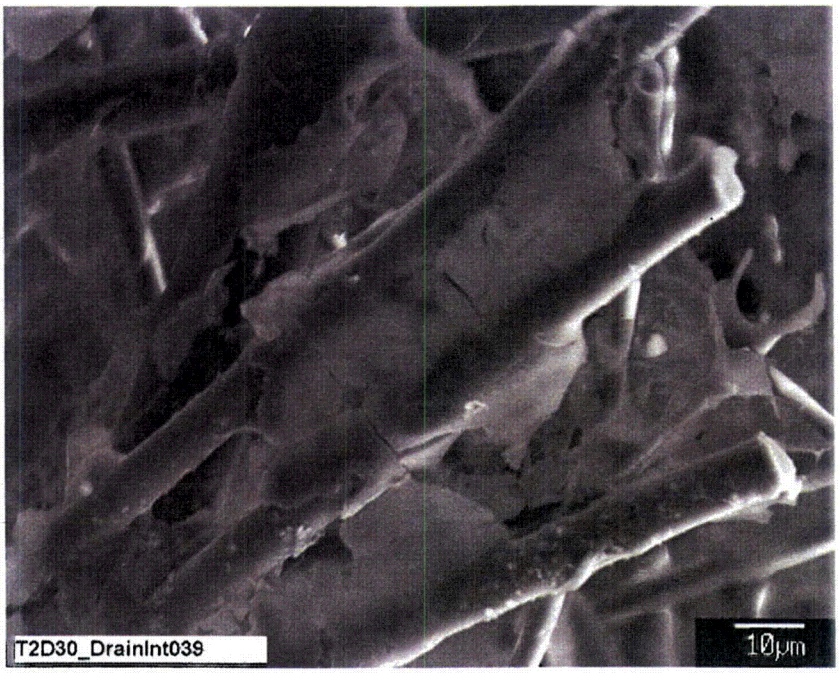


Figure D3-15. SEM image of a higher magnification for a Test #2, Day-30 interior fiberglass sample on the drain collar. The image shows deposits or growth on fiberglass. (T2D30_Drain Int039)

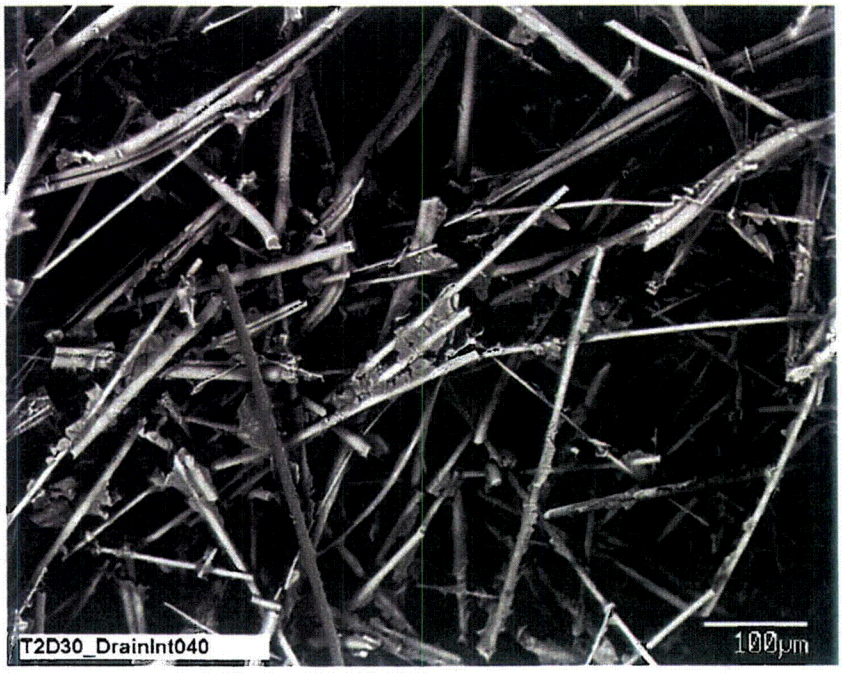


Figure D3-16. Backscattered SEM image for a Test #2, Day-30 interior fiberglass sample on the drain collar. Deposits appear to have a similar or lower atomic number as compared with fiberglass. (T2D30_DrainInt040)

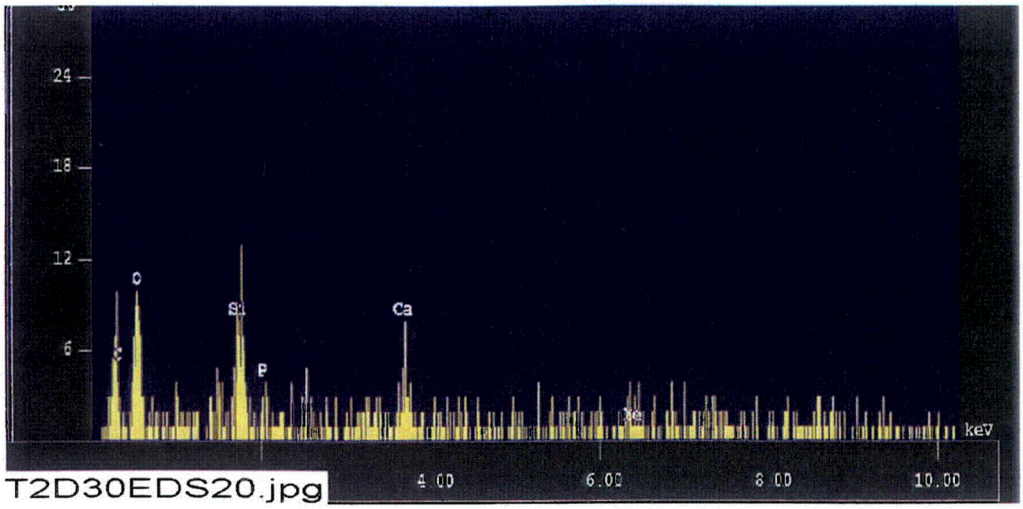


Figure D3-17. EDS counting spectrum for the deposits or growth on fiberglass. The deposits are rich in silicon, carbon, oxygen, and calcium. The deposits are very thin, and thus it was difficult to obtain high-quality EDS spectra. (T2D30EDS20)

The results from the chemical composition analysis for T2D30EDS20 are given in Table D3-4.

Table D3-4. The Chemical Composition for T2D30EDS20 (Figure D3-17)

```
Mar  9 17:16 2005  /tmp/eds_pout.log Page 1


 Group     : NRC
 Sample    : T2D30  ID# : 20
 Comment   : particles on fiberglass
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 120.000 sec    Aperture #    : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.375E-09 A
             Stage Point : X=68.013 Y=68.140 Z=10.627
             Acq. Date   : Wed Mar  9 17:14:10 2005


 Element     Mode     ROI(KeV)    K-ratio(%)  +/-    Net/Background
   C K      Normal   0.09- 0.46    0.0420   0.0001       40 /       2
   O K      Normal   0.25- 0.77    0.1425   0.0005       92 /       3
  Si K      Normal   1.50- 2.07    0.0292   0.0002       89 /       2
  Ca K      Normal   3.40- 4.30    0.0225   0.0013       36 /       1
-------------------------------------------------------------------
                                Chi_square =  0.7730

 Element Mass%    Atomic%   ZAF      Z      A      F
      C   30.132  39.0987 2.5156 1.0305 2.4412 0.9999
      O   55.239  53.8107 1.3590 0.9832 1.3822 1.0000
     Si    8.443   4.6849 1.0136 0.9850 1.0293 0.9998
     Ca    6.187   2.4058 0.9650 1.0007 0.9642 1.0001
-------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  285.2892
```

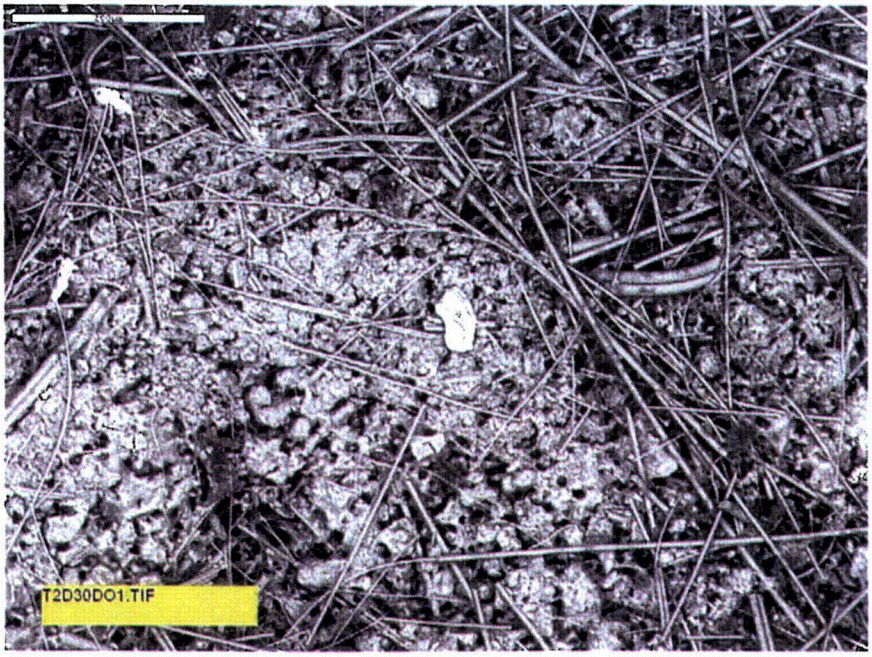


Figure D3-18. ESEM image for a Test #2, Day-30 exterior fiberglass sample on the drain collar. Image shows particulate deposits or growth on fiberglass. (T2D30DO1)

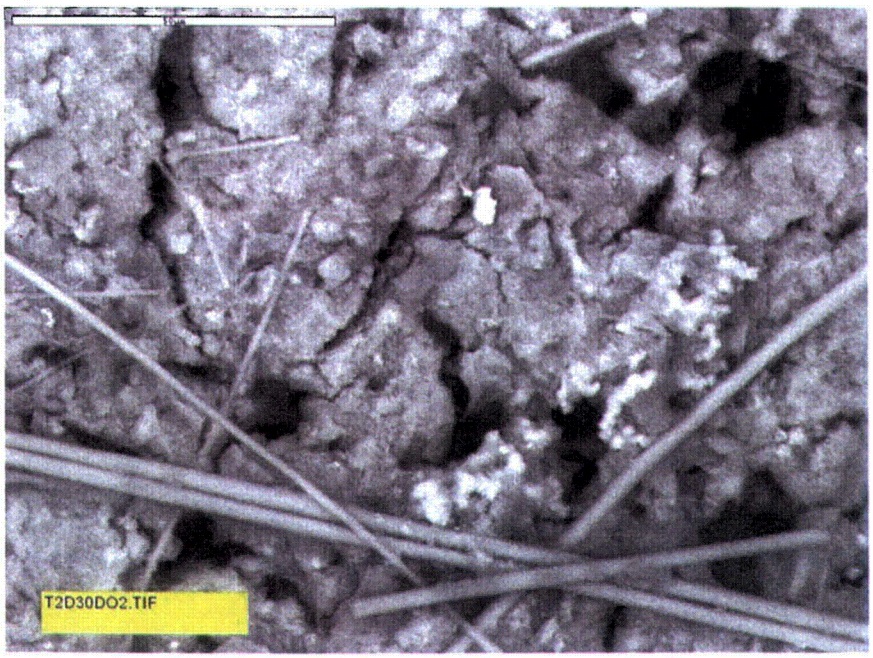


Figure D3-19. ESEM image of a higher magnification for a Test #2, Day-30 exterior fiberglass sample on the drain collar. The image shows particulate deposits or growth on fiberglass. (T2D30DO2)

Figure D3-20. ESEM image for a Test #2, Day-30 exterior fiberglass sample on the drain collar. Image shows particulate deposits or growth on fiberglass. (T2D30DO3)

Figure D3-21. ESEM image for a Test #2, Day-30 fiberglass sample on the drain collar next to the drain screen. (T2D30DS4)

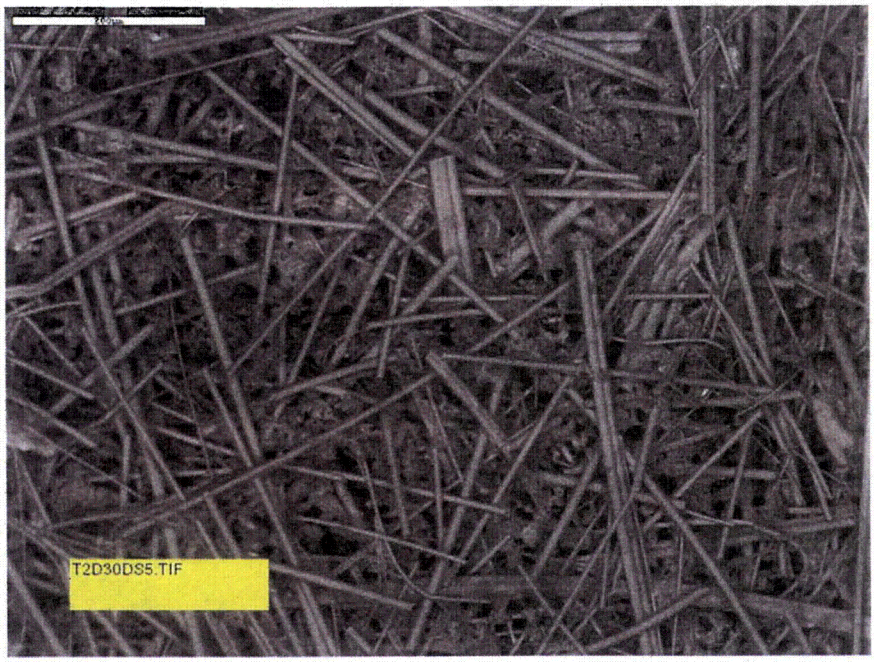


Figure D3-22. ESEM image for a Test #2, Day-30 fiberglass sample on the drain collar next to the drain screen. (T2D30DS5)

Figure D3-23. ESEM image of a higher magnification for a Test #2, Day-30 fiberglass sample on the drain collar next to the drain screen. (T2D30DS6)

Figure D3-24. ESEM image for a Test #2, Day-30 interior fiberglass sample on the drain collar. Image suggests that interior fiberglass was relatively clean as compared with exterior. (T2D30DI7)

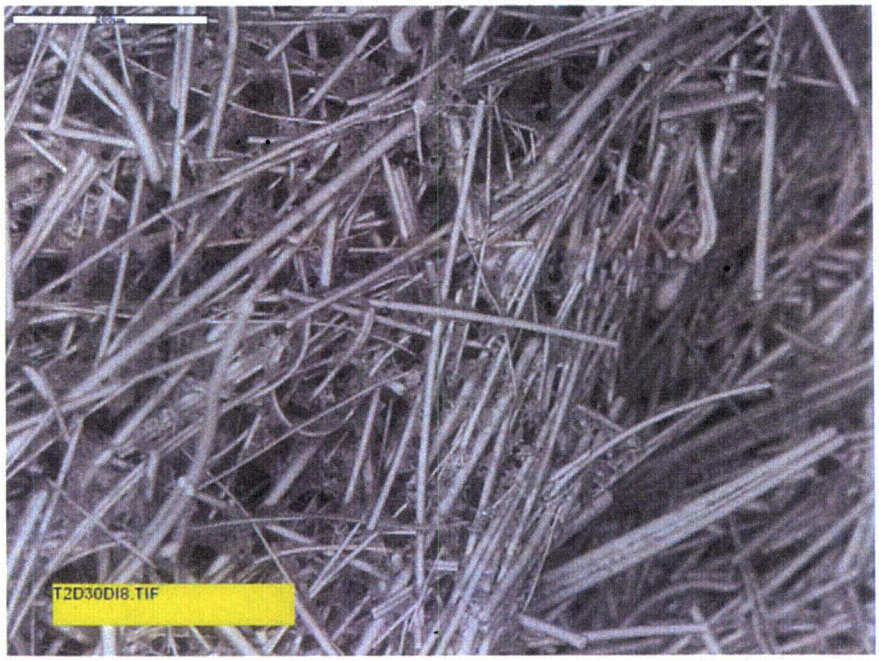


Figure D3-25. ESEM image for a Test #2, Day-30 interior fiberglass sample on the drain collar. (T2D30DI8)

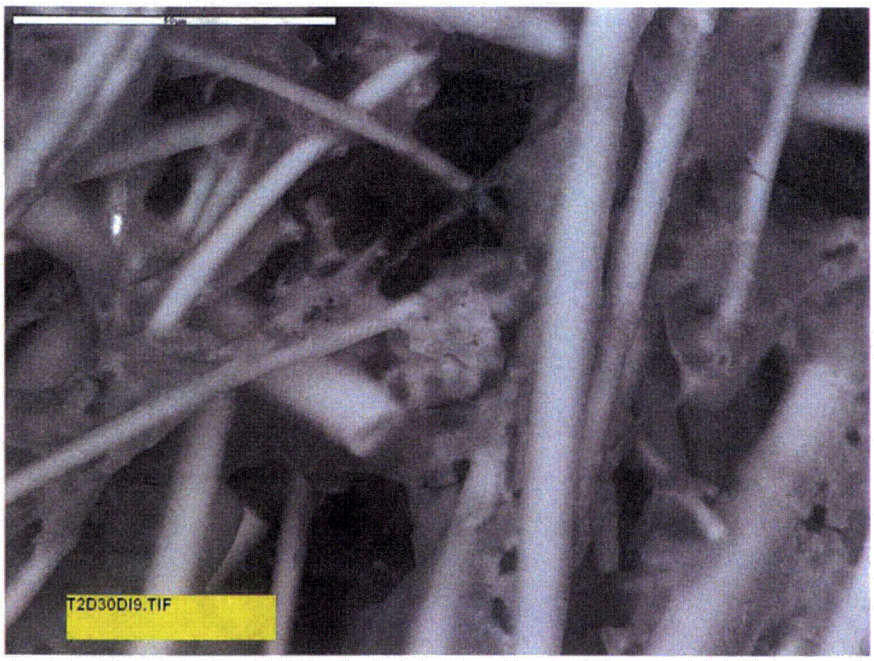


Figure D3-26. ESEM image of a higher magnification for a Test #2, Day-30 interior fiberglass sample on the drain collar. The image shows deposits or growth on the interior fiberglass, although the quantity was less than for exterior samples. (T2D30DI9)

Appendix D4

ESEM and SEM/EDS Data for Test #2, Day-30 Birdcage Fiberglass

Figures

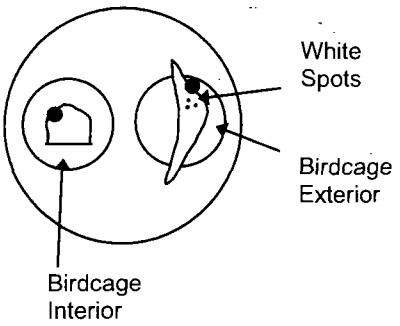
Tables

This appendix lists the ESEM/SEM/EDS results for the fiberglass samples within a birdcage submerged in the test solution. The purpose of this analysis was to determine the degree and the extent of particulate debris attached to the fiberglass. The fiberglass samples were extracted from the birdcage on March 7, 2005, the date Test #2 was shut down. Both exterior and interior fiberglass samples were examined. Microprobe SEM was used to examine the fiberglass samples after they were air dried and coated with gold/palladium. In addition to microprobe SEM, ESEM was used to analyze the wet fiberglass samples without any coating and under a low-vacuum condition (i.e., 80 Pa) to minimize the potential for modification of the fiberglass samples that might occur through the drying process. Microprobe SEM/EDS and ESEM results of the Test #2, Day-30 birdcage fiberglass samples were obtained on March 9, 2005.

Transcribed Laboratory Log

Microprobe laboratory session from March 9, 2005

T2D30 Samples—NRC



Conditions: 15-kV, 1-nA beam current, Aperture = 2
Note: Bold spots in sketch denote carbon glue used to secure samples.

Sample Birdcage Exterior

Image:	T2D30_BirdcageExt041	90 ×	BSE	Figure D4-1
EDS:	T2D30EDS21		Bright particle left side of image 041	Figure D4-2
Image:	T2D30_BirdcageExt042	150 ×	BSE	Figure D4-3
	T2D30_BirdcageExt043	150 ×	SE	Figure D4-4
	T2D30_BirdcageExt044	1000 ×	SE	Figure D4-5
EDS:	T2D30EDS22		EDS on lath-like crystal	Figure D4-6
	T2D30EDS23		Particles on fiberglass	Figure D4-7

Sample Birdcage Interior

Image:	T2D30_BirdcageInt045	90 ×	SE image	Figure D4-8
	T2D30_BirdcageInt046	150 ×	SE image same area	Figure D4-9
	T2D30_BirdcageInt047	150 ×	BSE same area	Figure D4-10
	T2D30_BirdcageInt048	1000 ×	SE same area	Figure D4-11
EDS:	T2D30EDS24		Globules on fiberglass	Figure D4-12

ESEM laboratory session from March 9, 2005

Birdcage Sample Exterior

Image:	T2D30BX9	95 ×	On debris/precipitate	Figure D4-13
	T2D30BX10	150 ×	On glass fibers	Figure D4-14
	T2D30BX11	1000 ×	On fibers	Figure D4-15
	T2D30BX12	700 ×	On particle	Figure D4-16

Birdcage Sample Interior

Image:	T2D30BI13	150 ×	On fibers	Figure D4-17
	T2D30BI14	1000 ×		Figure D4-18

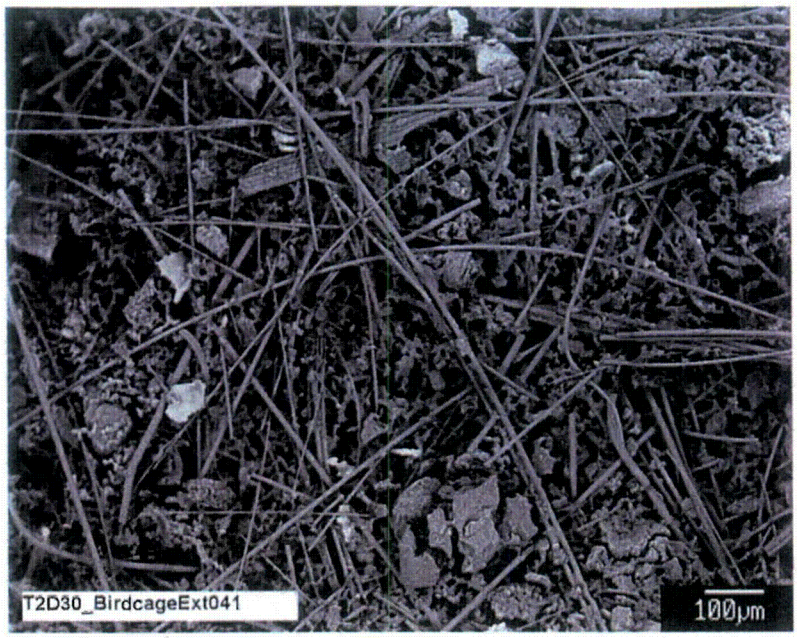


Figure D4-1. SEM image for a Test #2, Day-30 exterior fiberglass sample within the birdcage. The image shows particulate deposits or growth on fiberglass. (TD30_BirdcageExt041)

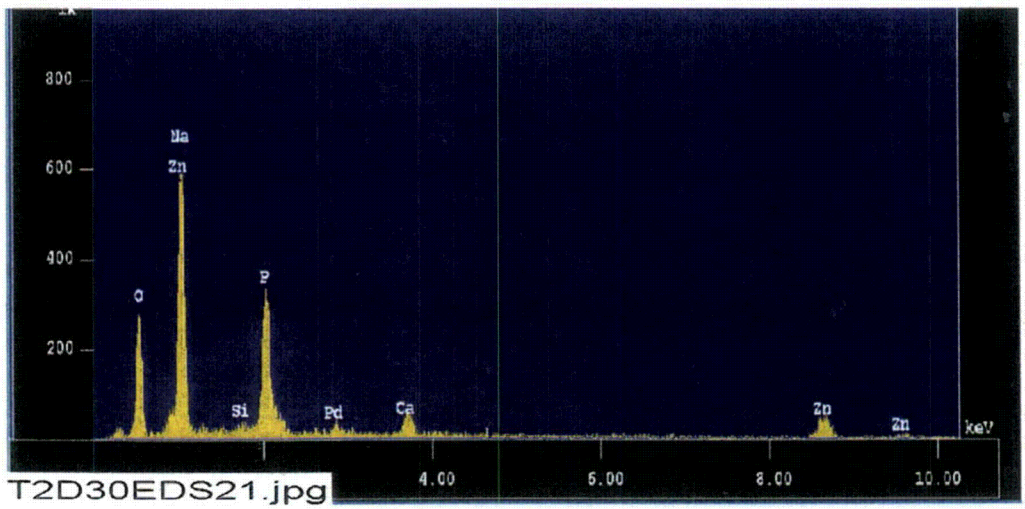


Figure D4-2. EDS counting spectrum for the bright particle on the lower-left side of Figure D4-1. (T2D30EDS21)

The results from the chemical composition analysis for T2D30EDS21 are given in Table D4-1.

Table D4-1. The Chemical Composition for T2D30EDS21

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Group : NRC
Sample : T2D30 ID# : 21
Comment : bright particle
Condition : Full Scale : 20KeV(10eV/ch,2Kch)
Live Time : 60.000 sec Aperture # : 1
Acc. Volt : 15.0 KV Probe Current : 5.403E-10 A
Stage Point : X=36.780 Y=58.457 Z=10.627
Acq. Date : Wed Mar 9 17:26:42 2005

Element	Mode	ROI(KeV)	K-ratio(%)	+/-	Net/Background
O K	Normal	0.25- 0.77	20.3402	0.0022	2572 / 15
Na K	Normal	0.83- 1.28	0.7506	0.0151	298 / 23
P K	Normal	1.75- 2.38	11.8434	0.0034	3577 / 28
Ca K	Normal	3.40- 4.30	1.8504	0.0050	586 / 11
Zn K	Normal	8.22-10.03	19.6836	0.0071	719 / 2

Chi_square = 3.0137

Element	Mass%	Atomic%	ZAF	Z	A	F
O	35.828	61.5751	1.0317	0.9179	1.1240	1.0000
Na	2.043	2.4438	1.5945	0.9209	1.7289	1.0014
P	19.372	17.1970	0.9581	1.1032	0.8685	0.9999
Ca	3.013	2.0671	0.9537	0.9240	1.0329	0.9993
Zn	39.743	16.7170	1.1826	1.1840	0.9988	1.0000
Total	100.000	100.0000				

Normalization factor = 1.7073

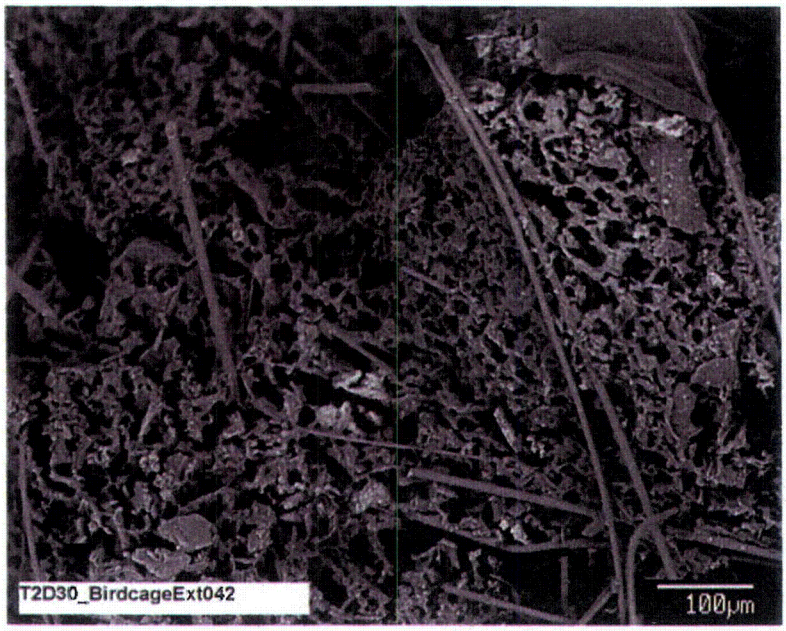


Figure D4-3. Backscatter SEM image for a Test #2, Day-30 exterior fiberglass sample within the birdcage. (T2D30_BirdcageExt042)

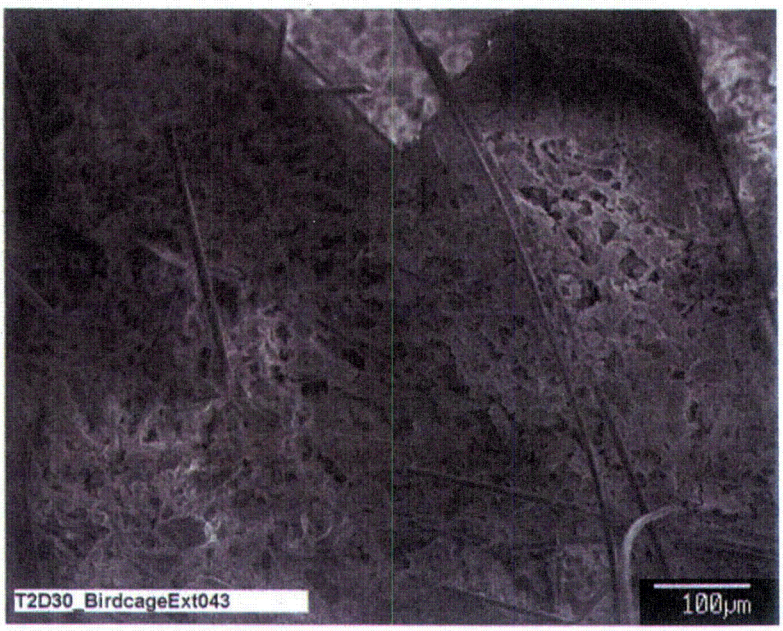


Figure D4-4. SEM image for a Test #2, Day-30 exterior fiberglass sample within the birdcage. The field is the same as that shown in Figure D4-3. (T2D30_BirdcageExt043)

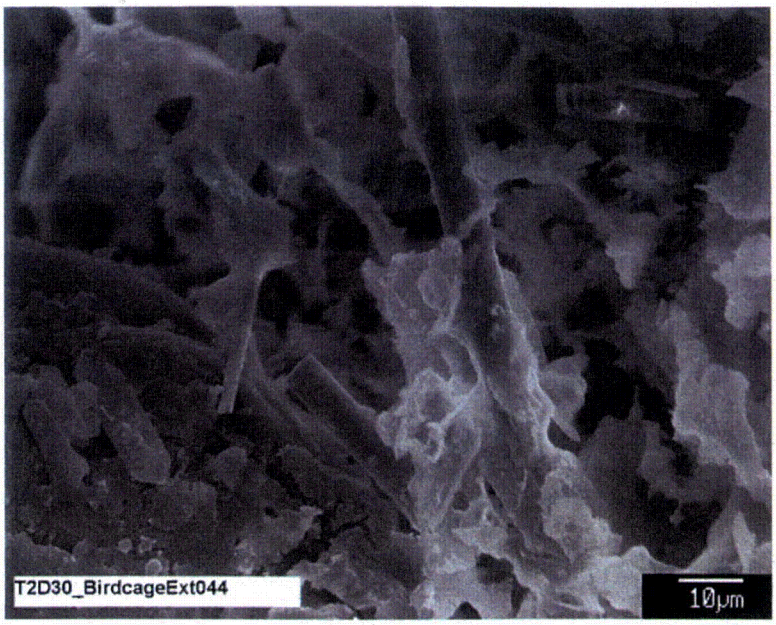


Figure D4-5. SEM image of a higher magnification for a Test #2, Day-30 exterior fiberglass sample within the birdcage. (T2D30_BirdcageExt044)

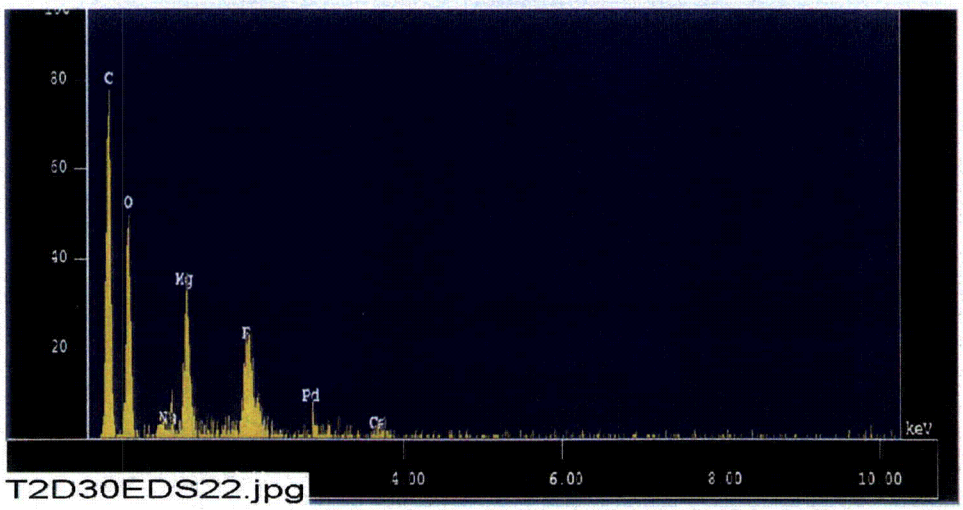


Figure D4-6. EDS counting spectrum for the crystal-shaped deposit at the lower-left side of Figure D4-5. (T2D30EDS22)

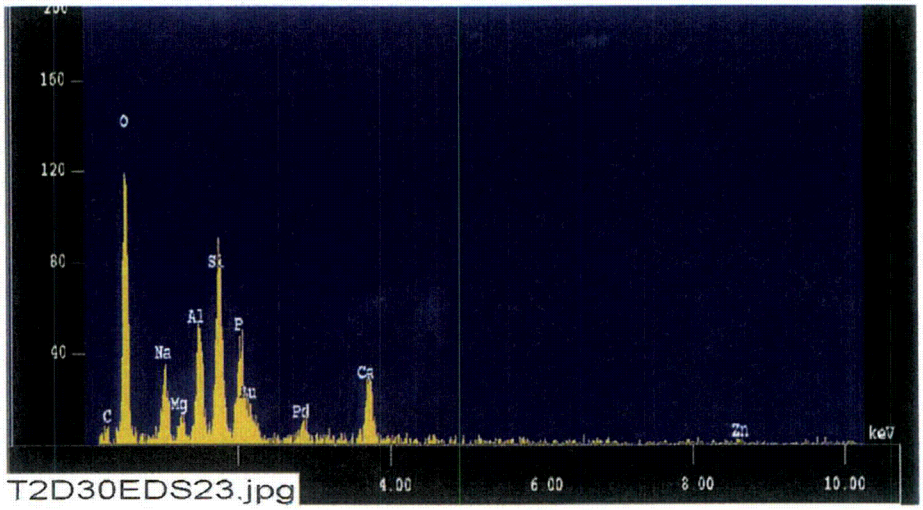


Figure D4-7. EDS counting spectrum for the deposits attached to fiberglass, as shown in Figure D4-5. (T2D30EDS23)

The results from the chemical composition analysis for T2D30EDS23 are given in Table D4-2.

Table D4-2. The Chemical Composition for T2D30EDS23

```
Mar  9 17:49 2005  /tmp/eds_pout.log Page 1


 Group      : NRC
 Sample     : T2D30  ID# : 23
 Comment    : particles on fiberglass
 Condition  : Full Scale  : 20KeV(10eV/ch,2Kch)
              Live Time   : 120.000 sec    Aperture #     : 1
              Acc. Volt   : 15.0 KV        Probe Current  : 1.020E-10 A
              Stage Point : X=35.661 Y=58.464 Z=10.627
              Acq. Date   : Wed Mar  9 17:47:47 2005


 Element      Mode      ROI(KeV)    K-ratio(%)   +/-    Net/Background
   O K       Normal    0.25- 0.77    23.8450    0.0014      1139 /       6
  Na K       Normal    0.83- 1.28     1.5443    0.0028       232 /      10
  Mg K       Normal    1.03- 1.52     0.4403    0.0005        84 /      38
  Al K       Normal    1.26- 1.78     1.8853    0.0004       427 /      28
  Si K       Normal    1.50- 2.07     3.3376    0.0006       755 /      38
   P K       Normal    1.75- 2.38     3.3673    0.0014       384 /      43
  Ca K       Normal    3.40- 4.30     2.8112    0.0031       336 /       2
-------------------------------------------------------------------------
                                  Chi_square =  2.0568

 Element Mass%    Atomic%   ZAF      Z      A      F
      O   62.741  75.5081 0.9977 0.9907 1.0070 1.0000
     Na    4.658   3.9012 1.1437 0.9951 1.1485 1.0007
     Mg    1.284   1.0170 1.1059 0.9978 1.1091 0.9993
     Al    5.681   4.0539 1.1426 1.0033 1.1431 0.9963
     Si    9.837   6.7440 1.1176 0.9910 1.1308 0.9973
      P    8.399   5.2214 0.9458 1.1947 0.7920 0.9996
     Ca    7.399   3.5544 0.9980 1.0045 0.9934 1.0001
-------------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  2.6373
```

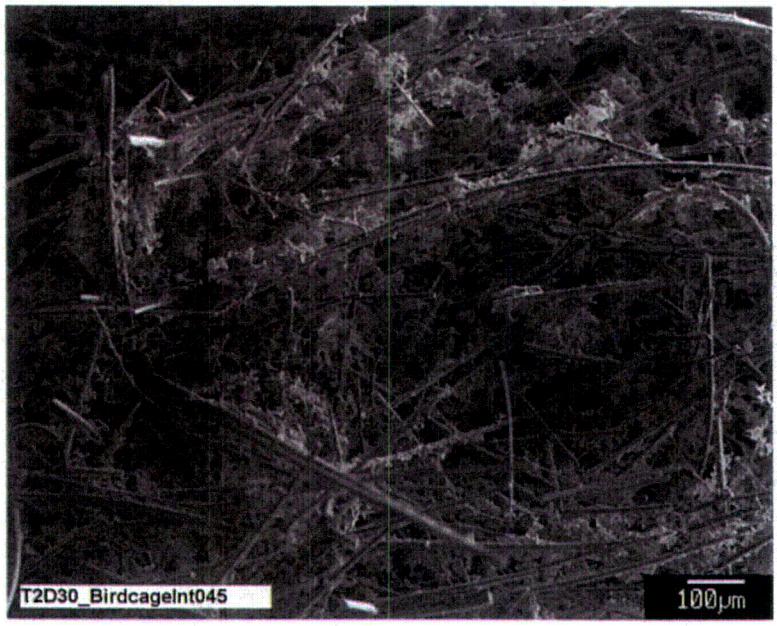


Figure D4-8. SEM image for a Test #2, Day-30 interior fiberglass sample within the birdcage. The image shows deposits or growth on the fiberglass. (T2D30_BirdcageInt045)

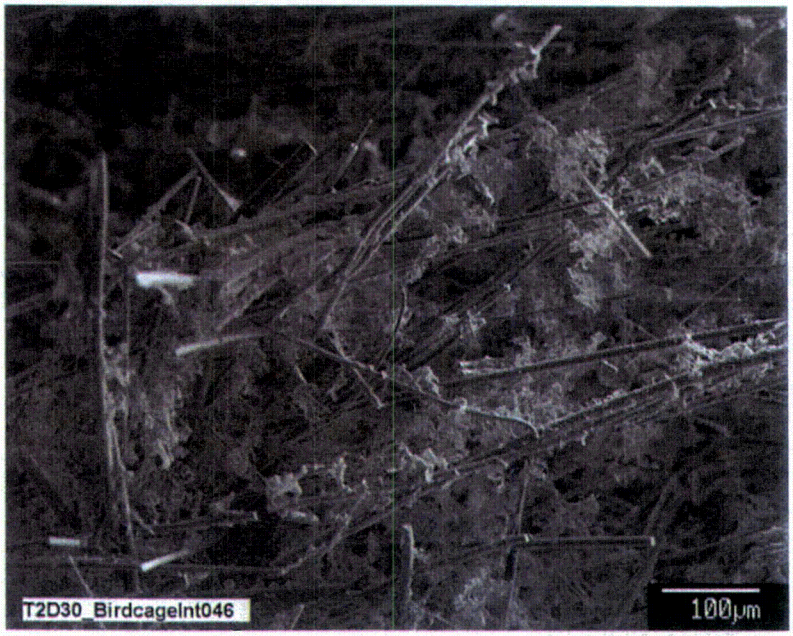


Figure D4-9. SEM image for a Test #2, Day-30 interior fiberglass sample within the birdcage. The image shows deposits or growth on the fiberglass. (T2D30_BirdcageInt046)

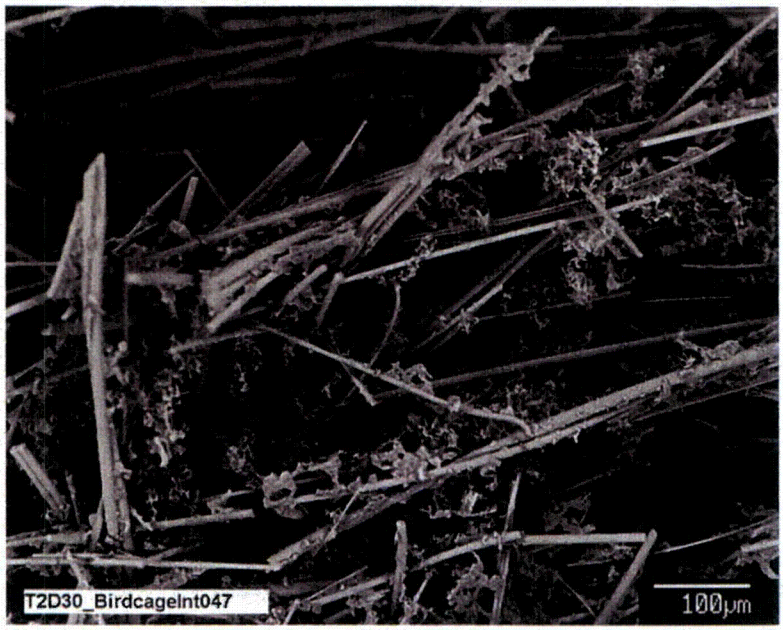


Figure D4-10. Backscattered SEM image for a Test #2, Day-30 interior fiberglass sample within the birdcage. The atomic number of the deposits is similar to that of the fiberglass. (T2D30_BirdcageInt047)

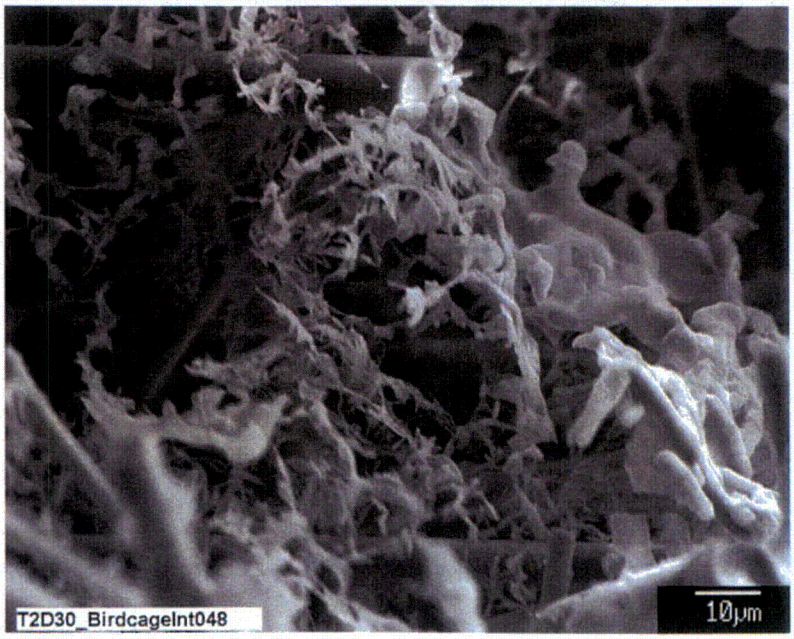


Figure D4-11. SEM image of a higher magnification for a Test #2, Day-30 interior fiberglass sample within the birdcage. The image shows deposits or growth on the fiberglass. (T2D30_BirdcageInt048)

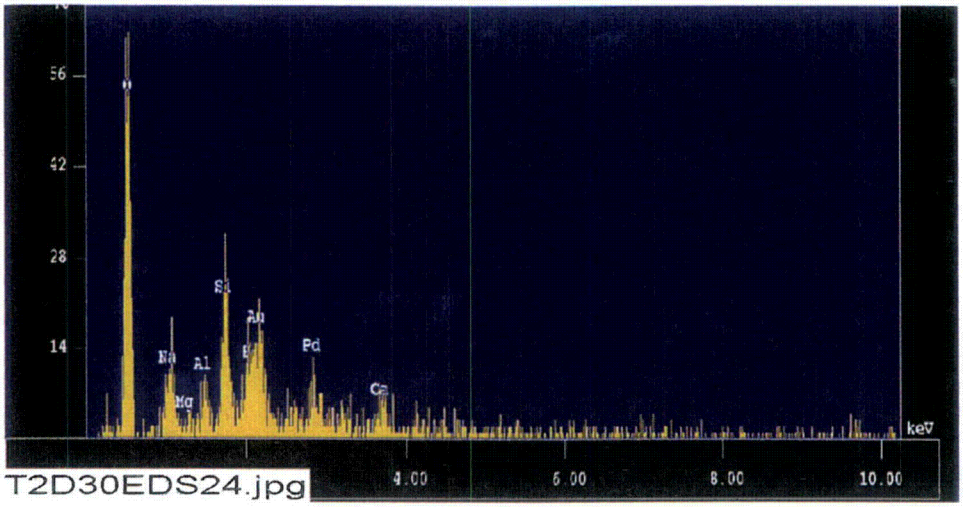


Figure D4-12. EDS counting spectrum for deposits on the fiberglass, as shown in Figure D4-11. (T2D30EDS24)

The results from the chemical composition analysis for T2D30EDS24 are given in Table D4-3.

Table D4-3. The Chemical Composition for T2D30EDS2

```
Mar  9 18:08 2005  /tmp/eds_pout.log Page 1


 Group     : NRC
 Sample    : T2D30  ID# : 24
 Comment   : globules on fiberglass birdcage interior
 Condition : Full Scale  : 20KeV(10eV/ch,2Kch)
             Live Time   : 120.000 sec    Aperture #    : 1
             Acc. Volt   : 15.0 KV        Probe Current : 1.019E-10 A
             Stage Point : X=49.105 Y=62.519 Z=10.627
             Acq. Date   : Wed Mar  9 18:06:33 2005


 Element     Mode      ROI(KeV)    K-ratio(%)  +/-    Net/Background
   O K      Normal   0.25- 0.77    10.6755   0.0009      509 /       4
  Na K      Normal   0.83- 1.28     0.6105   0.0018       92 /       3
  Mg K      Normal   1.03- 1.52     0.0691   0.0003       13 /      10
  Al K      Normal   1.26- 1.78     0.1947   0.0002       44 /       8
  Si K      Normal   1.50- 2.07     0.8895   0.0004      201 /      12
   P K      Normal   1.75- 2.38     0.6913   0.0009       79 /      14
  Ca K      Normal   3.40- 4.30     0.4040   0.0018       48 /       2
-------------------------------------------------------------------------
                                 Chi_square =  1.1748

 Element Mass%    Atomic%   ZAF      Z      A      F
      O   73.306  82.8087 0.7875 0.9951 0.7914 1.0000
     Na    6.327   4.9737 1.1884 0.9997 1.1875 1.0011
     Mg    0.700   0.5202 1.1607 1.0024 1.1578 1.0001
     Al    1.996   1.3369 1.1755 1.0080 1.1697 0.9969
     Si    8.560   5.5082 1.1035 0.9959 1.1103 0.9981
      P    5.609   3.2731 0.9305 1.2006 0.7752 0.9998
     Ca    3.502   1.5793 0.9941 1.0101 0.9841 1.0001
-------------------------------------------------------------------------
 Total   100.000 100.0000
 Normalization factor =  8.7200
```

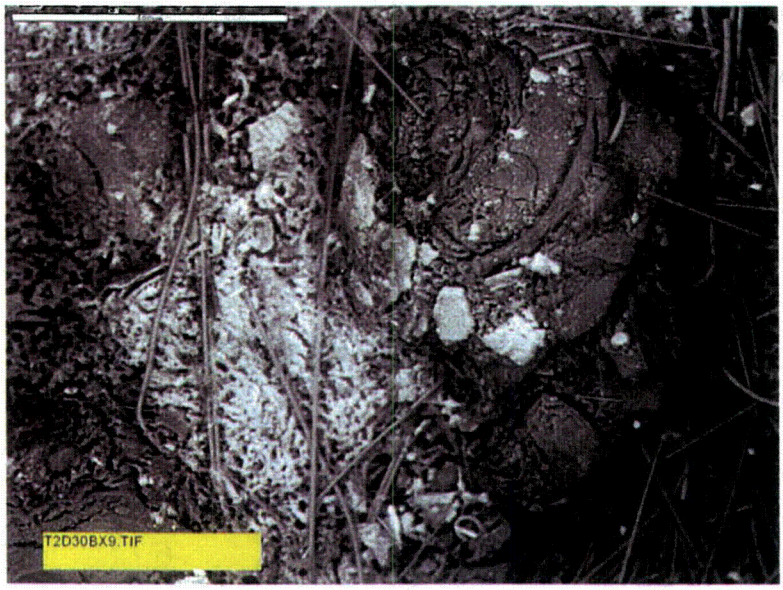


Figure D4-13. ESEM image for a Test #2, Day-30 exterior fiberglass sample within the birdcage. (T2D30BX9)

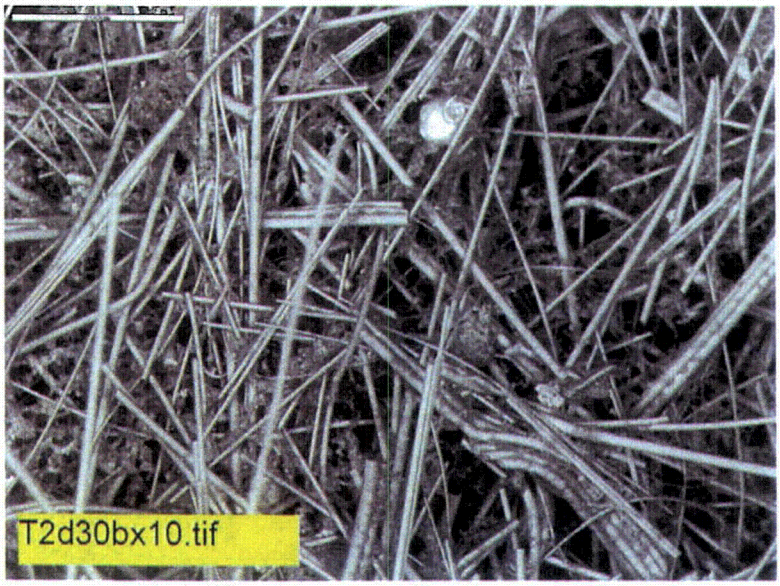


Figure D4-14. ESEM image for a Test #2, Day-30 exterior fiberglass sample within the birdcage. (T2d30bx10)

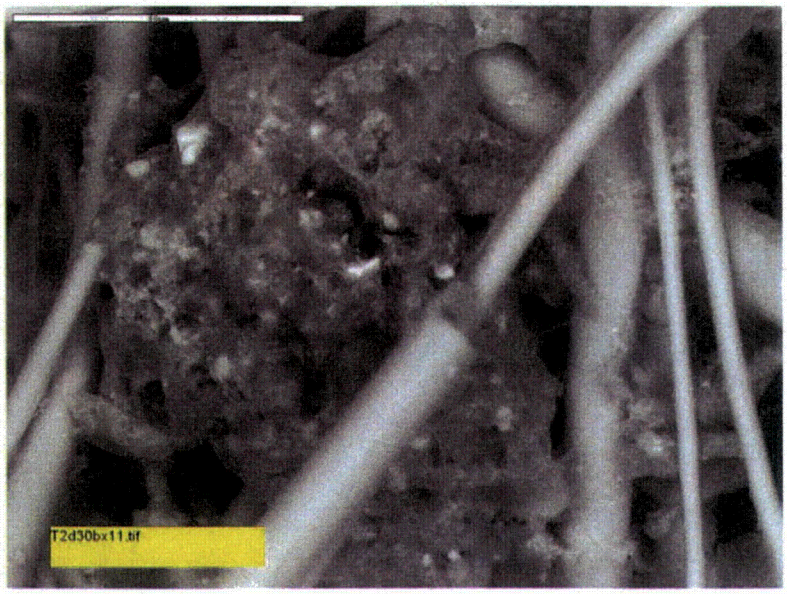


Figure D4-15. ESEM image of a higher magnification for a Test #2, Day-30 exterior fiberglass sample within the birdcage. (T2d30bx11)

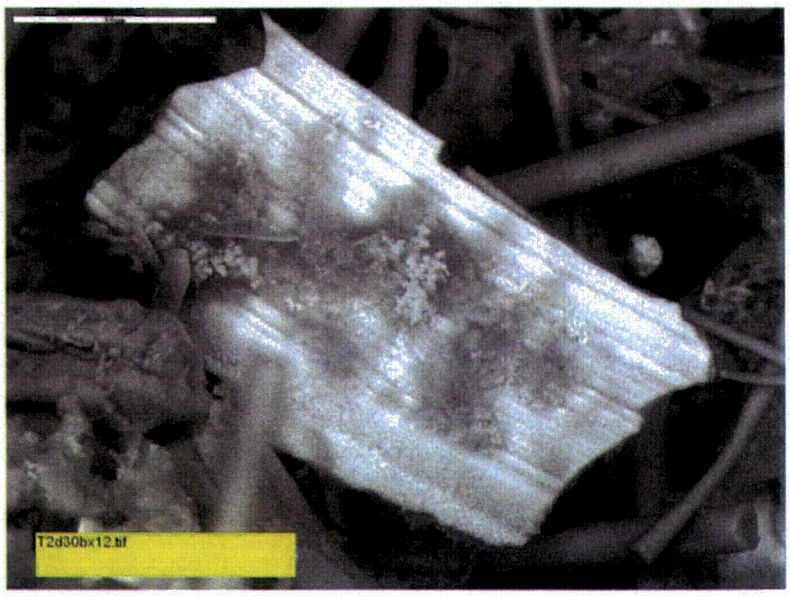


Figure D4-16. ESEM image of a higher magnification from another area for a Test #2, Day-30 exterior fiberglass sample within the birdcage. (T2d30bx12)

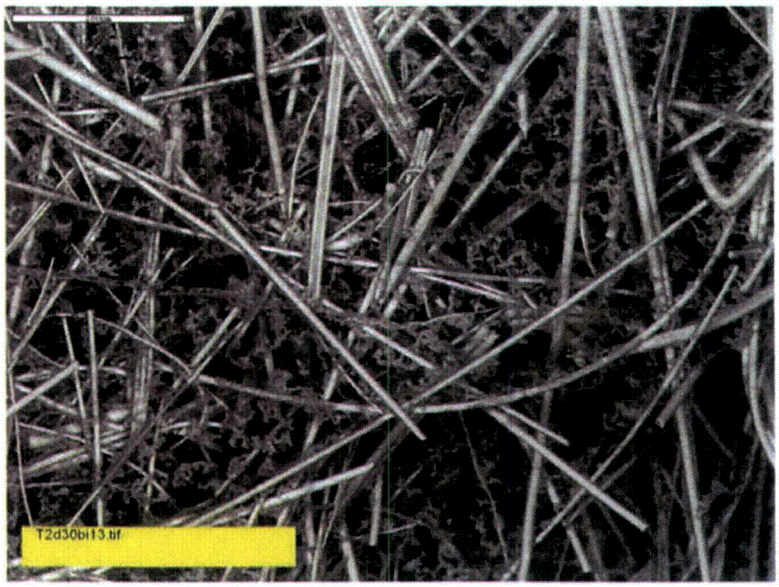


Figure D4-17. ESEM image for a Test #2, Day-30 interior fiberglass sample within the birdcage. The image shows deposits or growth on the fiberglass. (T2d30bi13)

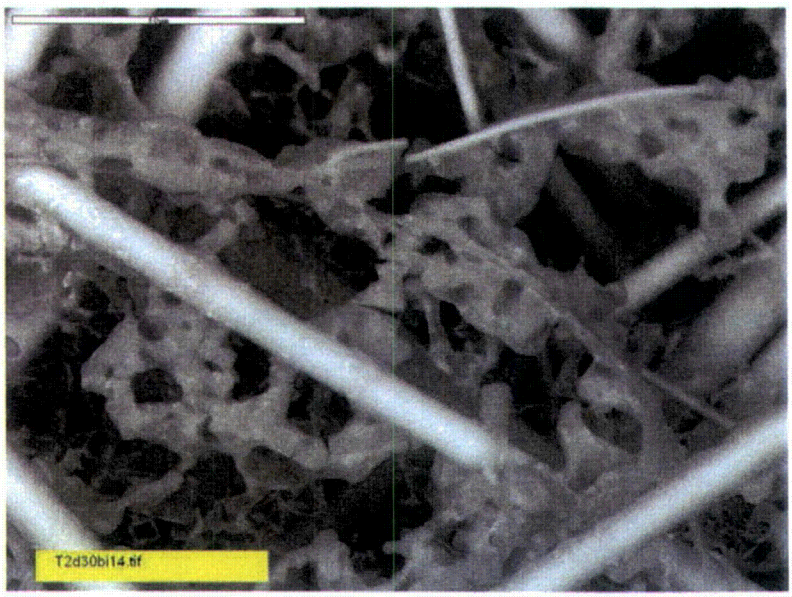


Figure D4-18. ESEM image of a higher magnification for a Test #2, Day-30 interior fiberglass sample within the birdcage. The image shows deposits or growth on the fiberglass. (T2d30bi14)

Appendix E

SEM/EDS Data for T2D30 Sediment

Figures

Tables

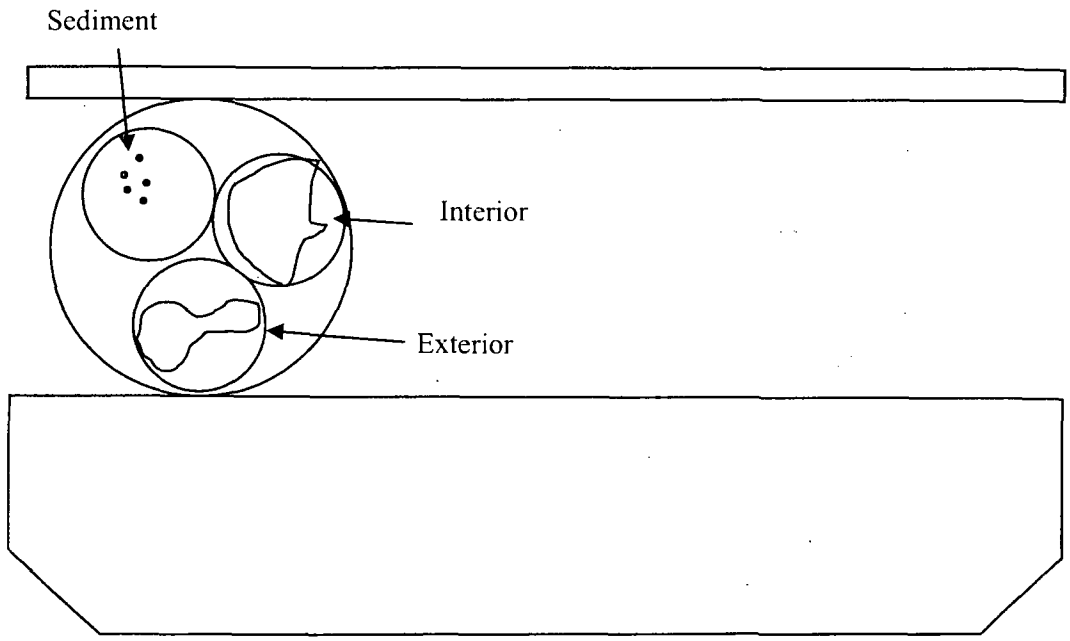
Particulate sediments at the bottom of the tank directly relate to the corrosion products and debris generated during ICET tests. This appendix lists the SEM/EDS results for the sediment samples collected from the bottom of the tank on the date Test #2 was shut down (March 7, 2005). The purpose of these analyses is to provide information on the morphology and the composition of the sediment to evaluate the potentially occurring chemical reactions during ICET tests.

Probe SEM was used to examine the sediment samples after drying in air at room temperature, followed by being coated with carbon. EDS results provide a semi-quantitative elemental analysis of the sediment after calibration. Probe SEM/EDS results of the Test #2, Day-30 sediment samples were obtained on April 12, 2005.

Transcribed Laboratory Log

Laboratory session from April 12, 2005.

T2D30 Sediment Samples



Sediment Samples

Image:	T2D30SEDMT003	150 ×	SEM image	Figure E-1
	T2D30SEDMT006	100 ×	SEM image sediment sample	Figure E-2
EDS:	T2D30SED1		Spot of the layer show in 006	Figure E-3
Image:	T2D30SEDMT004	300 ×	Porous structure	Figure E-4
EDS:	T2D30SED2		Of porous material in Image 004	Figure E-5

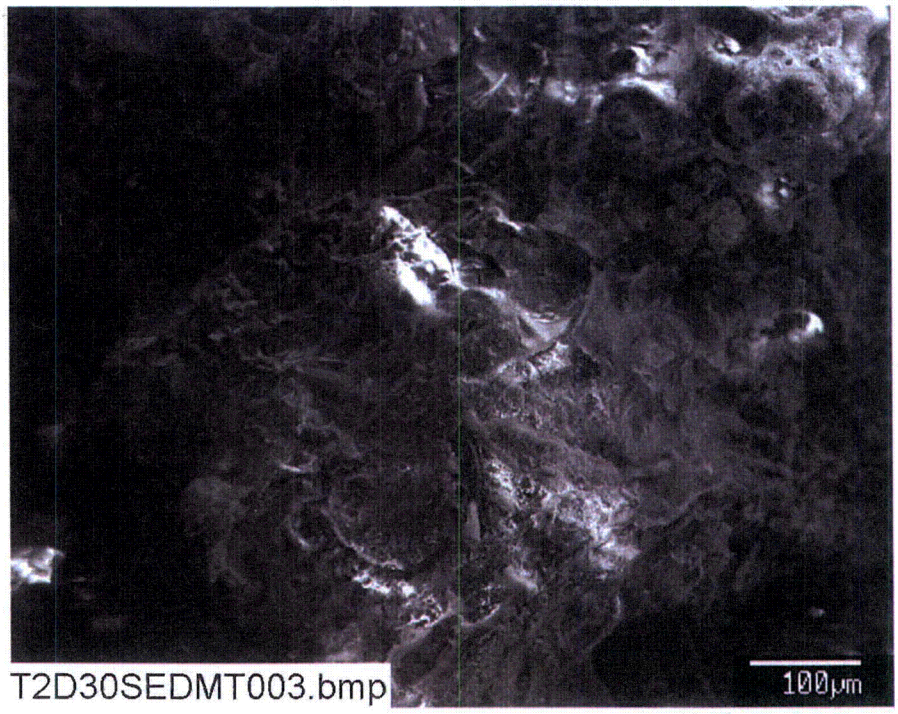


Figure E-1. SEM image for a Test #2, Day-30 sediment sample at 150 × magnification. (T2D30SEDMT003)

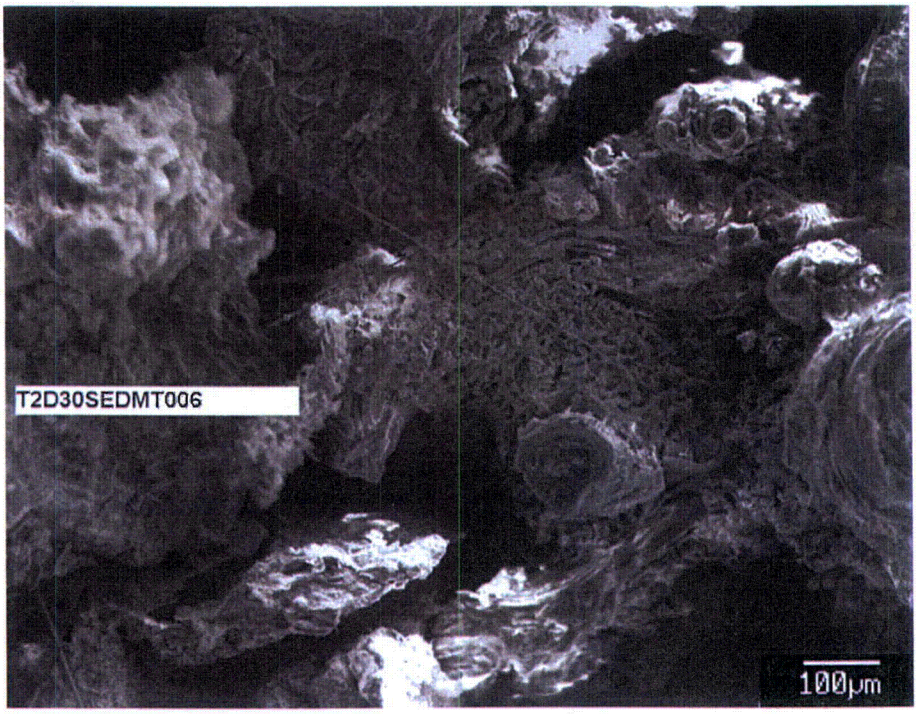


Figure E-2. SEM image for a Test #2, Day-30 sediment sample at 100 × magnification. (T2D30SEDMT006)

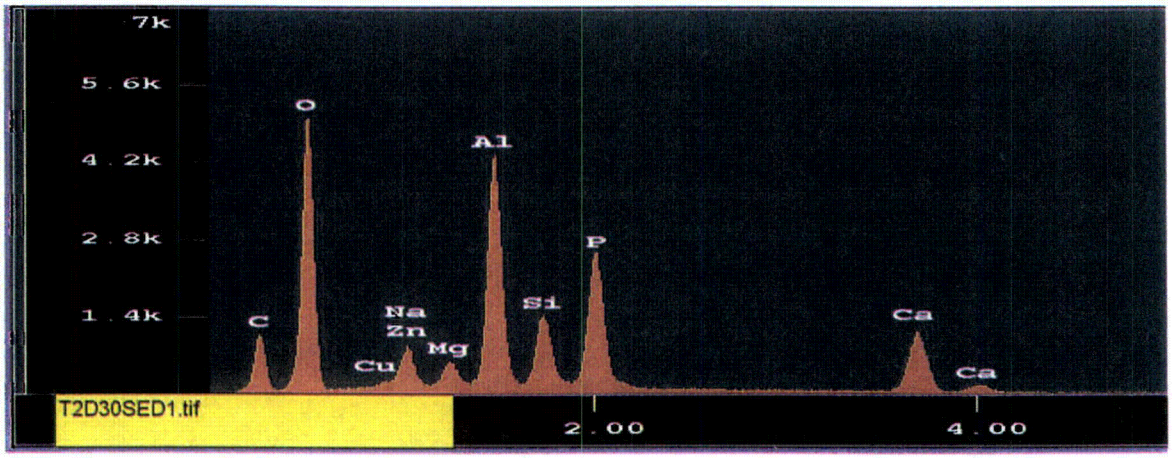


Figure E-3. **EDS counting spectrum for the circularly layered material close to the right edge of Figure E-2. (T2D30SED1)**

The results from the chemical composition analysis for T2D30SED1 are given in Table E-1.

Table E-1. The Chemical Composition for T2D30SED1 (Figure E-2)

Apr 12 13:35 2005 /tmp/eds_pout.log Page 1

Group : NRC
Sample : Sediment ID# : 1
Comment : T2D30 layered sediment
Condition : Full Scale : 20KeV(10eV/ch,2Kch)
Live Time : 60.000 sec Aperture # : 1
Acc. Volt : 15.0 KV Probe Current : 4.371E-09 A
Stage Point : X=86.820 Y=57.236 Z=10.927
Acq. Date : Tue Apr 12 13:28:07 2005

Element	Mode	ROI(KeV)	K-ratio(%)	+/-	Net/Background
C K	Normal	0.09- 0.46	4.5208	0.0013	6861 / 798
O K	Normal	0.25- 0.77	30.9657	0.0080	31679 / 628
Na K	Normal	0.81- 1.27	0.2289	0.0033	673 / 316
Mg K	Normal	0.97- 1.57	0.9830	0.0008	4198 / 412
Al K	Normal	1.19- 1.83	8.3515	0.0016	35453 / 290
Si K	Normal	1.50- 2.05	2.8377	0.0012	11233 / 2308
P K	Normal	1.75- 2.38	9.9889	0.0090	24403 / 700
Ca K	Normal	3.39- 4.30	7.5785	0.0045	14581 / 62
Cu K	Normal	7.63- 9.27	0.2619	0.0048	102 / 10
Zn K	Normal	8.22-10.03	0.6558	0.0069	194 / 10

Chi_square = 136.8970

Element	Mass%	Atomic%	ZAF	Z	A	F
C	20.663	30.4778	4.4603	1.0251	4.3512	1.0000
O	45.036	49.8700	1.4193	0.9778	1.4515	1.0000
Na	0.316	0.2434	1.3462	1.0323	1.3050	0.9993
Mg	1.403	1.0223	1.3928	0.9720	1.4370	0.9971
Al	10.778	7.0766	1.2594	1.0050	1.2560	0.9977
Si	3.597	2.2689	1.2370	0.9827	1.2628	0.9968
P	9.217	5.2716	0.9004	1.1798	0.7635	0.9996
Ca	7.778	3.4382	1.0016	1.0043	0.9974	1.0000
Cu	0.344	0.0959	1.2820	1.2856	0.9972	1.0000
Zn	0.868	0.2353	1.2917	1.2954	0.9971	1.0000

Total 100.000 100.0000
Normalization factor = 1.0247

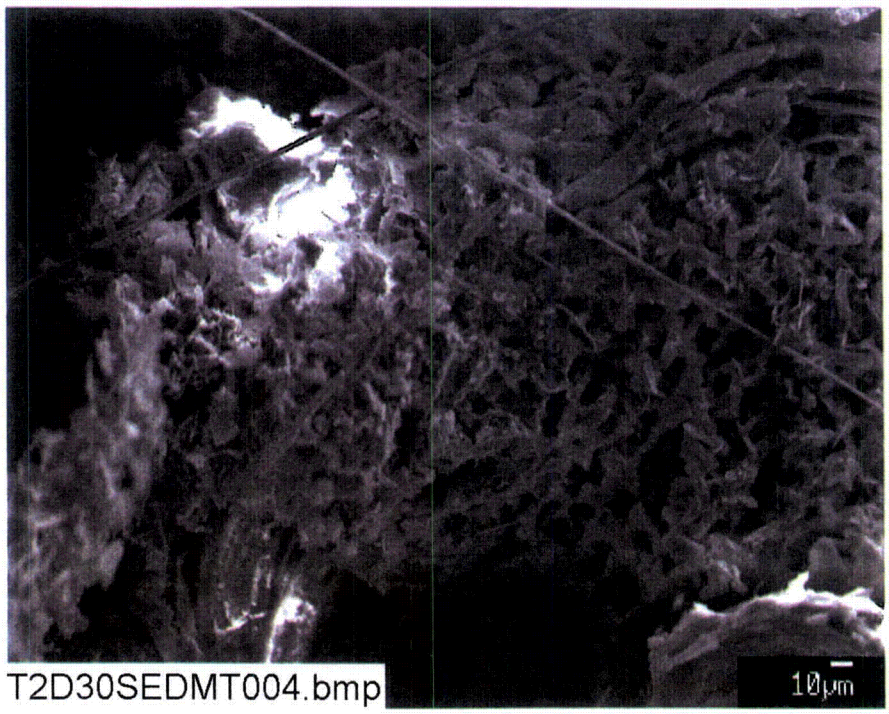


Figure E-4. SEM image for a Test #2, Day-30 sediment sample at 300 × magnification. (T2D30SEDMT004)

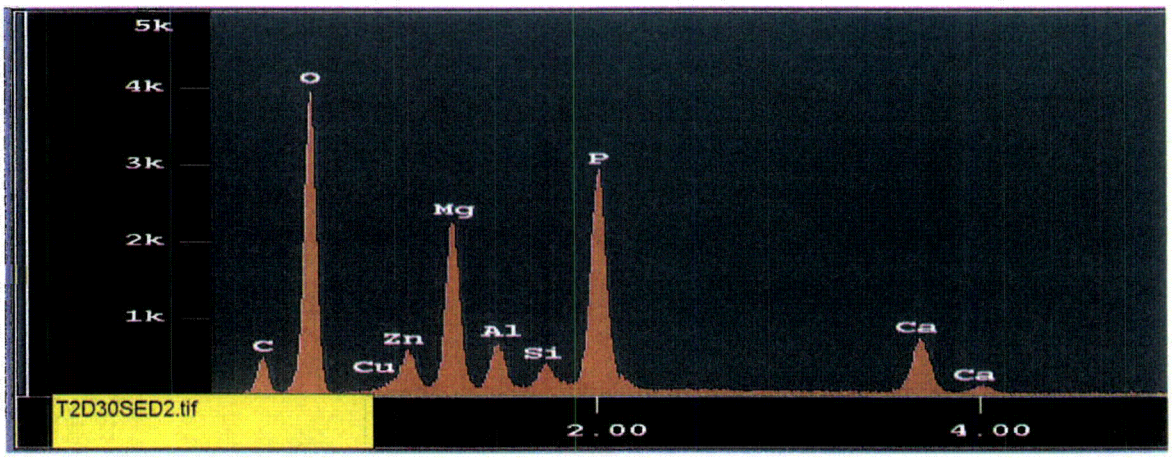


Figure E-5. EDS counting spectrum for the porous structured material shown in Figure E-3. (T2D30SED2)

Appendix F1

TEM Data for Test #2, Day-4 Solution Samples

Figures

This appendix presents TEM images and diffraction patterns for Test #2, Day-4 (February 9, 2005) filtered and unfiltered solution samples. The filtered samples were obtained by passing solution through a 0.7-μm fiberglass filter at 60°C. The unfiltered solution samples were extracted from the tank directly. A drop of each solution sample was placed onto a copper grid of 200 mesh. After being dried in air at room temperature, the sample was ready for TEM analysis. The TEM results and diffraction patterns were obtained on February 9, 2005. Diffraction patterns show whether the sample was amorphous or crystalline. When a sample gives clear and significant diffraction patterns, it is crystalline. Otherwise, it is amorphous. The results show that all of the Test #2, Day-4 samples were amorphous.

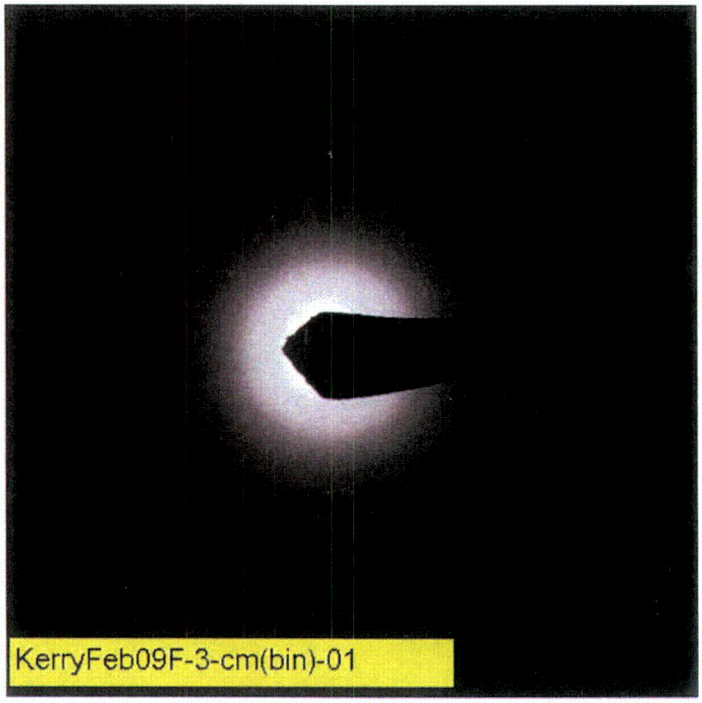


Figure F1-1. TEM image for a Test #2, Day-4 filtered sample solution. (KerryFeb09F-3-cm(bin)-01)

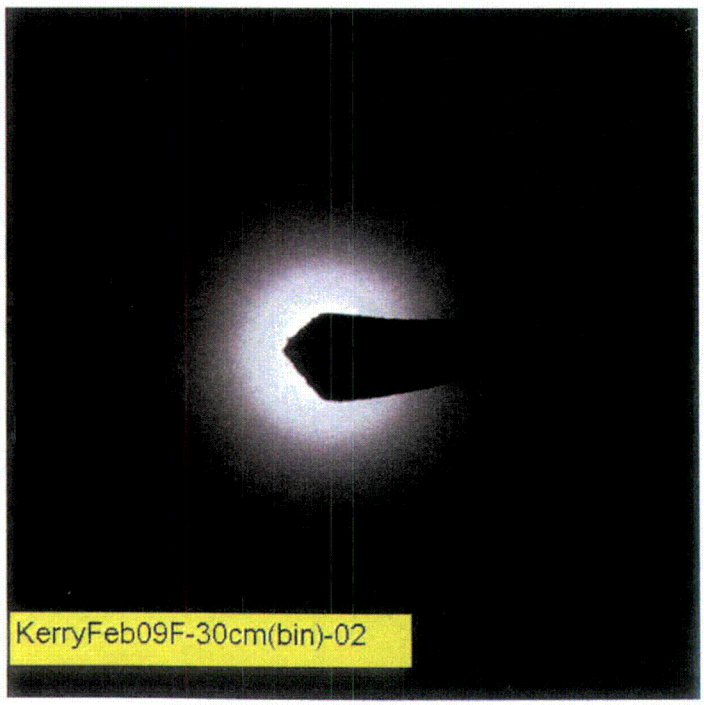


Figure F1-2. TEM image for a second Test #2, Day-4 filtered sample solution. (KerryFeb09F-30-cm (bin)-02)

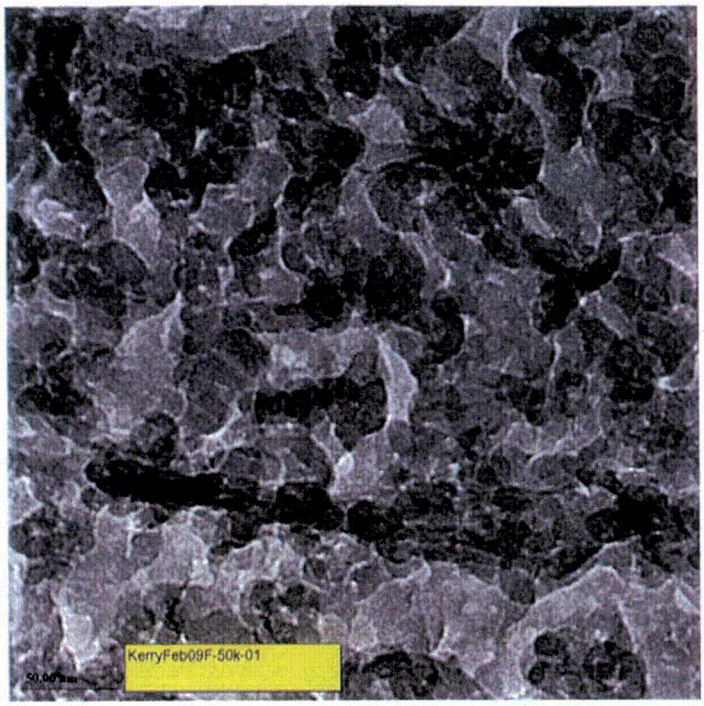


Figure F1-3. Electron micrograph magnified 50,000 times for one Test #2, Day-4 filtered sample location. (KerryFeb09F-50k-01)

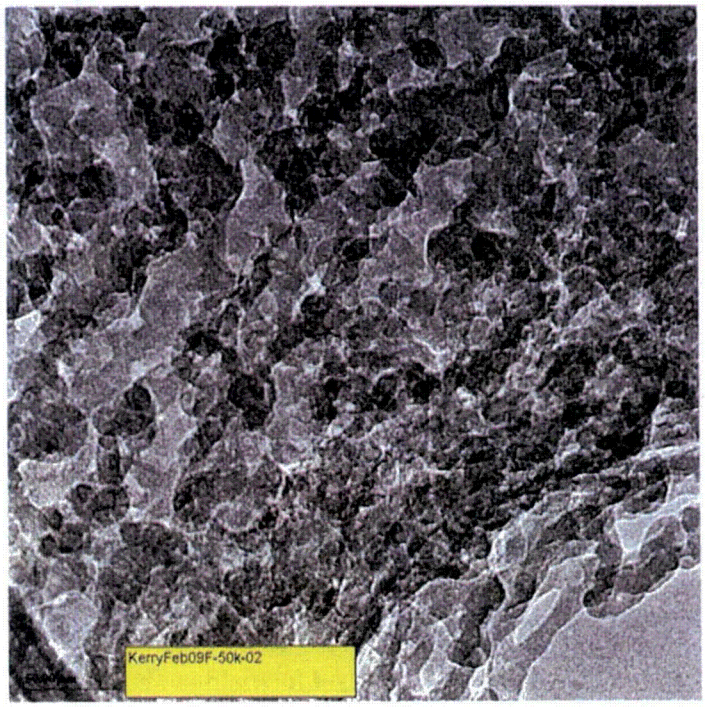


Figure F1-4. Electron micrograph magnified 50,000 times for a second Test #2, Day-4 filtered sample location. (KerryFeb09F-50k-02)

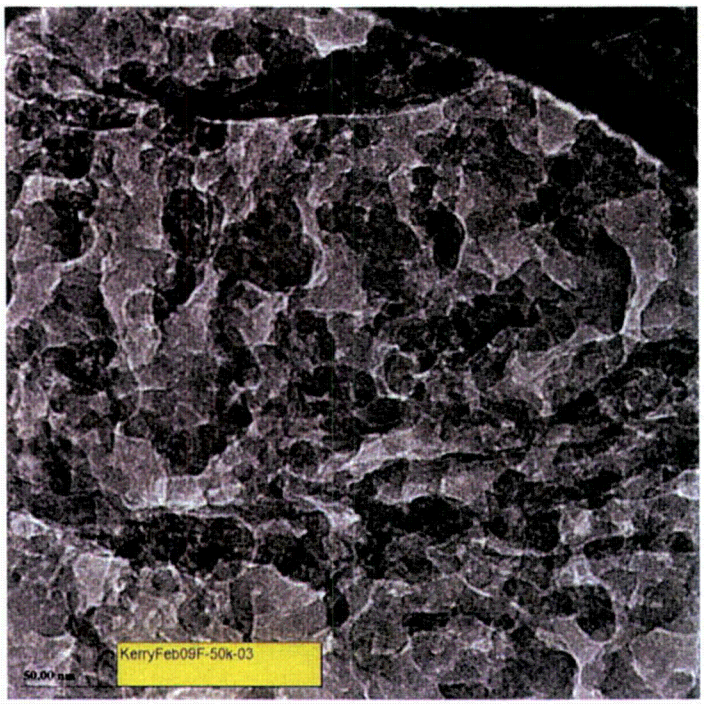


Figure F1-5. Electron micrograph magnified 50,000 times for a third Test #2, Day-4 filtered sample location. (KerryFeb09F-50k-03)

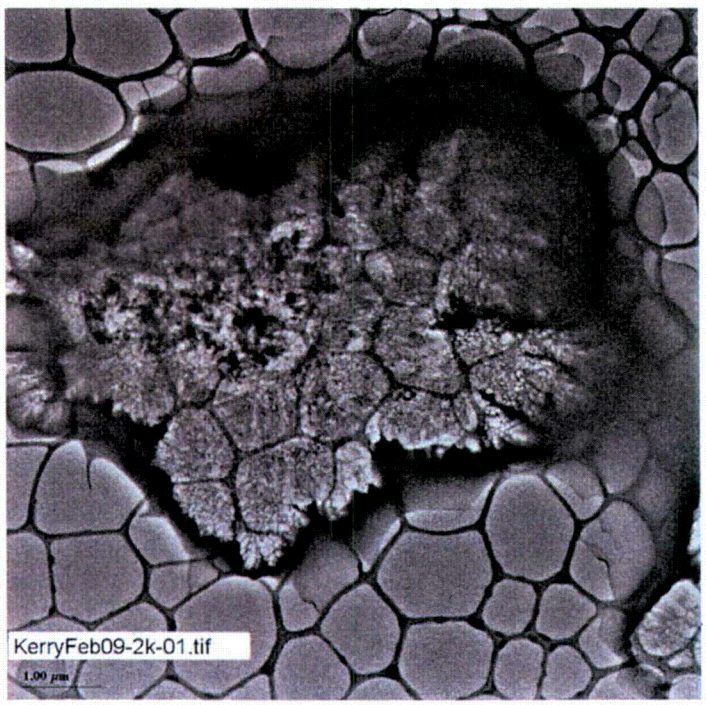


Figure F1-6. Electron micrograph magnified 2000 times for one Test #2, Day-4 unfiltered sample location. (KerryFeb09-2k-01)

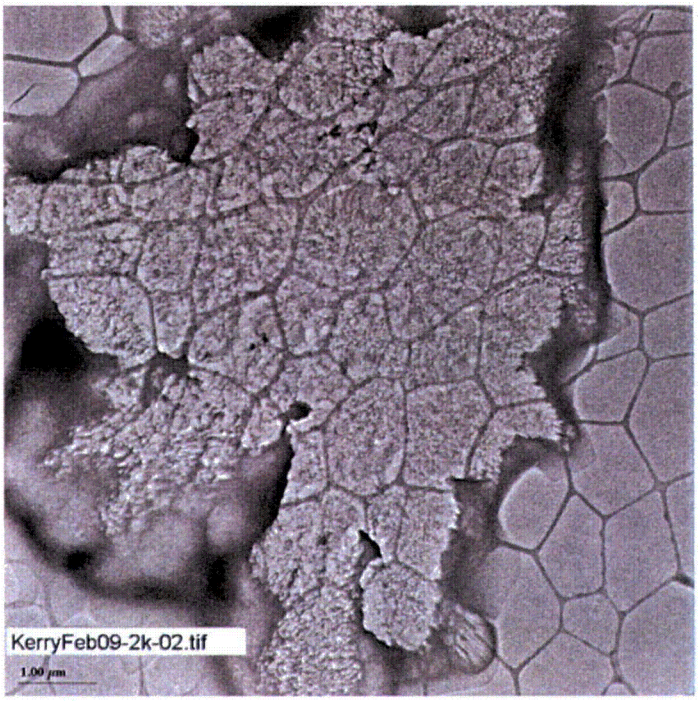


Figure F1-7. Electron micrograph magnified 2000 times for a second Test #2, Day-4 unfiltered sample location. (KerryFeb09-2k-02)

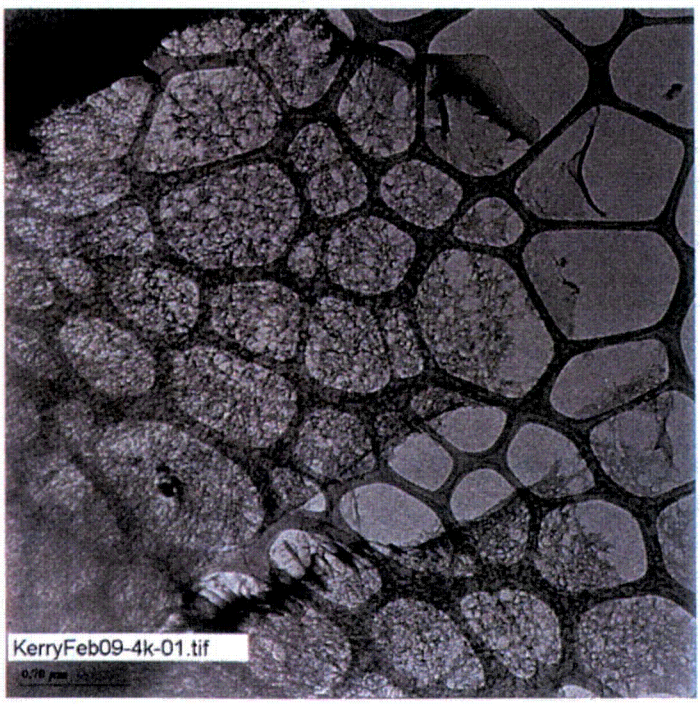


Figure F1-8. Electron micrograph magnified 4000 times for one Test #2, Day-4 unfiltered sample location. (KerryFeb09-4k-01)

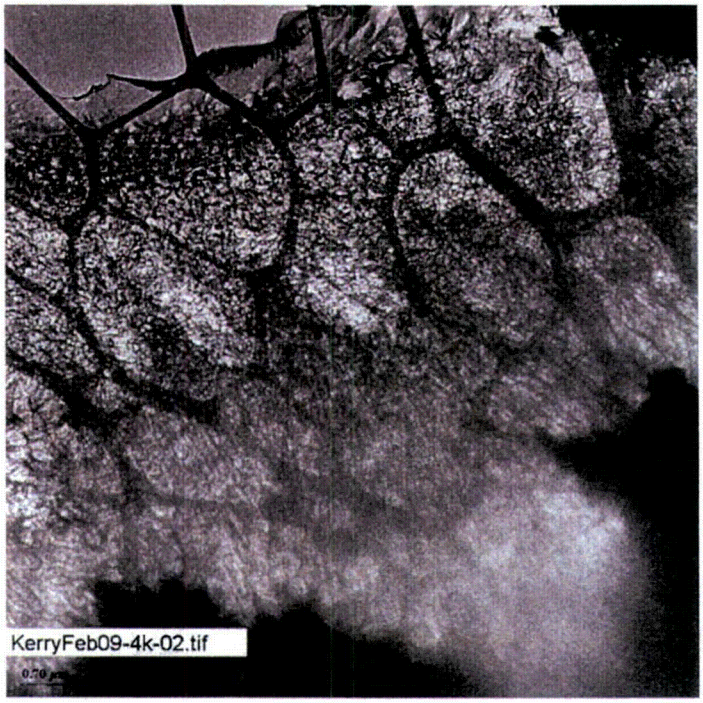


Figure F1-9. Electron micrograph magnified 4000 times for a second Test #2, Day-4 unfiltered sample location. (KerryFeb09-4k-02)

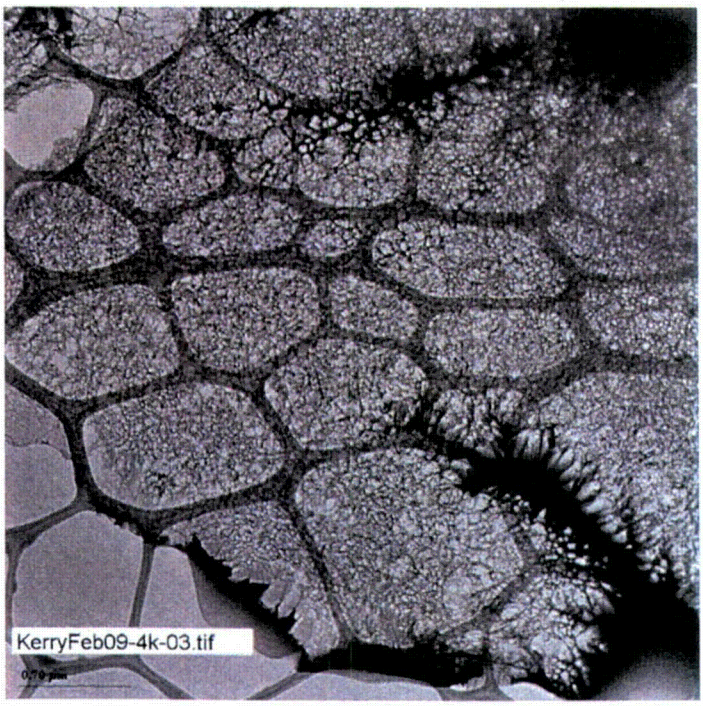


Figure F1-10. Electron micrograph magnified 4,000 times for a third Test #2, Day-4 unfiltered sample location. (KerryFeb09-4k-03)

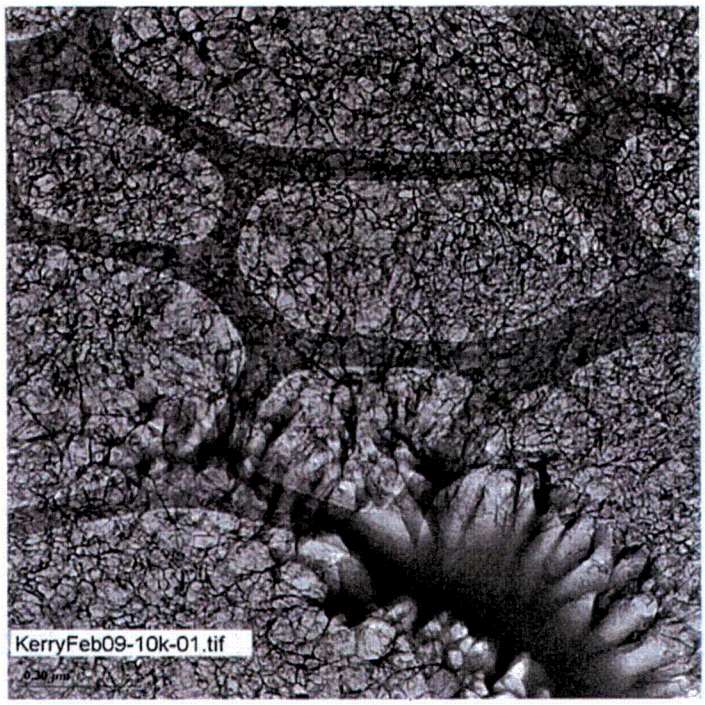


Figure F1-11. Electron micrograph magnified 10,000 times for one Test #2, Day-4 unfiltered sample location. (KerryFeb09-10k-01)

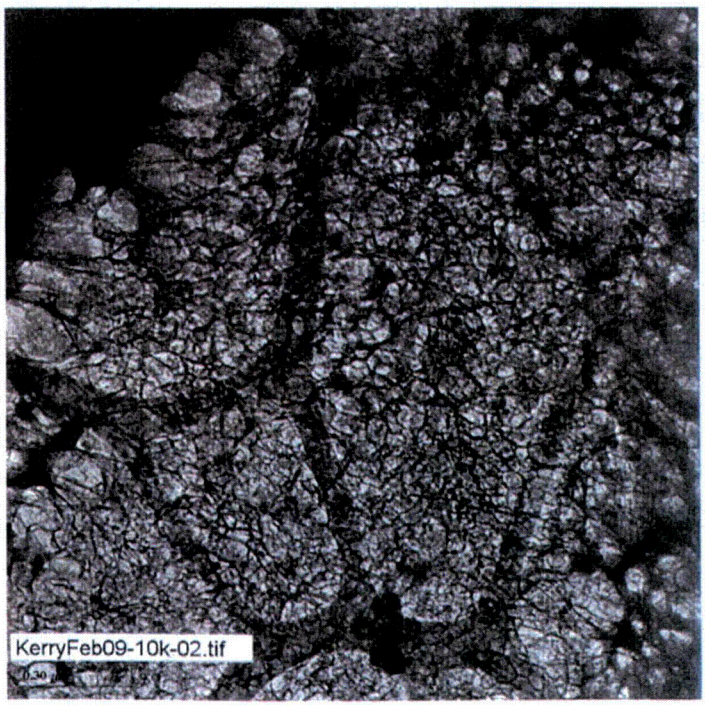


Figure F1-12. Electron micrograph magnified 10,000 times for a second Test #2, Day-4 unfiltered sample location. (KerryFeb09-10k-02)

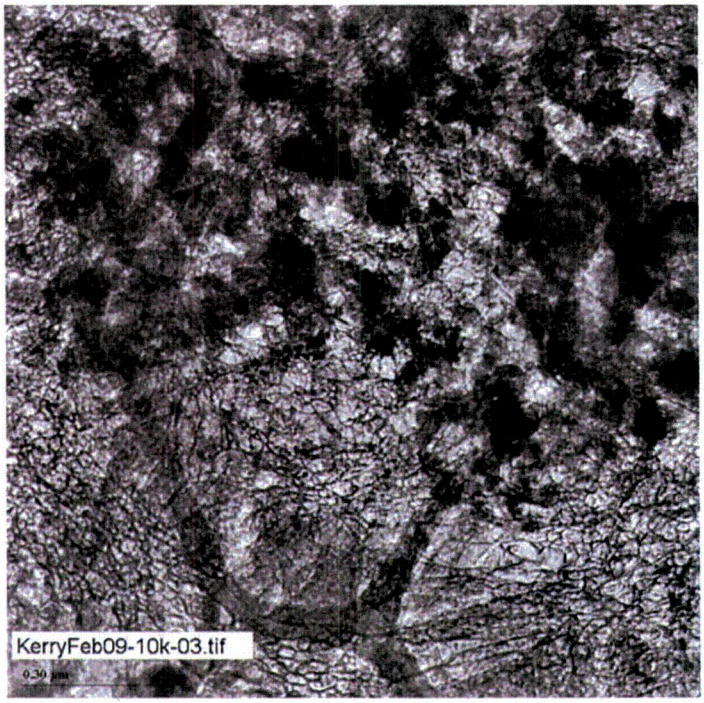


Figure F1-13. Electron micrograph magnified 10,000 times for a third Test #2, Day-4 unfiltered sample location. (KerryFeb09-10k-03)

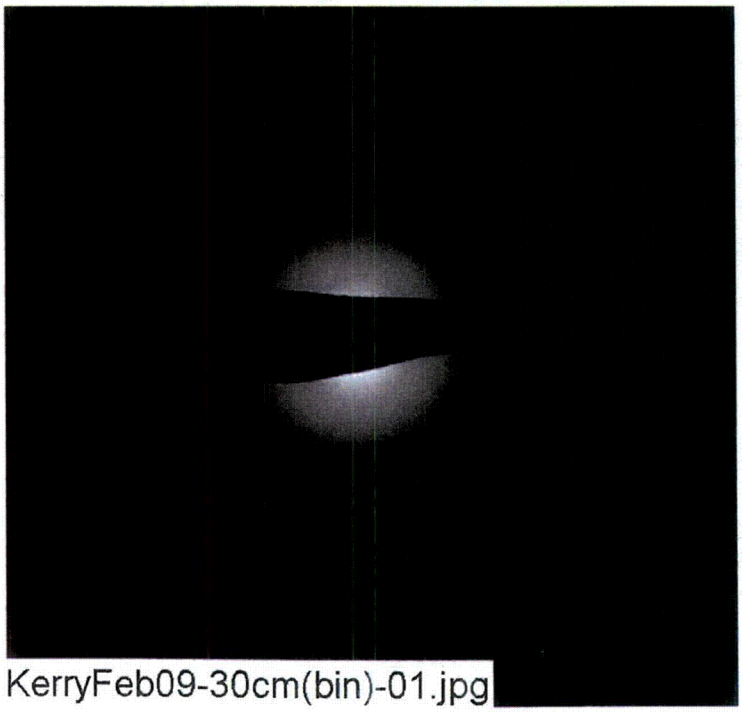


Figure F1-14. TEM image for one Test #2, Day-4 unfiltered sample location. (KerryFeb09-30cm(bin)-01)

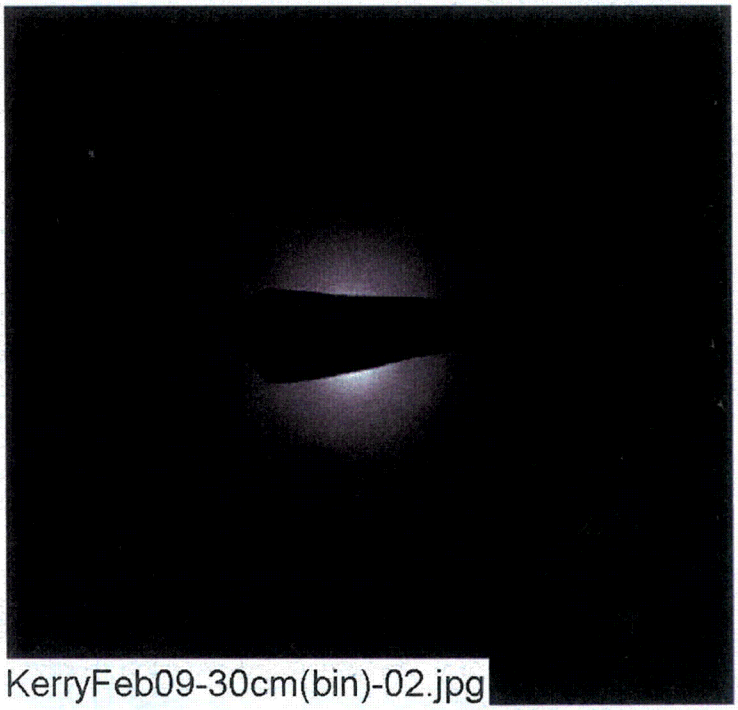


Figure F1-15. TEM image for a second Test #2, Day-4 unfiltered sample location. (KerryFeb09-30cm(bin)-02)

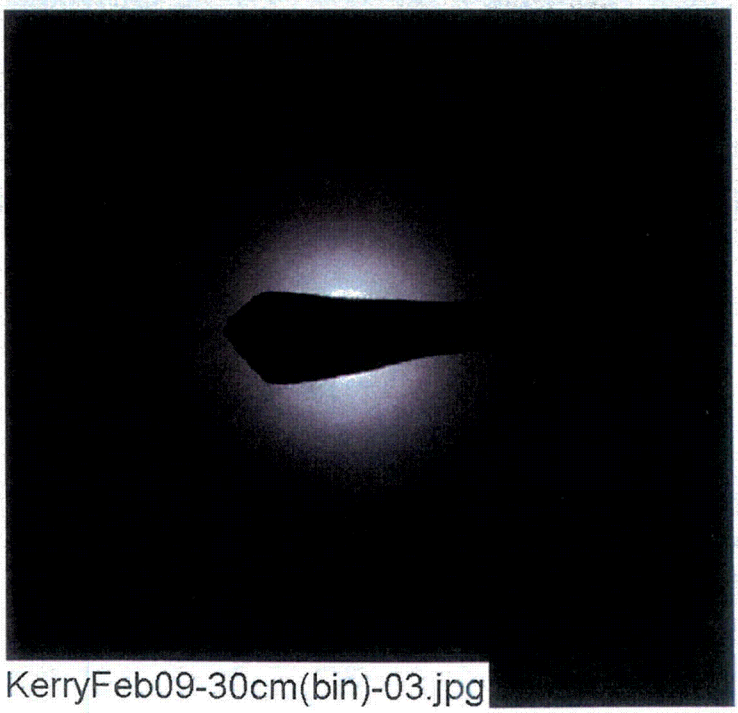


Figure F1-16. TEM image for a third Test #2, Day-4 unfiltered sample location. (KerryFeb09-30cm (bin)-03)

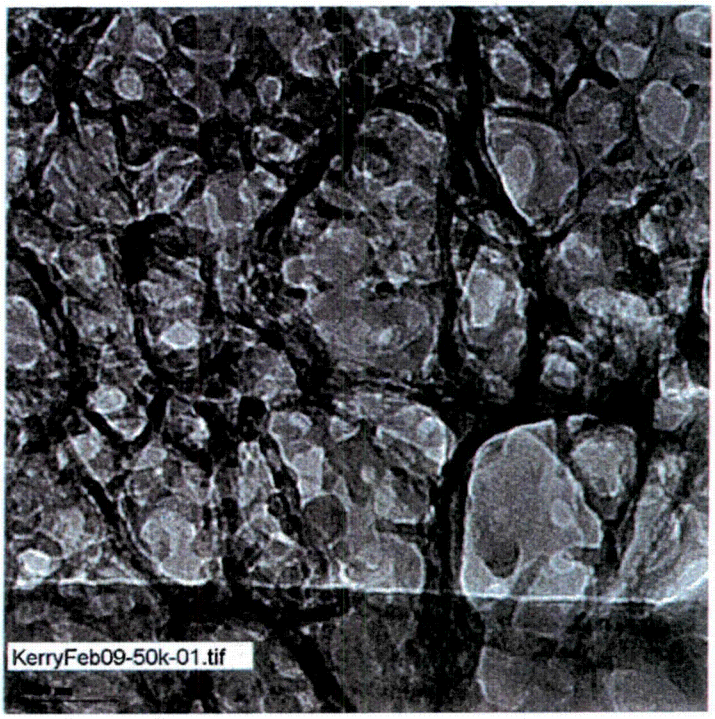


Figure F1-17. Electron micrograph magnified 50,000 times for one Test #2, Day-4 unfiltered sample location. (KerryFeb09-50k-01)

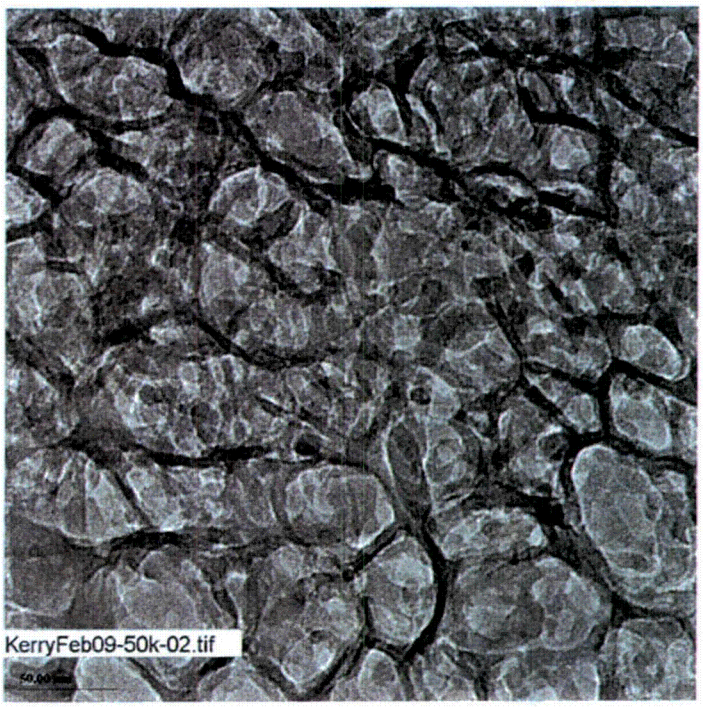


Figure F1-18. Electron micrograph magnified 50,000 times for a second Test #2, Day-4 unfiltered sample location. (KerryFeb09-50k-02)

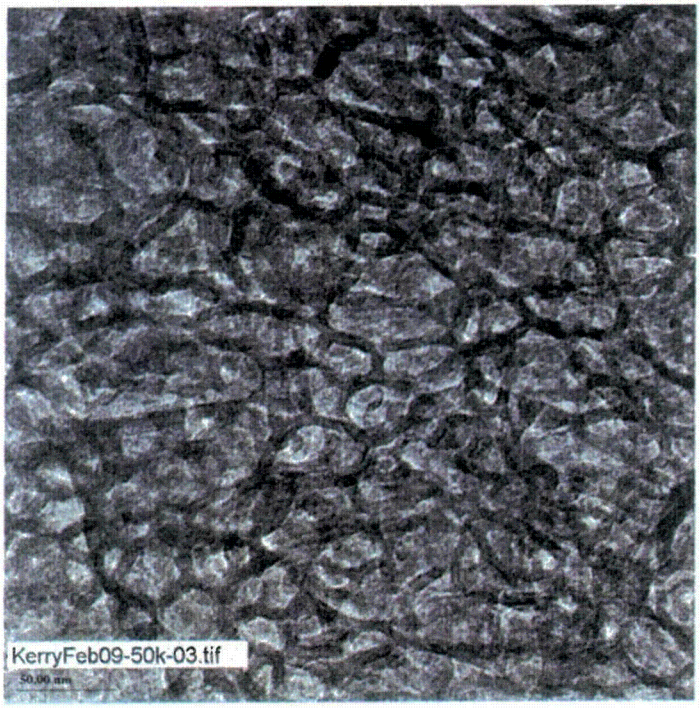


Figure F1-19. Electron micrograph magnified 50,000 times for a third Test #2, Day-4 unfiltered sample location. (KerryFeb09-50k-03)

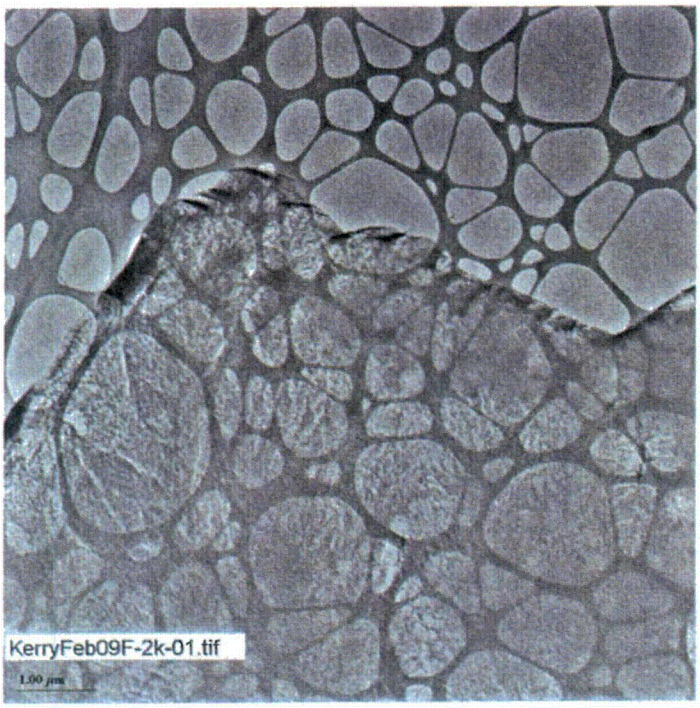


Figure F1-20. Electron micrograph magnified 2000 times for one Test #2, Day-4 filtered sample location. (KerryFeb09F-2k-01)

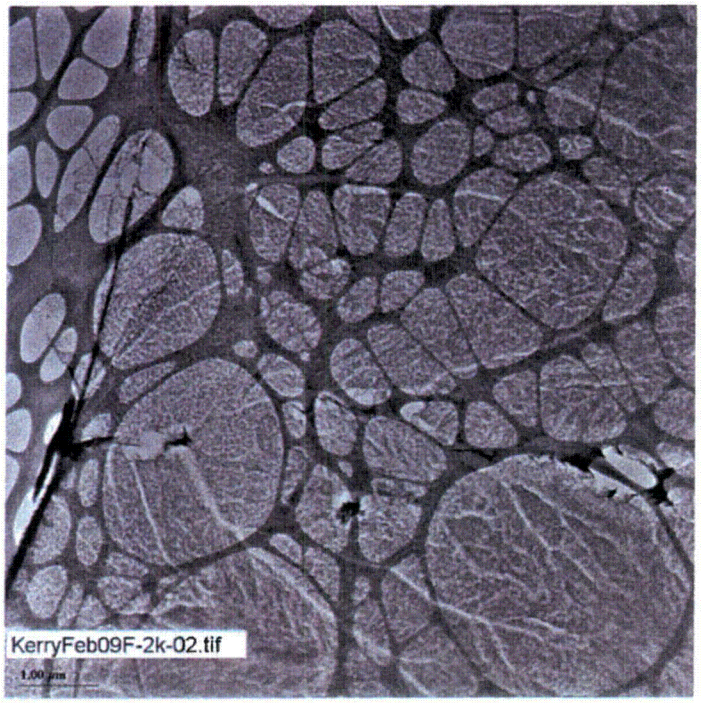


Figure F1-21. Electron micrograph magnified 2000 times for a second Test #2, Day-4 filtered sample location. (KerryFeb09F-2k-02)

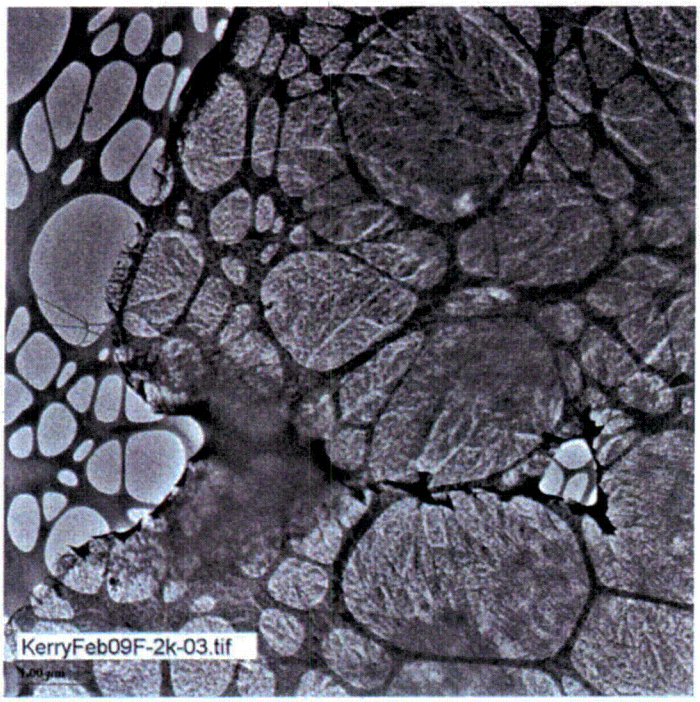


Figure F1-22. Electron micrograph magnified 2000 times for a third Test #2, Day-4 filtered sample location. (KerryFeb09F-2k-03)

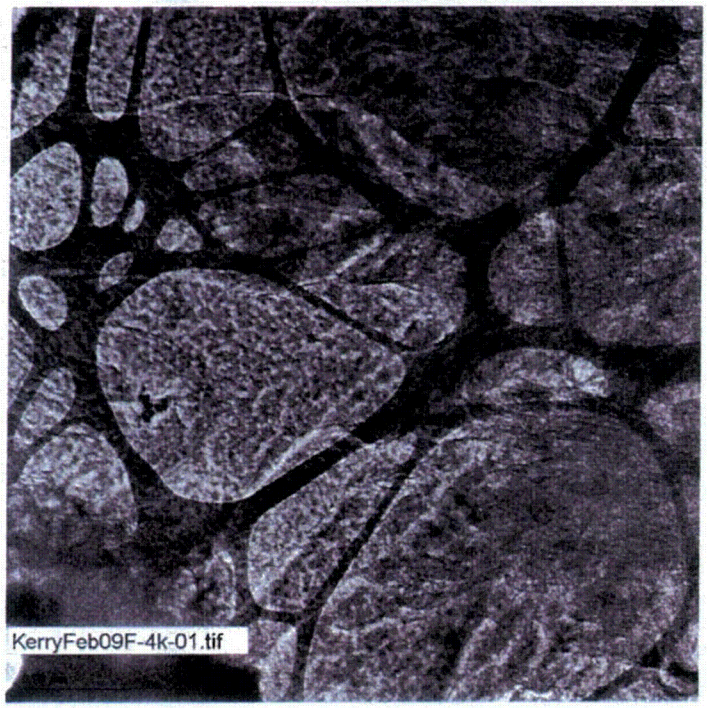


Figure F1-23. Electron micrograph magnified 4000 times for one Test #2, Day-4 filtered sample location. (KerryFeb09F-4k-01)

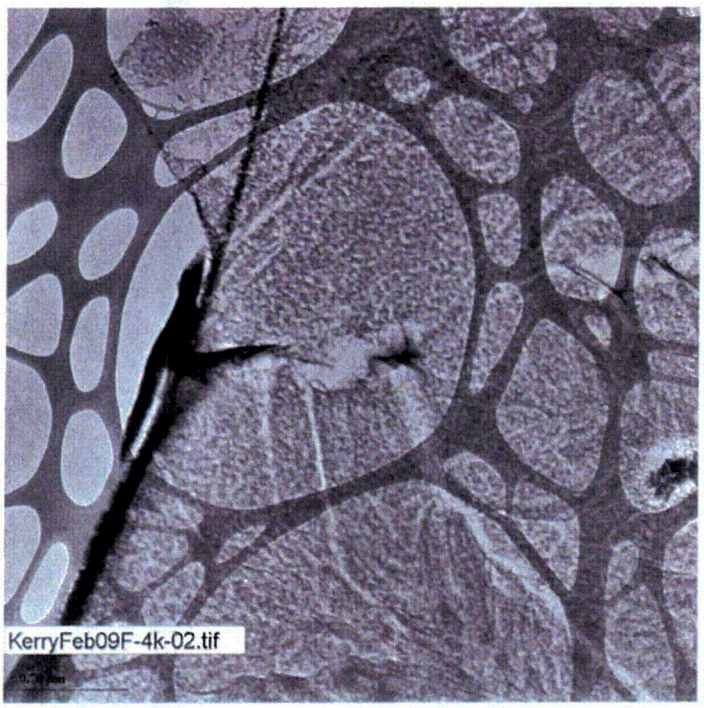


Figure F1-24. Electron micrograph magnified 4000 times for a second Test #2, Day-4 filtered sample location. (KerryFeb09F-4k-02)

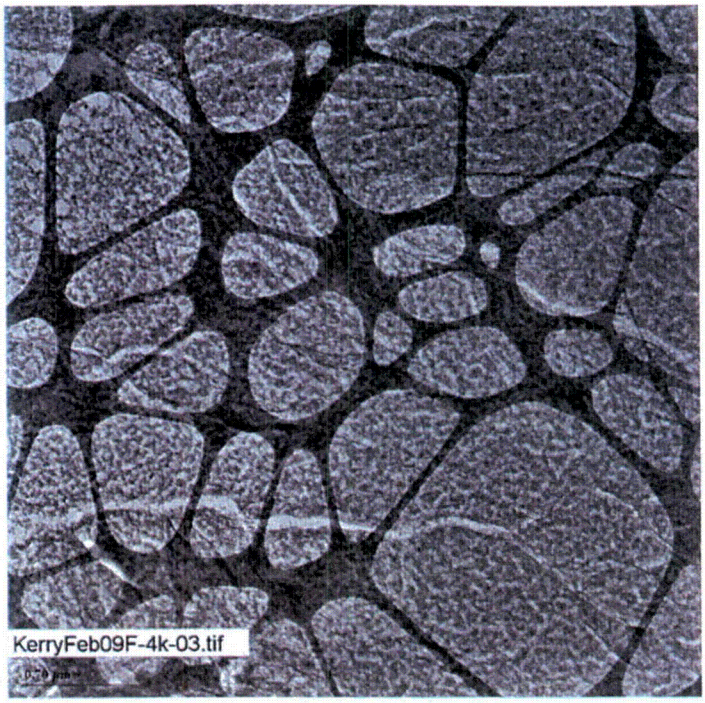


Figure F1-25. Electron micrograph magnified 4000 times for a third Test #2, Day-4 filtered sample location. (KerryFeb09F-4k-03)

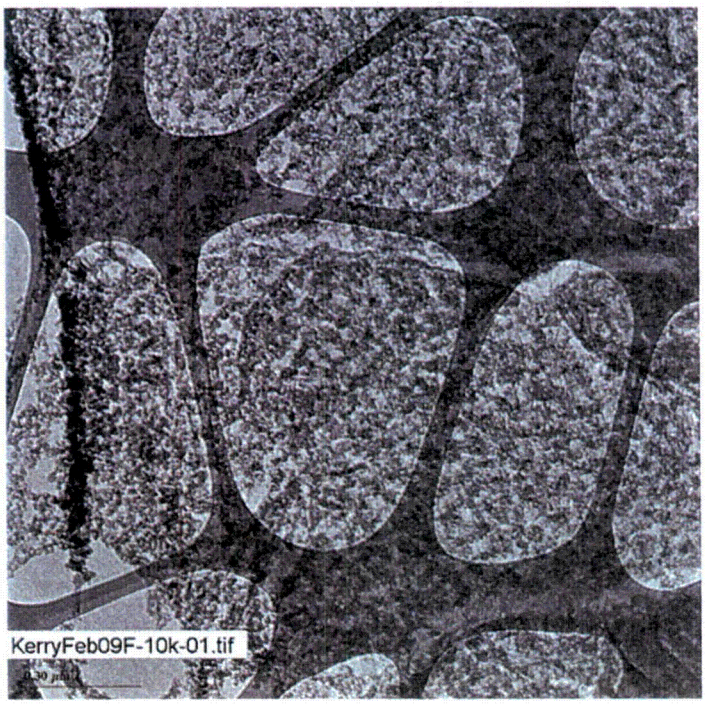


Figure F1-26. Electron micrograph magnified 10,000 times for one Test #2, Day-4 filtered sample location. (KerryFeb09F-10k-01)

Figure F1-27. Electron micrograph magnified 10,000 times for a second Test #2, Day-4 filtered sample location. (KerryFeb09F-10k-02)

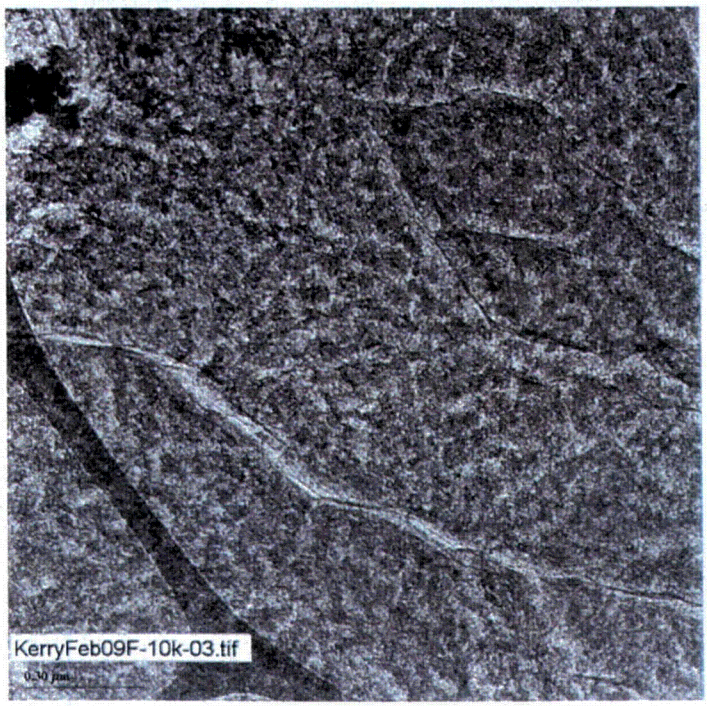


Figure F1-28. Electron micrograph magnified 10,000 times for a third Test #2, Day-4 filtered sample location. (KerryFeb09F-10k-03)