3.0 Fiber Analysis

There were two different types of fiber beds used during test; (1) blender-processed debris beds and (2) NEI-processed debris beds. The NEI-processed debris bed was used for the duration of the 30-day test followed by the insertion of the blender-processed debris bed exposed to solution for 2 days. At the end of the test, the beds were analyzed by the naked eye to spot any noticeable features (particles, debris, etc.). Sections of the fiber bed with particulate were extracted and sent for SEM analysis. The following images depict samples taken from Test 1 post-test fiber beds. The name of the sample includes which bed it came from (NEI or Blender) and the approximate description of the visual appearance of the particle being examined is noted in the figure captions. If EDX of a particle was acquired, the location of the particle examined is indicated on the figure by an "X".

Blender, Tight Fiber No Particle, 1

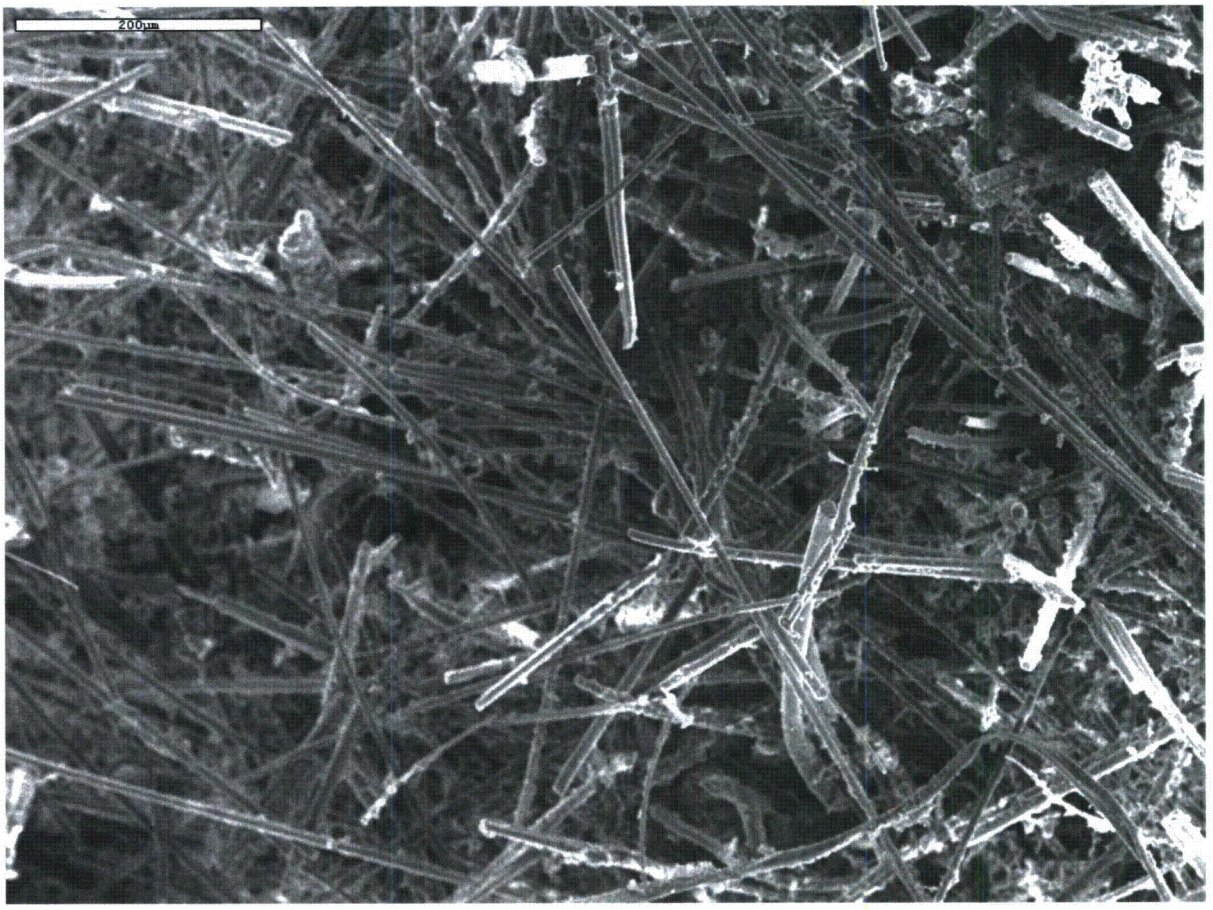

Figure 53 - "Blender, Tight Fiber No Particle, 1" Very dirty fiber

Blender, Tight Fiber No Particle, 2

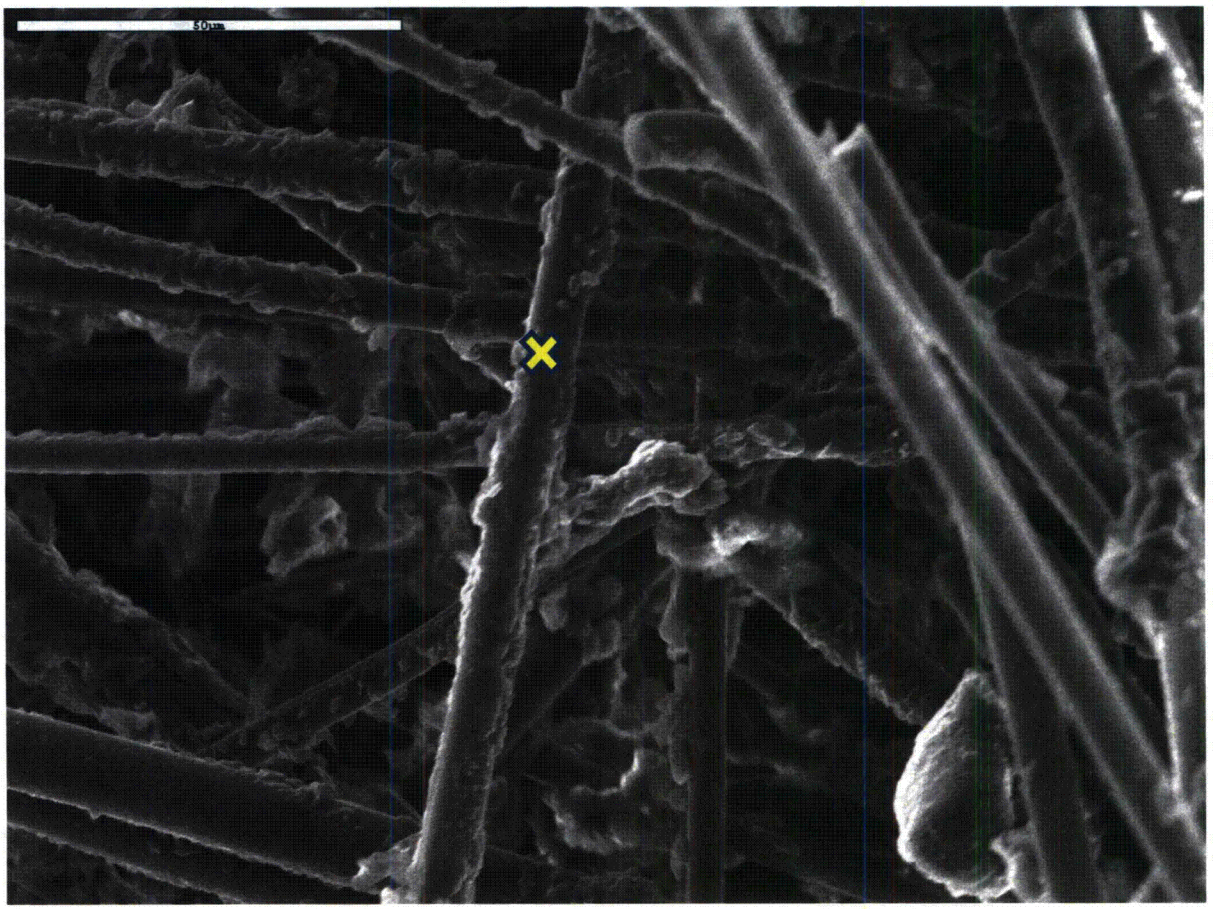

Figure 54 - "Blender, Tight Fiber No Particle, 2" Zoomed in view of dirty fiber

Elmt	Element %	Atomic %
O	56.77065	69.19812
Na	9.799163	8.312148
Mg	1.583022	1.269783
Al	0.82532	0.596501
Si	26.61184	18.47771
Ca	4.410004	2.145727

Blender, Tight Fiber No Particle, 4

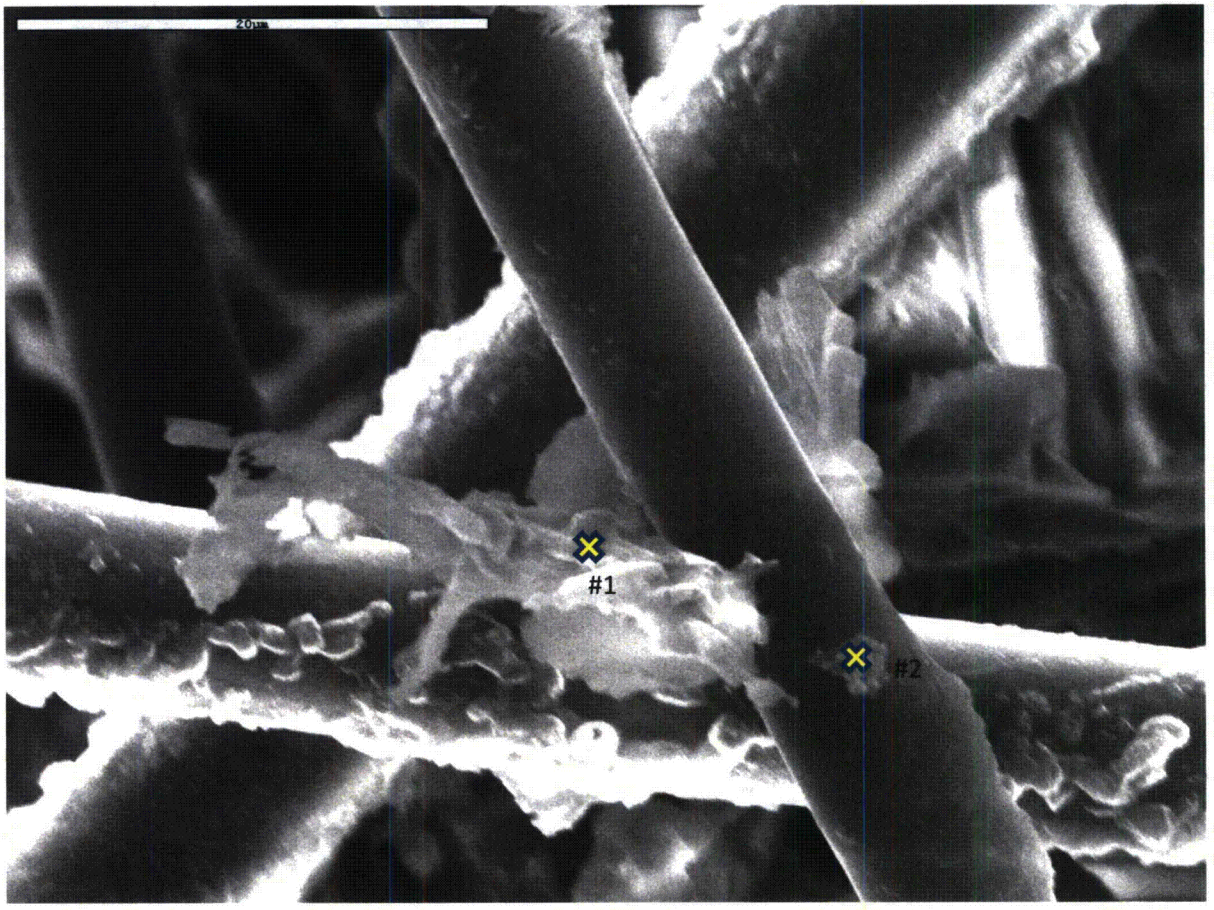

Figure 55 - "Blender, Tight Fiber No Particle, 4" Fiber bonded by precipitate

#1

Elmt	Element %	Atomic %
O	87.29305	91.56556
Na	7.752471	5.659089
Si	3.919436	2.341958
Ca	1.035042	0.433387

#2

Elmt	Element %	Atomic %
O	53.04387	66.44089
Na	8.375714	7.300892
Mg	1.601632	1.320186
Al	1.01925	0.757006
Si	29.04379	20.72318
Ca	6.915733	3.457829

Blender, White Specks, 1

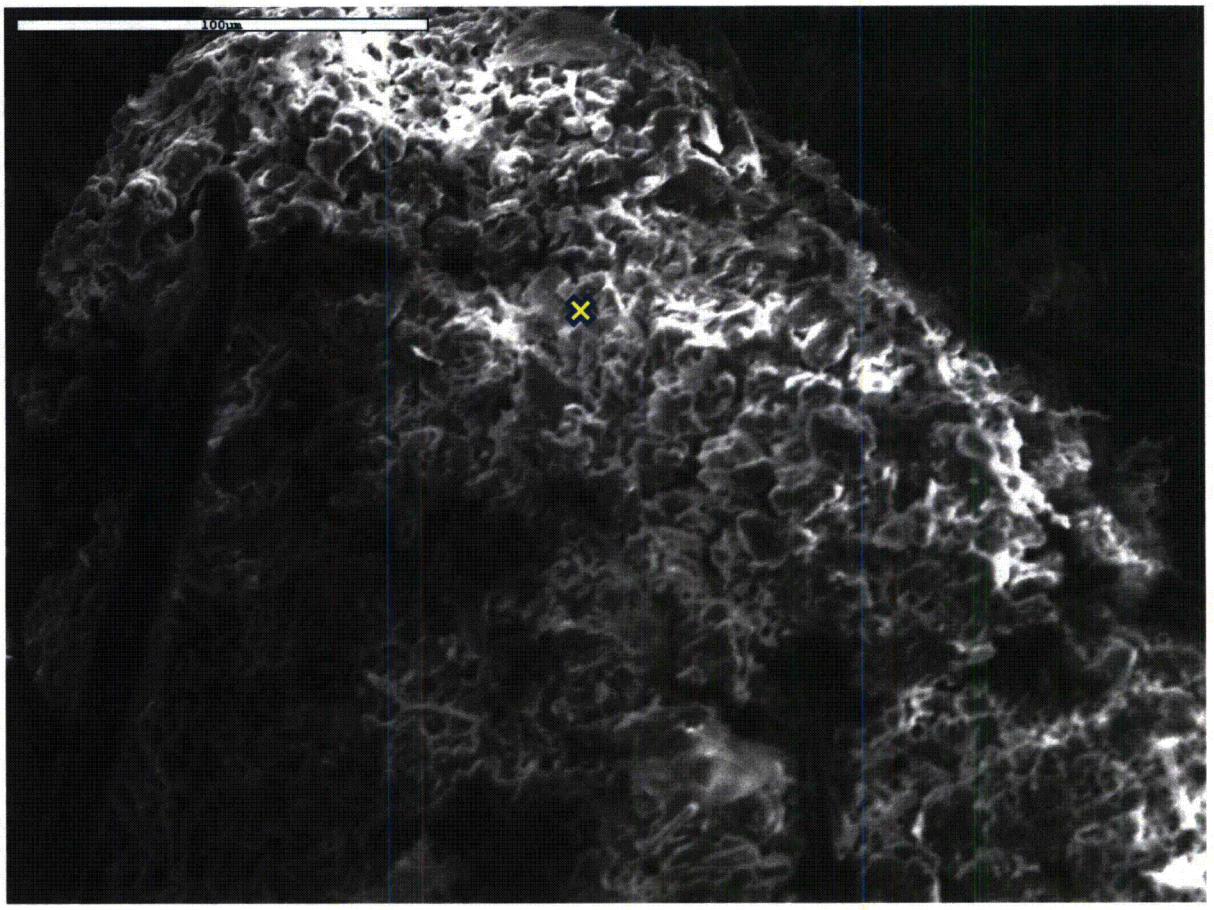

Figure 56 - "Blender, White Specks, 1" Large particle on fiber

Elmt	Element %	Atomic %
O	38.35108	57.62598
Na	2.812468	2.940913
Al	1.792424	1.596983
Si	1.596614	1.366607
P	21.37774	16.59197
Ca	28.37723	17.02064
Ti	5.69245	2.856915

Blender, White Specks, 2

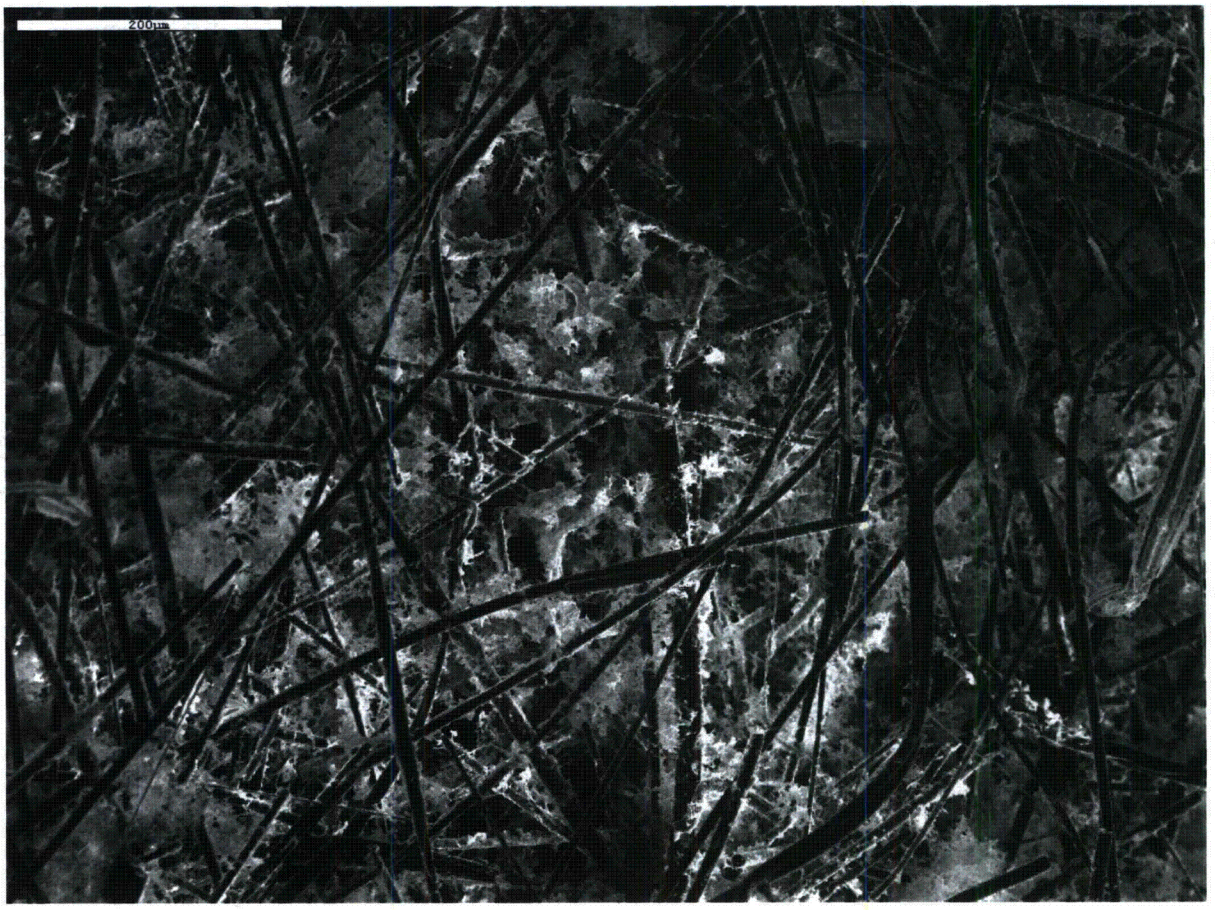

Figure 57 - "Blender, White Specks, 2" Spider web looking precipitate on fiber

Blender, black strip, 1

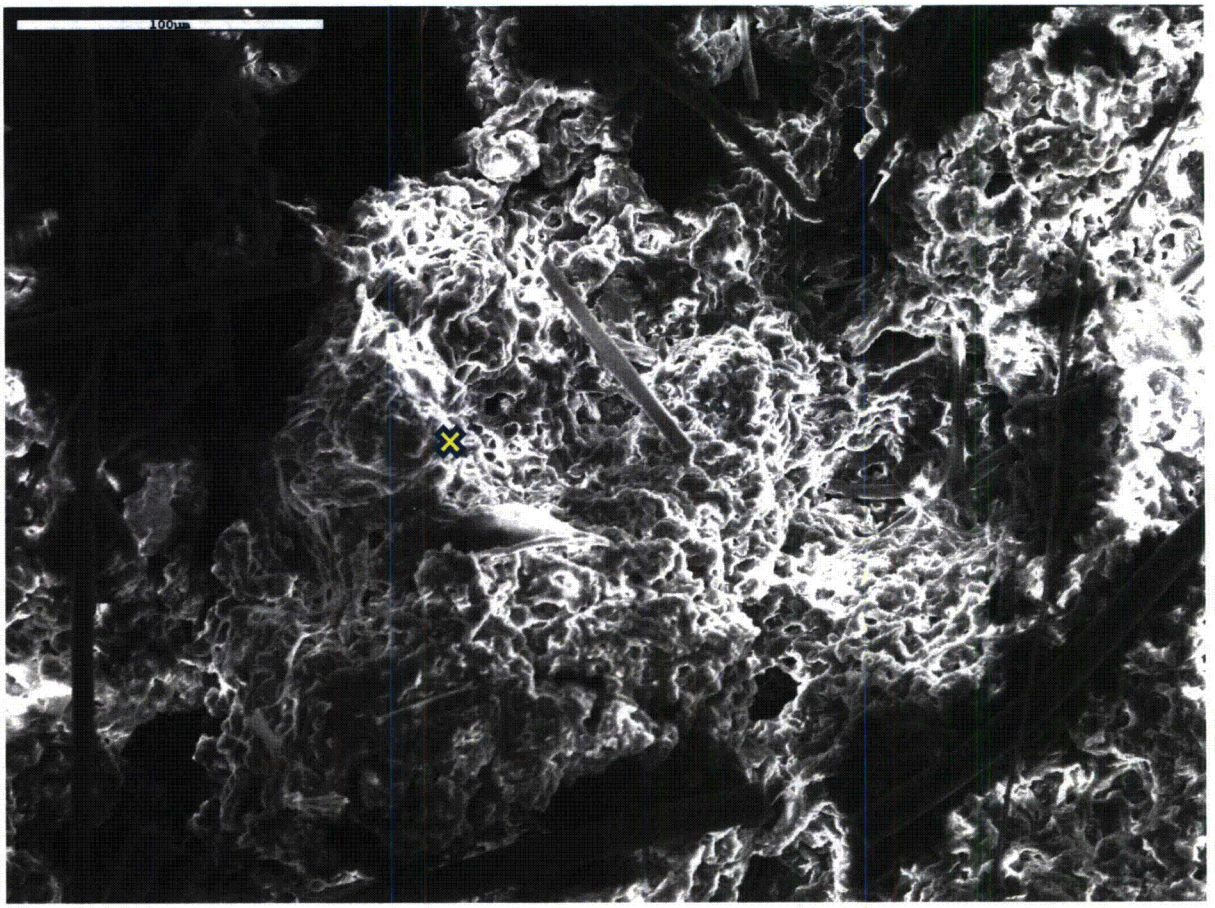

Figure 58 - "Blender, black strip, 1" Scattered precipitate

Elmt	Element %	Atomic %
O	72.39867	80.53704
Na	12.47189	9.654976
Al	8.515695	5.616993
Si	6.613756	4.190985

NEI, white flakes, 1

Figure 59 - "NEI, white flakes, 1" Layered particle on fiber

#1

Elmt	Element %	Atomic %
O	52.97784	73.97655
Al	0.577575	0.478219
Si	0.848312	0.674774
Ca	39.60971	22.07835
Ti	5.986553	2.792119

#2

Elmt	Element %	Atomic %
O	70.30152	84.59555
Al	3.347521	2.388497
Si	5.693091	3.902419
Ca	10.33824	4.965859
Ti	10.31964	4.147675

Blender, Grey Strip, 1

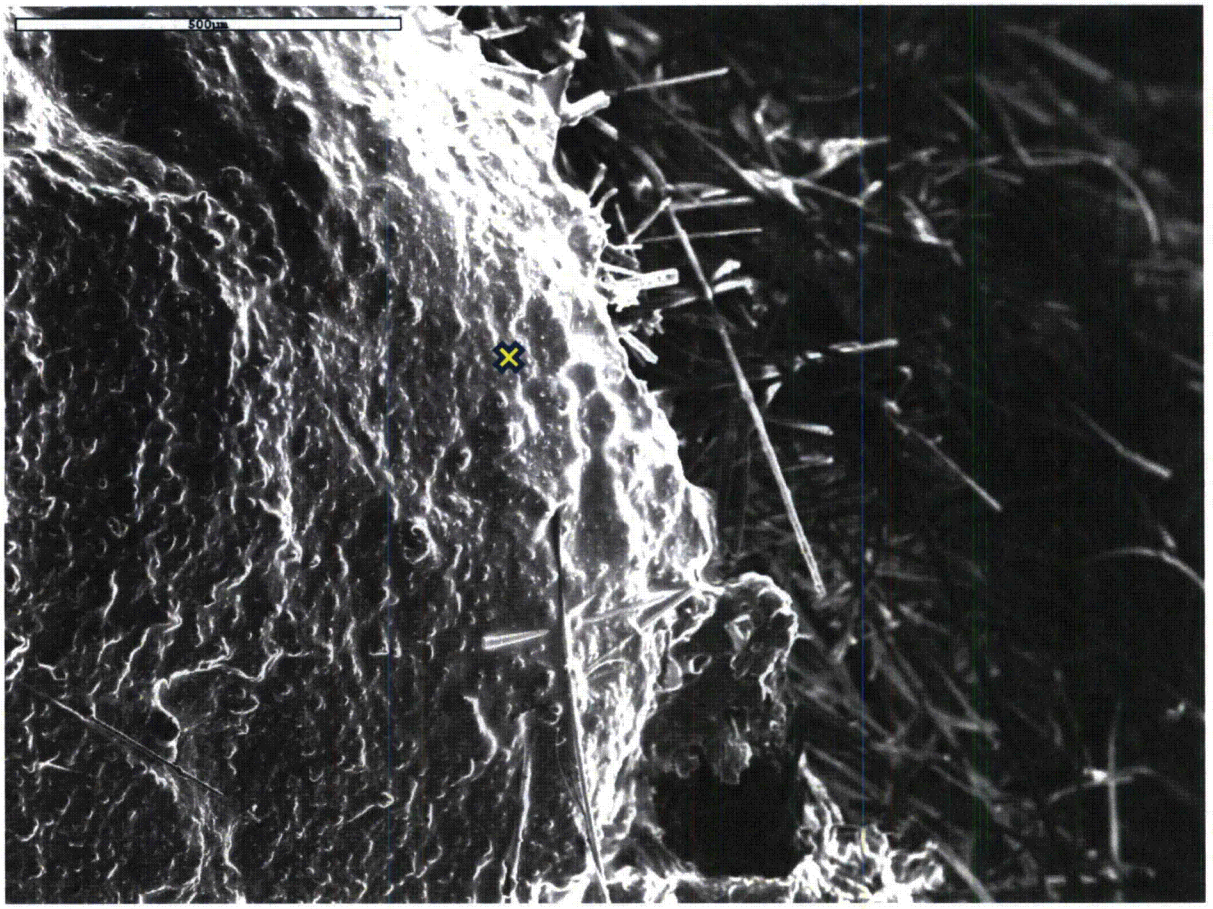

Figure 60 - "Blender, Grey Strip, 1" Flat precipitate

Elmt	Element %	Atomic %
O	31.24707	52.46994
Al	0.932475	0.928447
Si	1.000949	0.95745
P	10.25309	8.89307
Ca	45.91915	30.7794
Ti	10.64725	5.971675

Blender, Grey Strip, 2

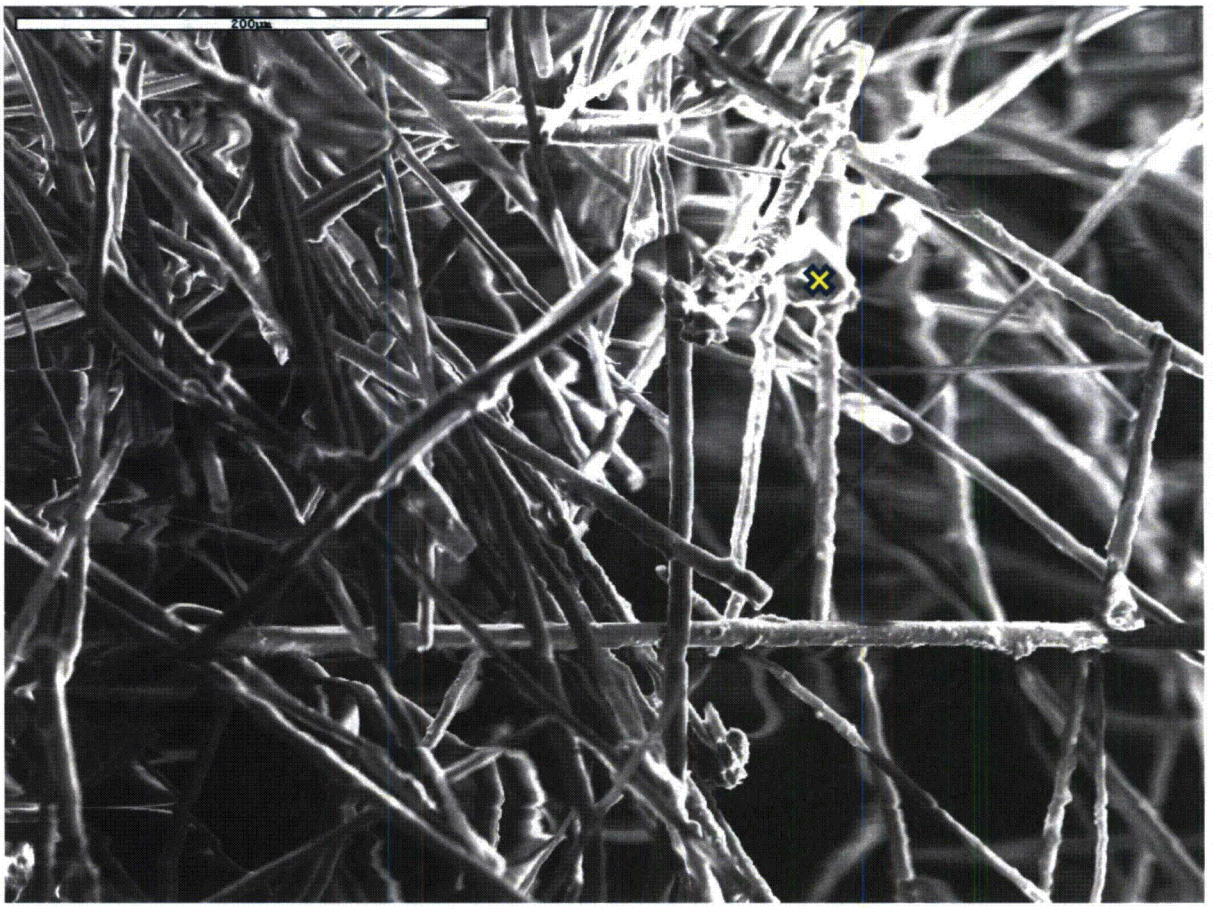

Figure 61 - "Blender, Grey Strip, 2" Small clump on fiber

Elmt	Element %	Atomic %
O	60.32007	78.11366
Na	2.673882	2.40969
Al	0.428939	0.329366
Si	0.669457	0.493845
P	1.023016	0.684295
Ca	34.12969	17.6426
Ti	0.754966	0.32655

Blender, Black Spots, 1

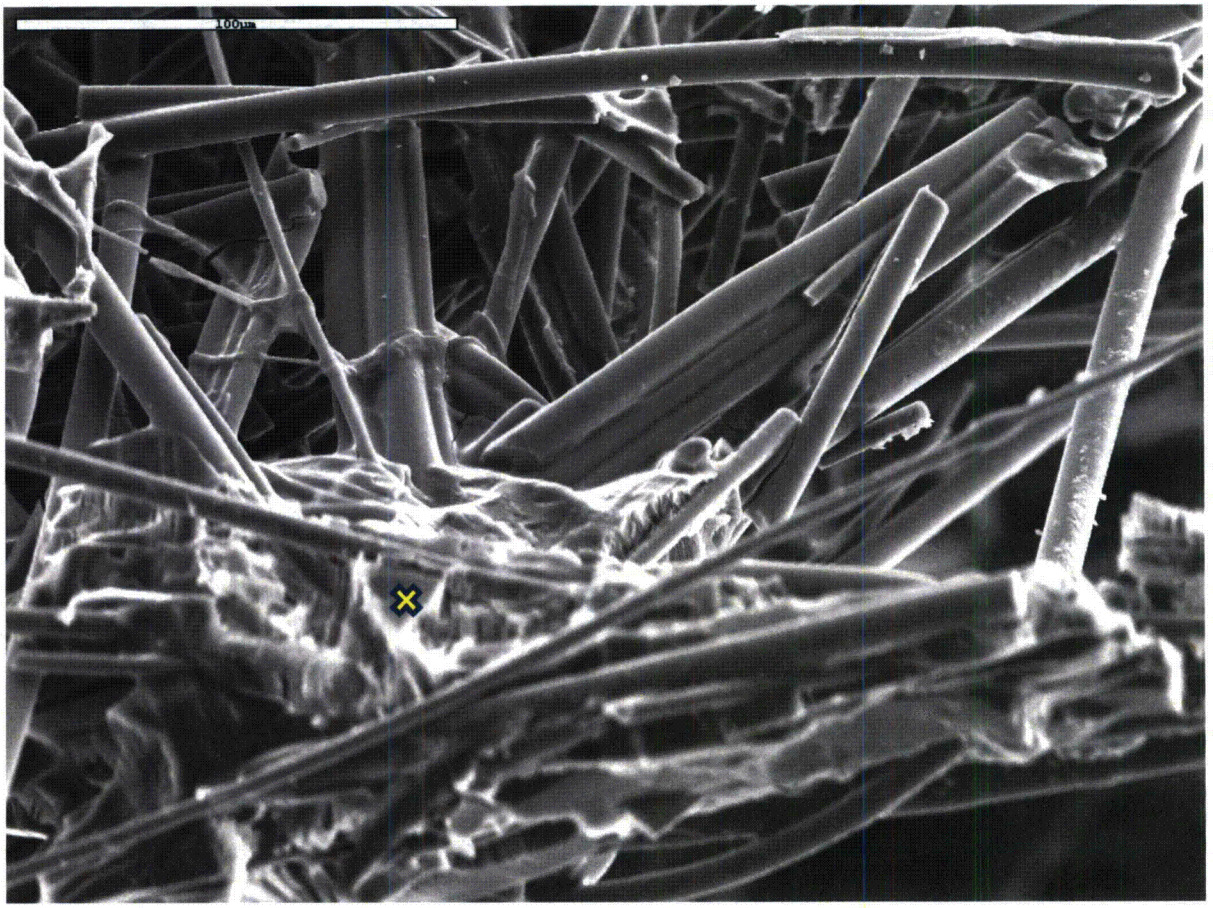

Figure 62 - "Blender, Black Spots, 1" Gunk on fiber

Elmt	Element %	Atomic %
O	97.36662	98.35217
Na	1.190426	0.836816
Si	1.083767	0.62361
P	0.359193	0.187412

Blender, Black Spots, 2

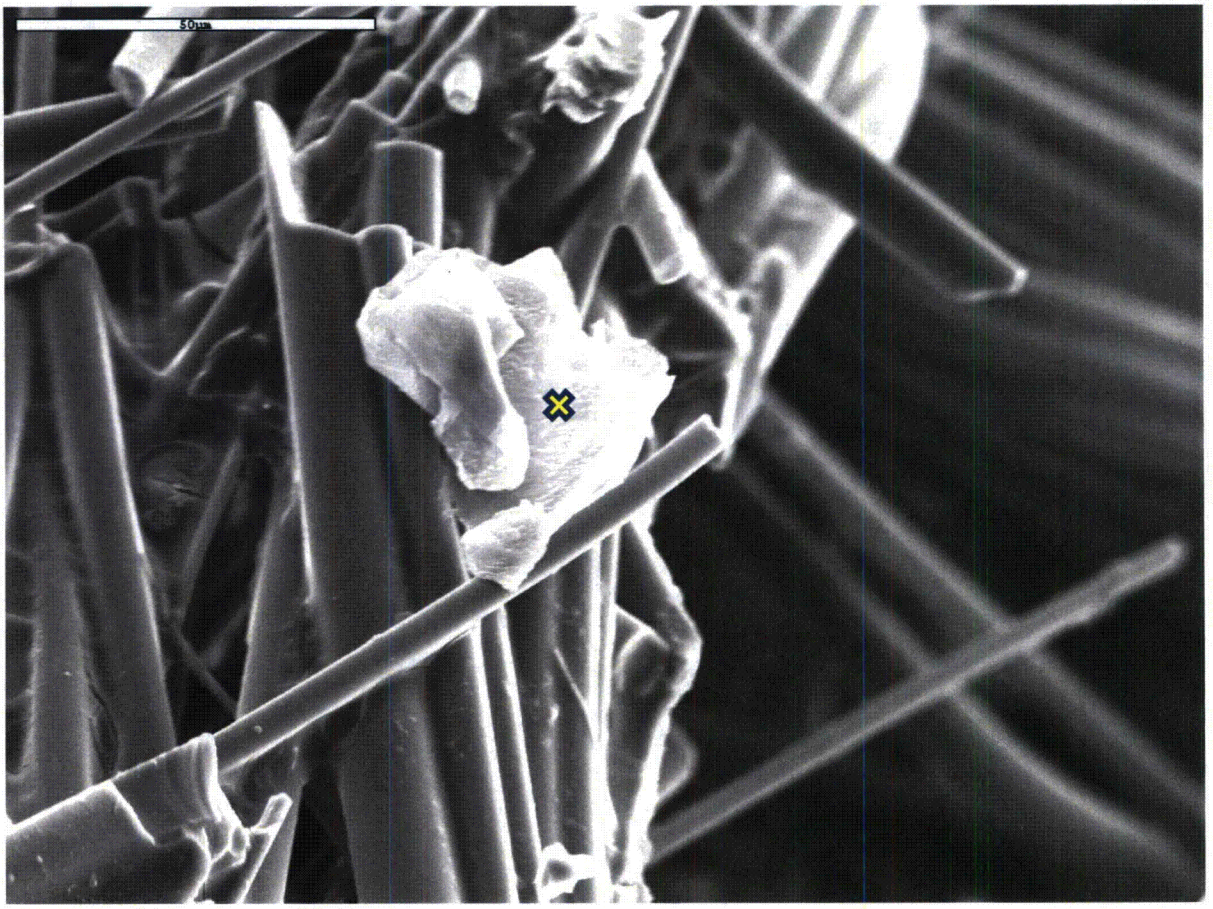

Figure 63 - "Blender, Black Spots, 2" Crystal on particle

Elmt	Element %	Atomic %
O	70.31113	80.97112
Na	2.706346	2.168919
Al	4.024393	2.748053
Si	18.12502	11.89015
Ca	4.833108	2.221762

Blender, Black Speck, 1

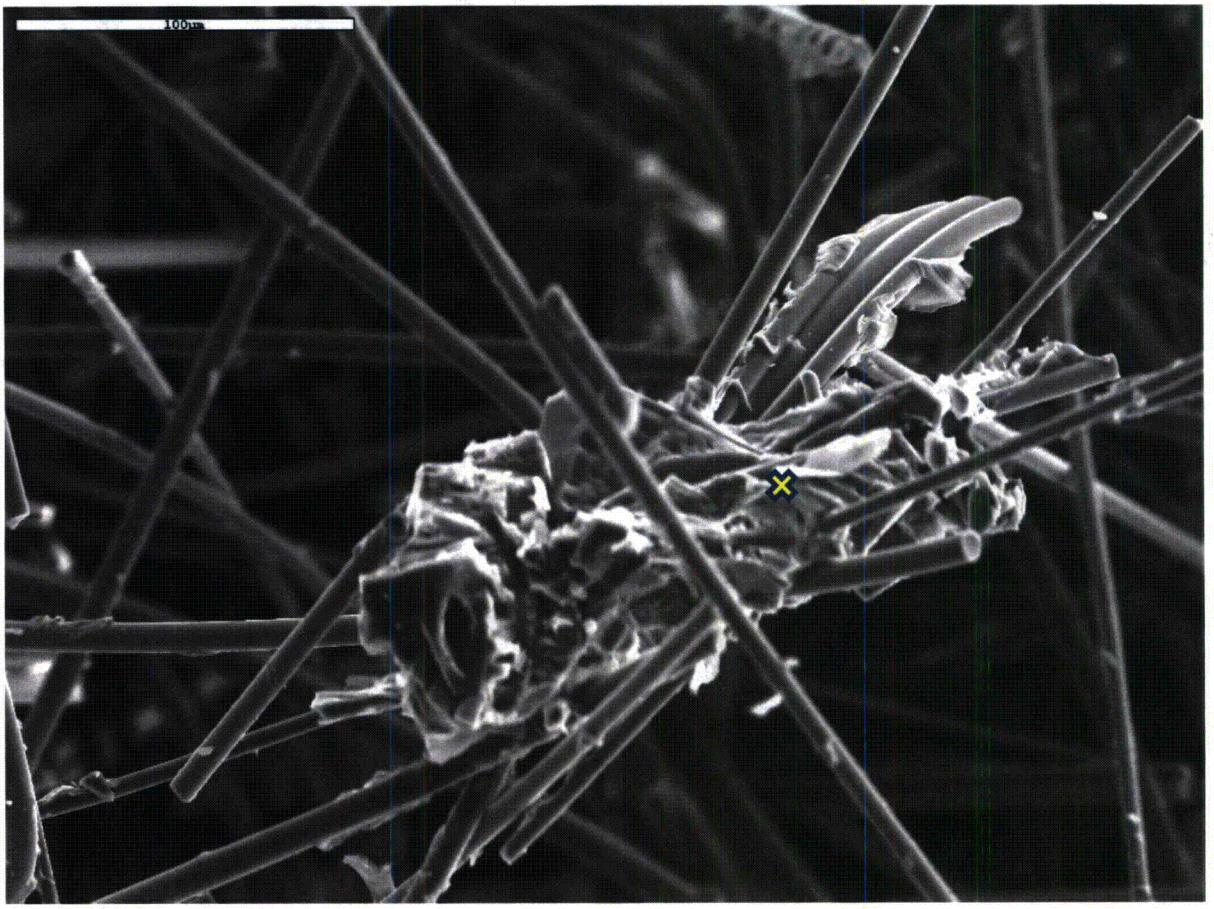

Figure 64 - "Blender, Black Speck, 1" Precipitate at fiber crossing

Elmt	Element %	Atomic %
O	99.25358	99.54417
Na	0.527579	0.368223
Ca	0.218836	8.76E-02

Blender, Black Speck, 2

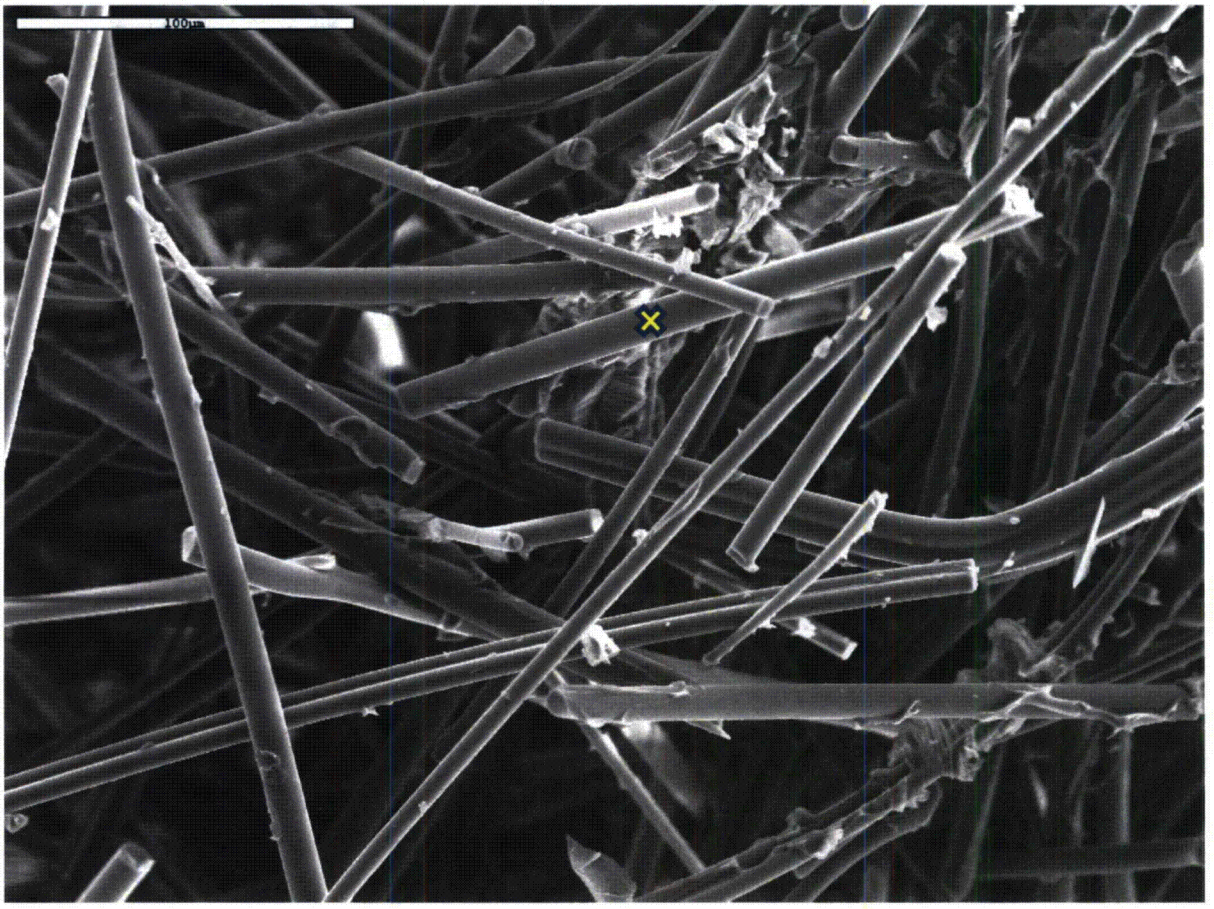

Figure 65 - "Blender, Black Speck, 2" Small amount of precipitate

Elmt	Element %	Atomic %
O	57.99848	70.58616
Na	8.362384	7.082506
Mg	1.429282	1.144703
Al	0.63881	0.460992
Si	25.97108	18.00512
Ca	5.599967	2.72053

NEI, Black Specks, 1

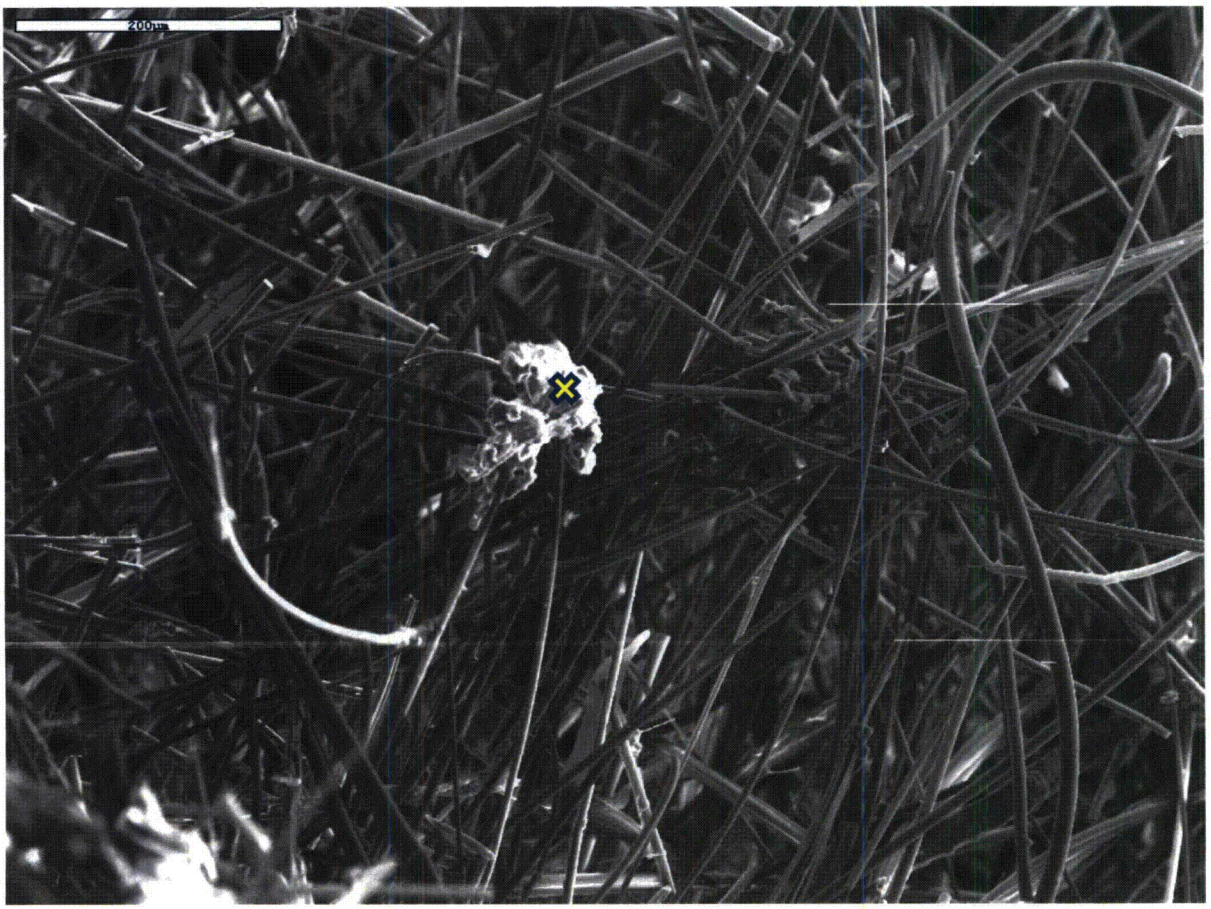

Figure 66 - "NEI, Black Specks, 1" Precipitate clump

Elmt	Element %	Atomic %
F	14.68916	27.62317
Al	1.641468	2.173415
Si	2.80432	3.567157
P	2.11163	2.435594
Ca	37.53921	33.46122
Ti	41.21422	30.73944

NEI, Black Specks, 2

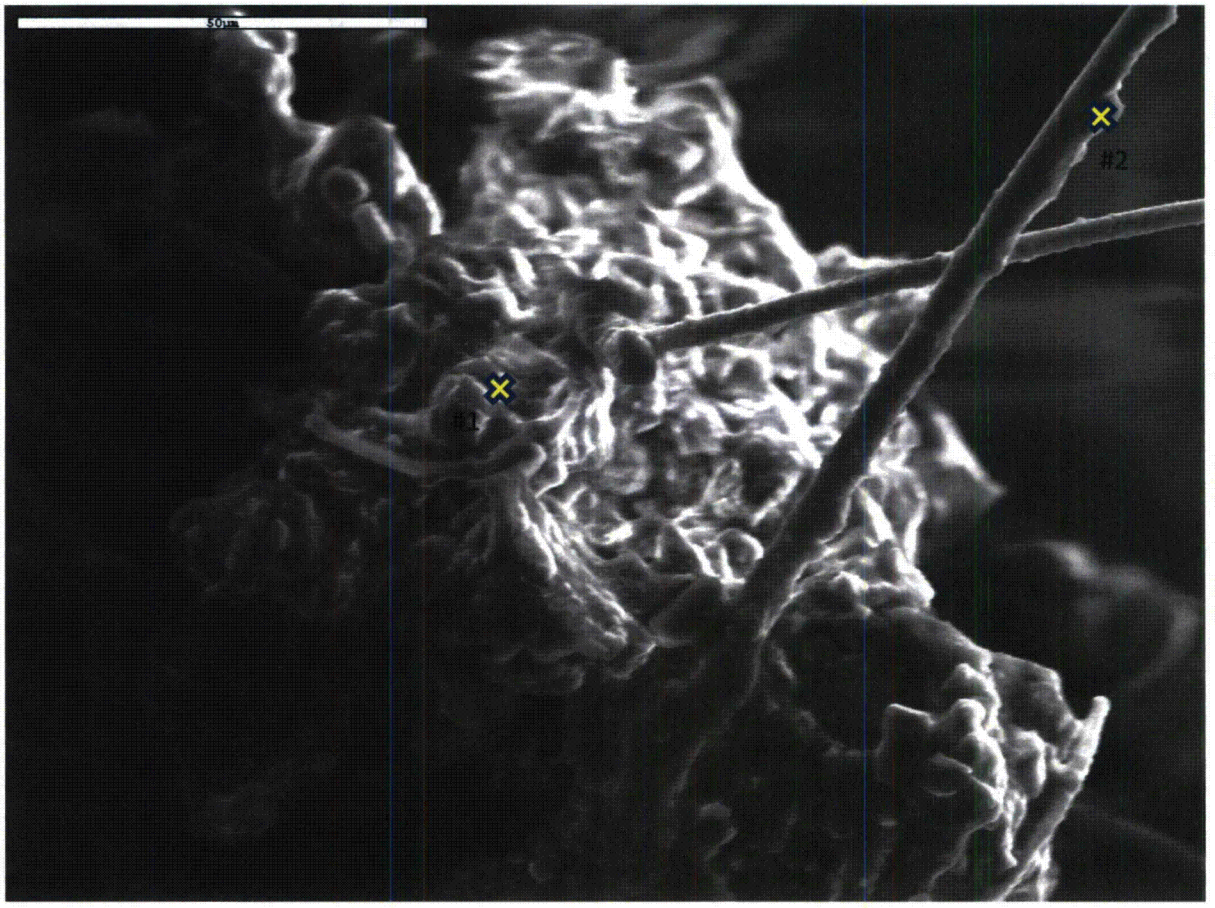

Figure 67 - "NEI, Black Specks, 2" Large amount of particulate

#1

Elmt	Element %	Atomic %
F	81.71114	90.61282
Al	0.819067	0.639531
Si	1.33287	0.999803
Ca	7.579323	3.983996
Ti	8.557604	3.763855

#2

Elmt	Element %	Atomic %
O	55.41555	68.31646
Na	7.913568	6.78922
Mg	1.477881	1.198962
Al	1.158964	0.847193
Si	29.0257	20.38353
Ca	5.008331	2.46463

NEI, Black Speck, 1

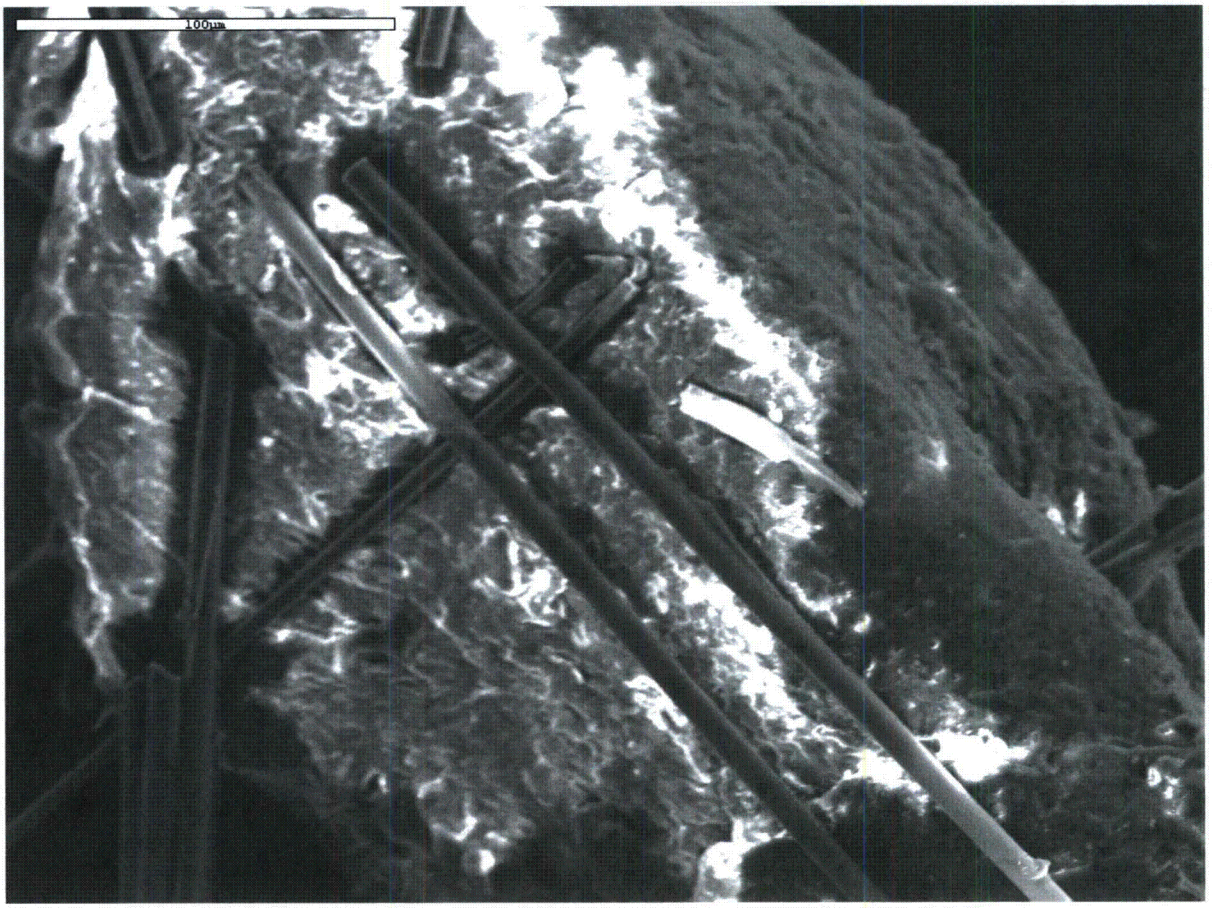

Figure 68 - "NEI, Black Speck, 1" Fiber "sunk" in precipitate

NEI, black speck, 2

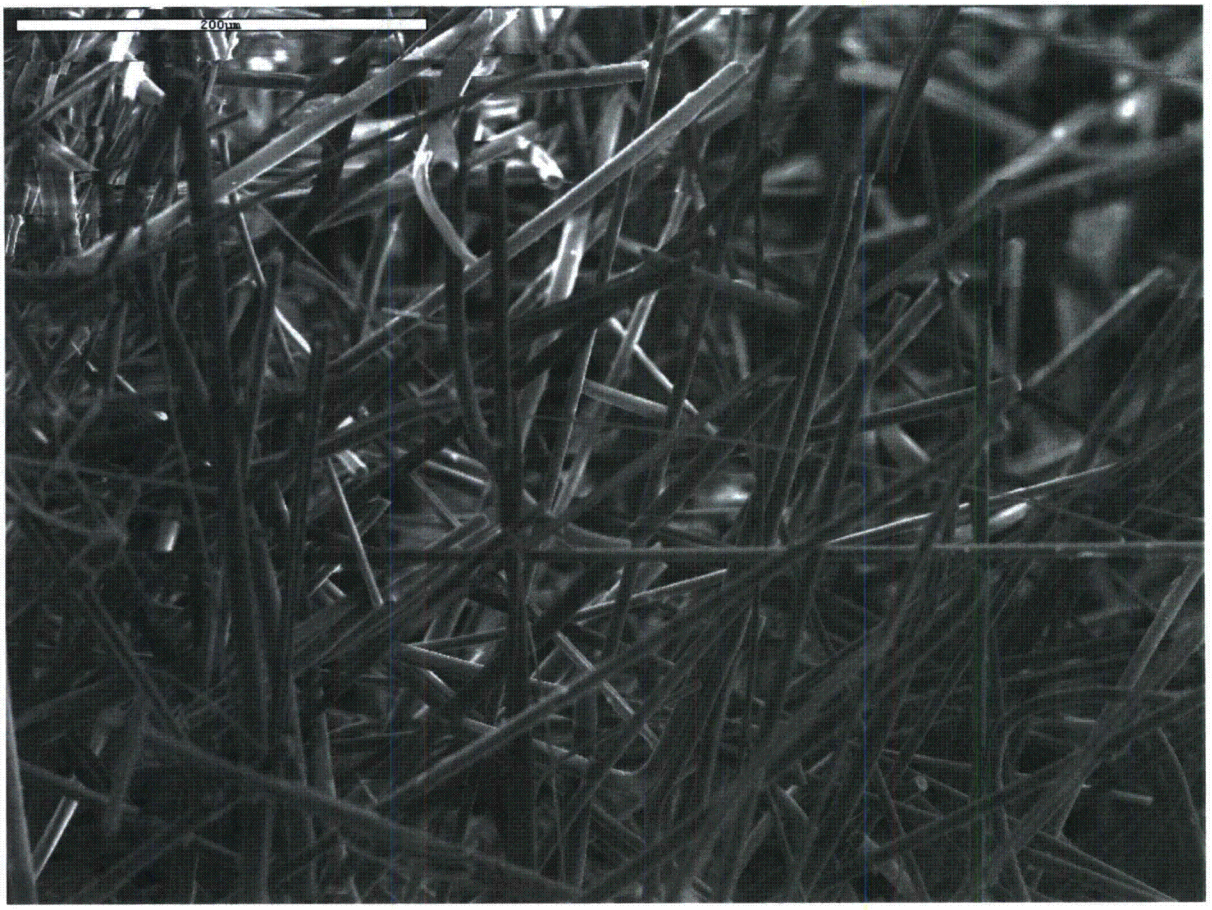

Figure 69 - "NEI, black speck, 2" Very clean NEI

NEI, Clean Fiber, 1

Figure 70 - "NEI, Clean Fiber, 1" Wispy fiber

4.0 Baseline Fiber

The method of preparation of fiber debris samples for SEM analysis was examined to determine if the procedure contributed to the formation of particulates or attributes that may be of interest. Two batches of NEI-processed fiber were prepared and soaked for 24 hours in solution of interest. One batch of fiber was allowed to soak in borated-TSP solution, while the other batch was soaked in in deionized (DI) water. Three types of samples were taken from the two batches. One sample was taken from the fiber soaked in the DI water and, a second sample was taken from the borated-TSP solution, and a third sample was taken from the borated TSP solution and quickly rinsed with DI water. All samples were allowed to dry in a desiccator before they were sputter coated. The results of the samples taken are below. A description of the images is given by the caption. If EDX of a particle was acquired, the location of the particle examined is indicated on the figure by an "X".

NEI, Soaked in DI, 1

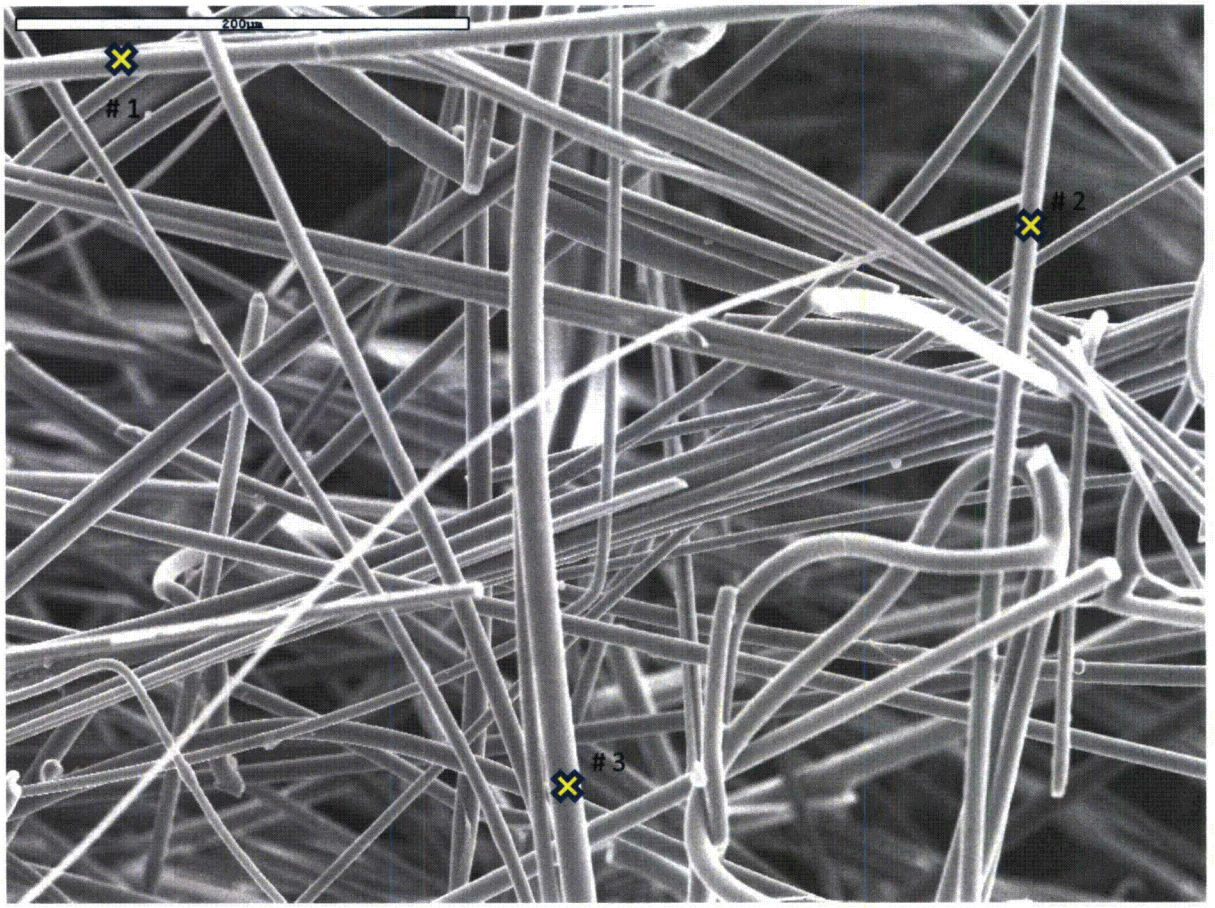

Figure 71 - "NEI, Soaked in DI, 1"

#1

Elmt	Element %	Atomic %
O	41.52557	55.65168
Na	10.70849	9.987221
Mg	1.639075	1.445552
Al	1.025322	0.814782
Si	35.36501	26.99849
Ca	9.031668	4.831653
Fe	0.704875	0.270625

#2

Elmt	Element %	Atomic %
O	46.62602	60.80523
Na	10.86826	9.863396
Mg	1.48125	1.271198
Al	0.663484	0.513052
Si	29.40307	21.84279
Ca	10.9579	5.704335

#3

Elmt	Element %	Atomic %
O	50.92377	63.92218
Na	13.0194	11.37302
Mg	1.954836	1.61478
Al	0.886411	0.659758
Si	27.35993	19.56361
Ca	5.37906	2.695271
Fe	0.476584	0.171381

NEI, Soaked in Borated TSP, 1

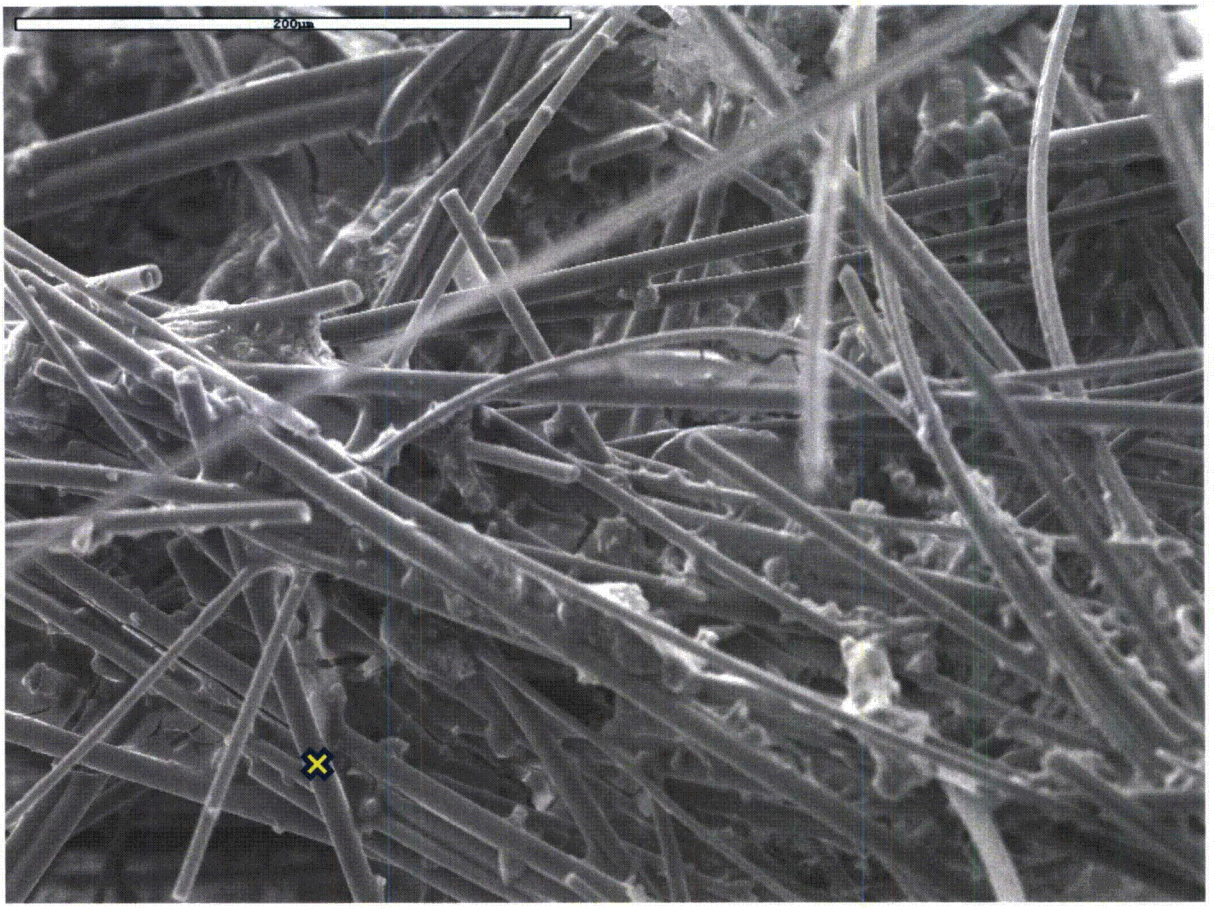

Figure 72 - "NEI, Soaked in Borated TSP, 1"

Elmt	Element %	Atomic %
O	54.4035	66.84762
Na	13.0756	11.18084
Mg	1.732408	1.400817
Al	0.821988	0.598885
Si	25.17802	17.62315
Ca	4.788505	2.348682

NEI, Soaked Borated TSP, 2

Figure 73 - "NEI, Soaked Borated TSP, 2" Zoomed in picture

Elmt	Element %	Atomic %
O	83.46626	89.07186
Na	8.438155	6.266585
Mg	0.349496	0.245439
Al	0.212037	0.134171
Si	3.75549	2.282964
P	3.109064	1.713779
Ca	0.669499	0.285197

NEI, Soaked Borated TSP rinsed with DI, 1

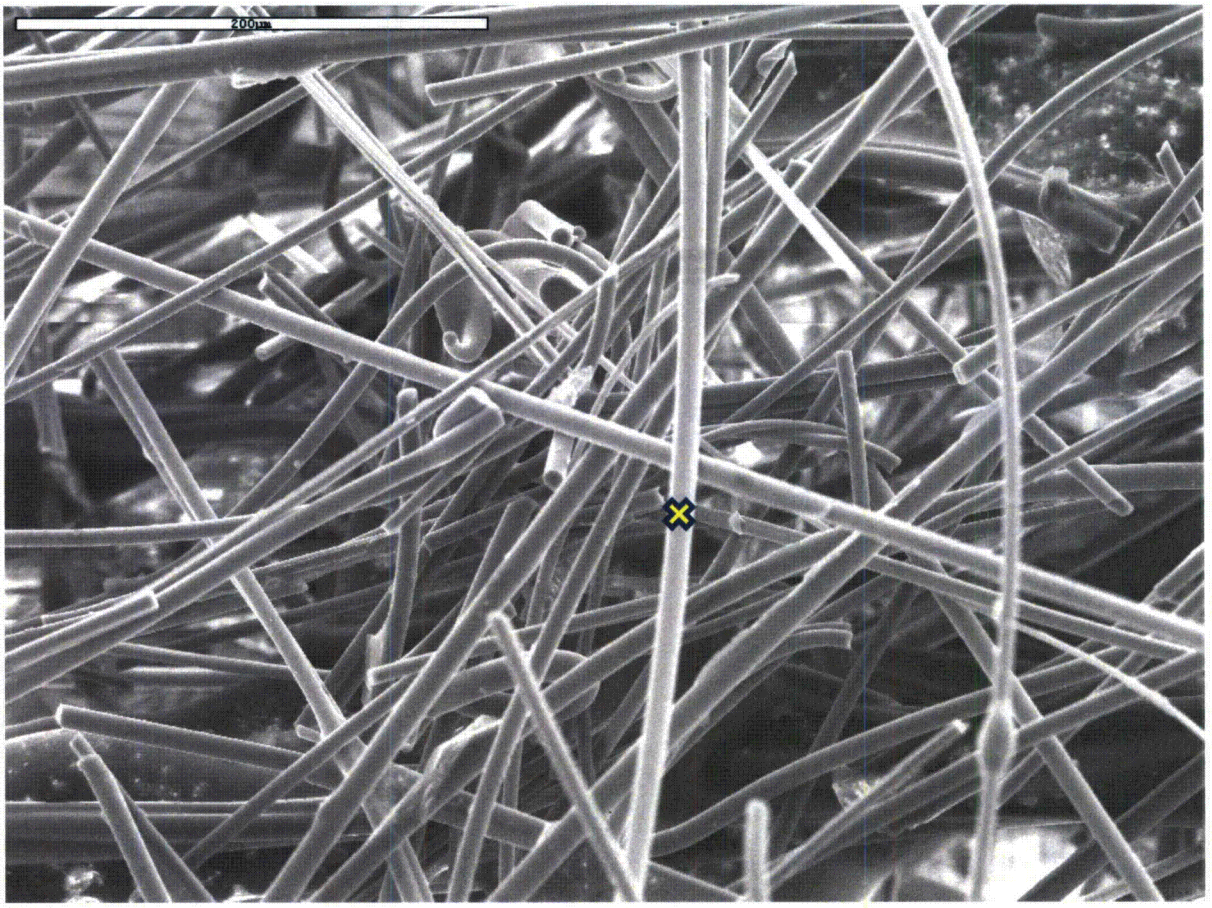

Figure 74 - "NEI, Soaked Borated TSP rinsed with DI, 1"

Elmt	Element %	Atomic %
O	54.5554	66.89457
Na	13.74195	11.72615
Mg	1.973917	1.592774
Al	0.871655	0.633747
Si	24.30052	16.97351
Ca	4.187444	2.049591
Fe	0.369102	0.129656

NEI, Soaked Borated TSP rinsed with DI, 2

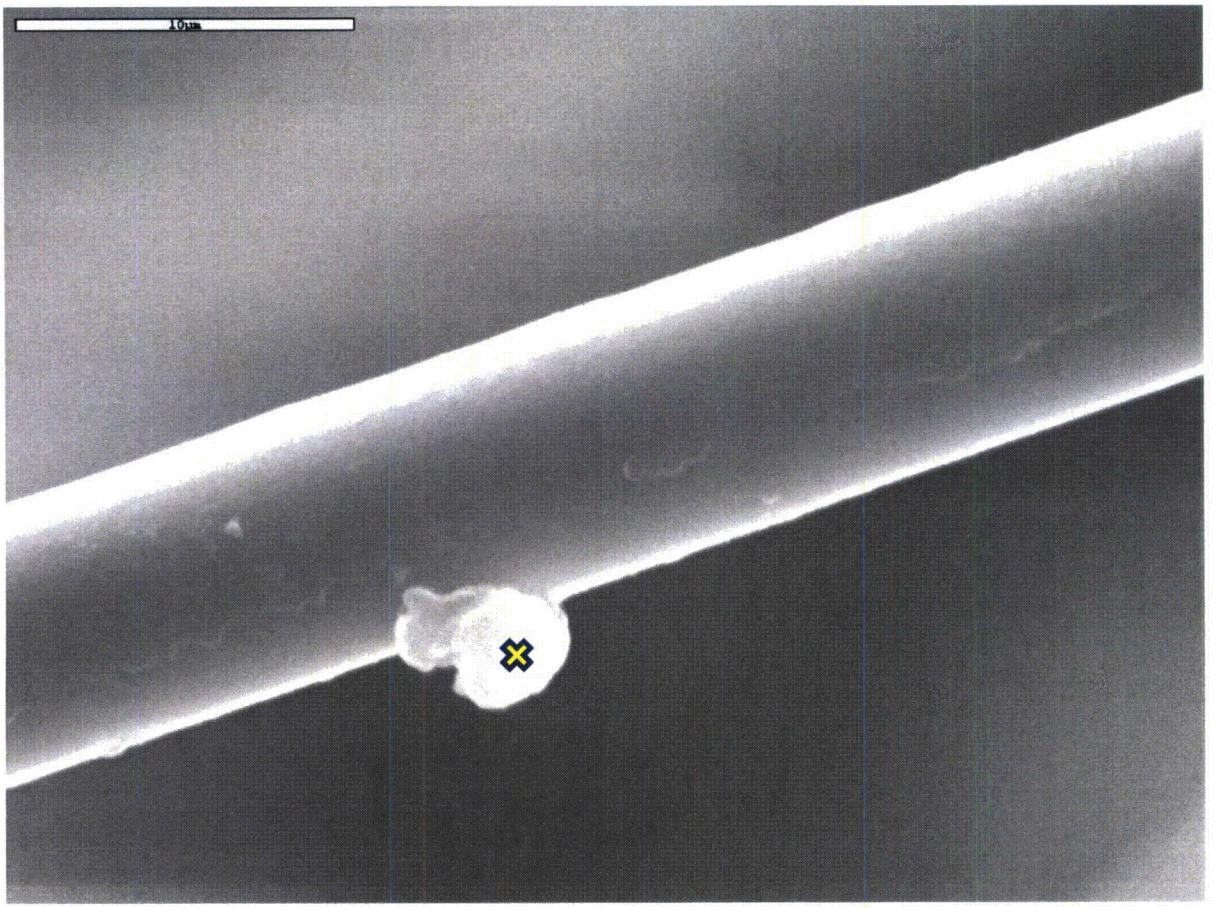

Figure 75 - "NEI, Soaked Borated TSP rinsed with DI, 2"

Big particles were not found anywhere. This in one of the very few particles that were actually found, but it is very small.

Elmt	Element %	Atomic %
O	61.0692	74.41264
Na	7.787324	6.603386
Mg	1.036385	0.831032
Al	1.091318	0.788487
Si	14.75426	10.24106
Cl	4.481705	2.46438
Ca	9.067391	4.410338
Fe	0.712416	0.248686

5.0 Aluminum SEM

Aluminum used in the test was taken from aluminum scaffolding obtained from STP. This scaffolding was a non-homogenous sample with unknown constituents from years of use which remained after cleaning and the alloy of aluminum is not known. The samples which were to be submerged were from the side of the scaffolding and had a different texture and appearance than the samples cut for the vapor space. Three types of aluminum samples for submerged and vapor samples were examined using SEM and are as follows: (1) examination of test samples, (2) analysis of pre-test samples (3) examination of test samples after scale removal. Post-test samples were labeled "used", while base line pre-test samples were labeled as "not used". Samples which had scale removed were labeled as "acid washed". Those that did not have scaled removed were labeled as "not washed". The SEM results of all aluminum samples are shown below. A description of the images is given by the caption. If EDX of a particle was acquired, the location of the particle examined is indicated on the figure by an "X".

Used Submerged, Not Washed, 1

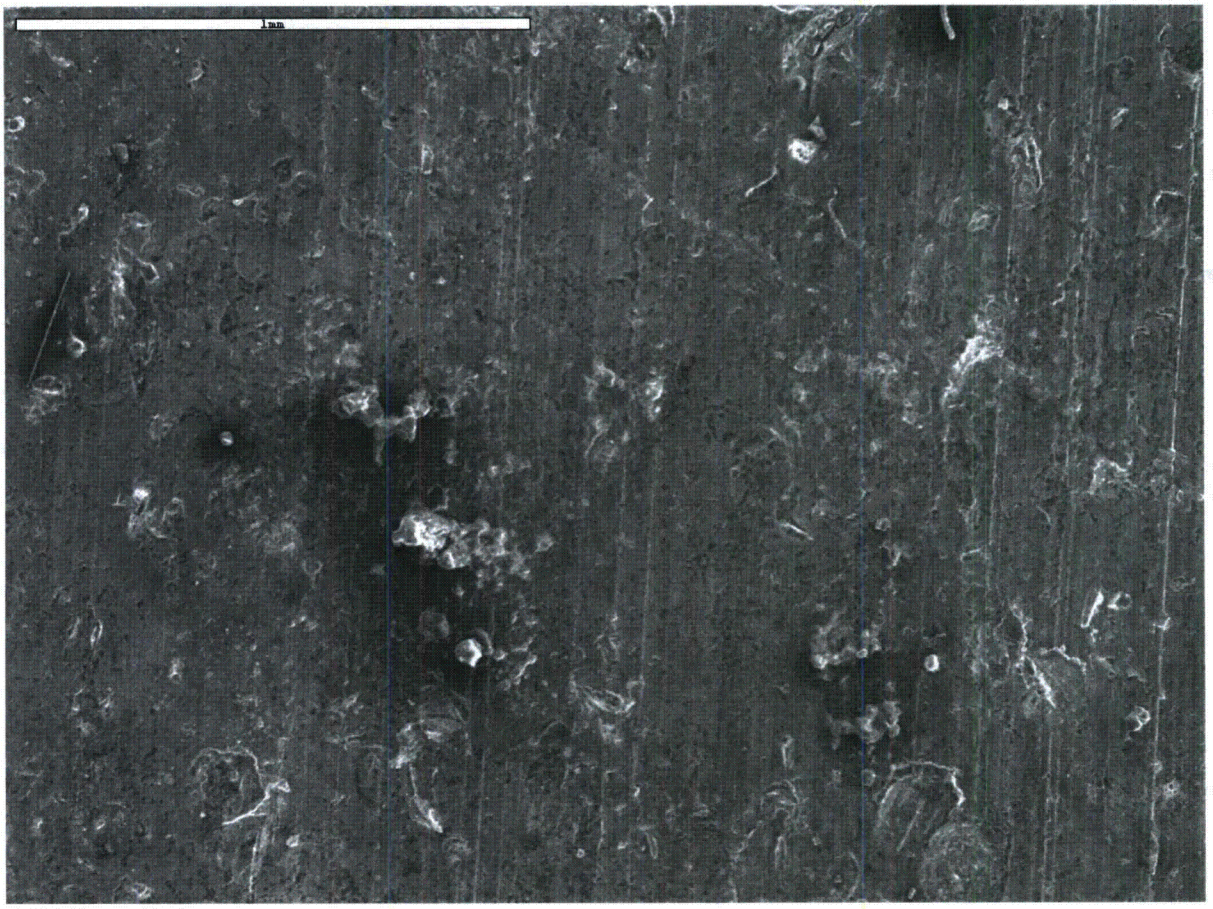

Figure 76 - "Used Submerged, Not Washed, 1"

Used Submerged, Not Washed, 2

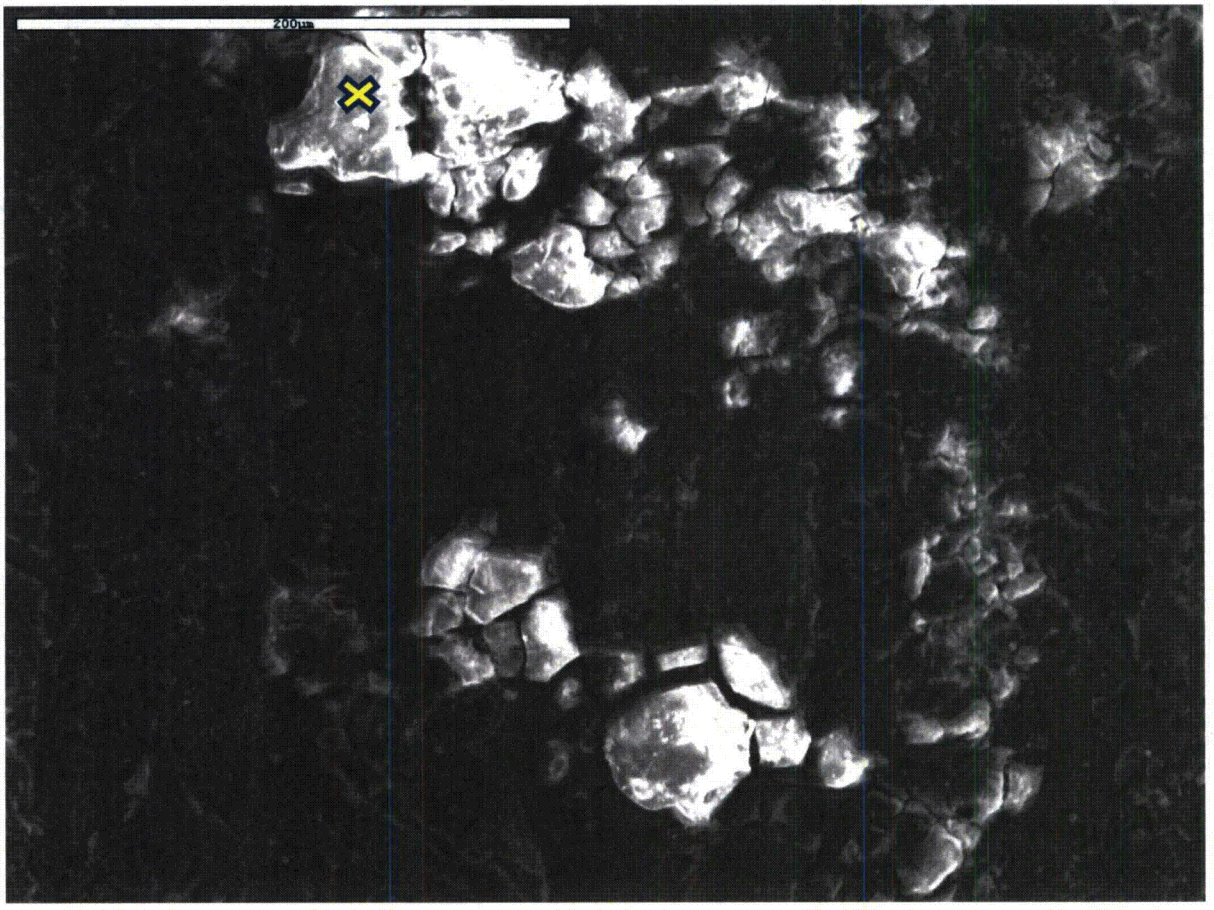

Figure 77 - "Used Submerged, Not Washed, 2" Cracking features

Elmt	Element %	Atomic %
O	55.87518	69.72538
Al	20.307	15.02576
Si	15.05654	10.70287
P	2.40957	1.553127
S	1.918446	1.194529
Ca	1.518032	0.756168
Fe	2.915237	1.042171

Used Submerged, Not Washed, 3

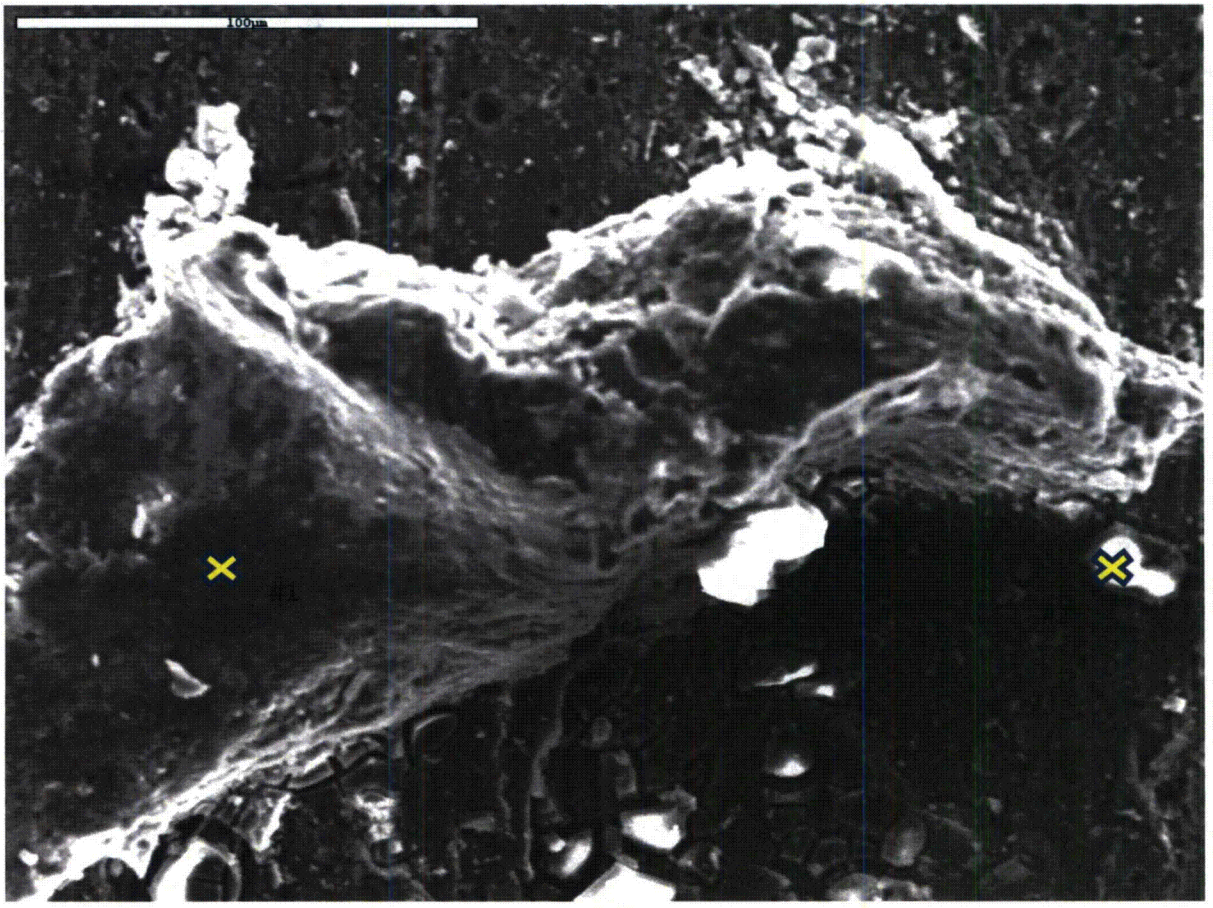

Figure 78 - "Used Submerged, Not Washed, 3"

#1

Elmt	Element %	Atomic %
O	16.29551	25.04923
Al	78.43685	71.49327
Si	1.253322	1.097469
P	1.147492	0.911111
S	0.170633	0.130877
Ca	0.754579	0.463016
Fe	1.941611	0.85503

#2

Elmt	Element %	Atomic %
O	54.97348	68.3452
Al	33.83013	24.93889
Si	0.833296	0.590143
P	2.316628	1.48767
S	5.929717	3.678442
Ca	1.468387	0.728719
Fe	0.648374	0.230926

Used Submerged, Not Washed, 4

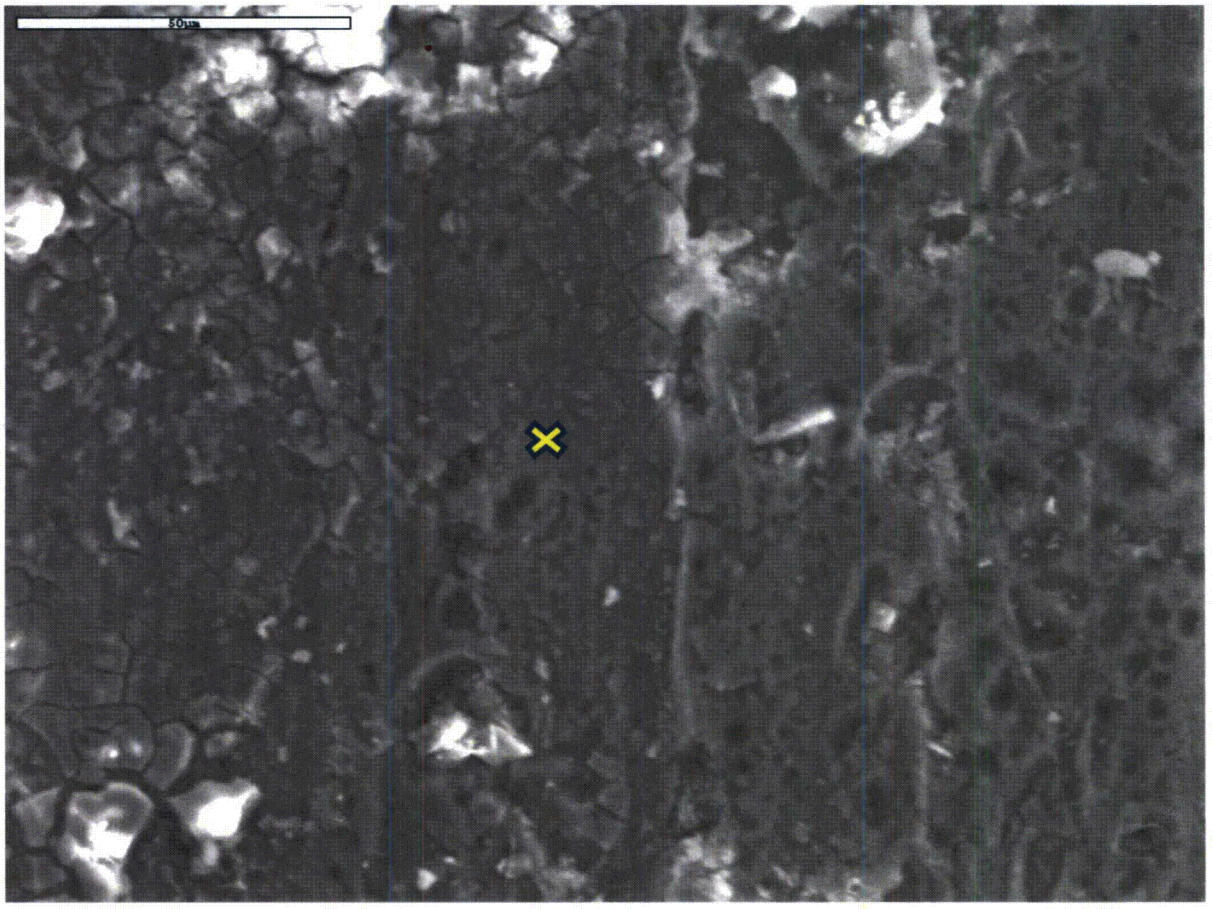

Figure 79 - "Used Submerged, Not Washed, 4" Small cracking

Elmt	Element %	Atomic %
O	32.17372	44.83123
Na	0.809217	0.78469
Al	58.67721	48.48054
Si	1.536704	1.219754
P	5.502426	3.960309
Ca	1.300734	0.723491

Used Submerged, Acid Washed, 1

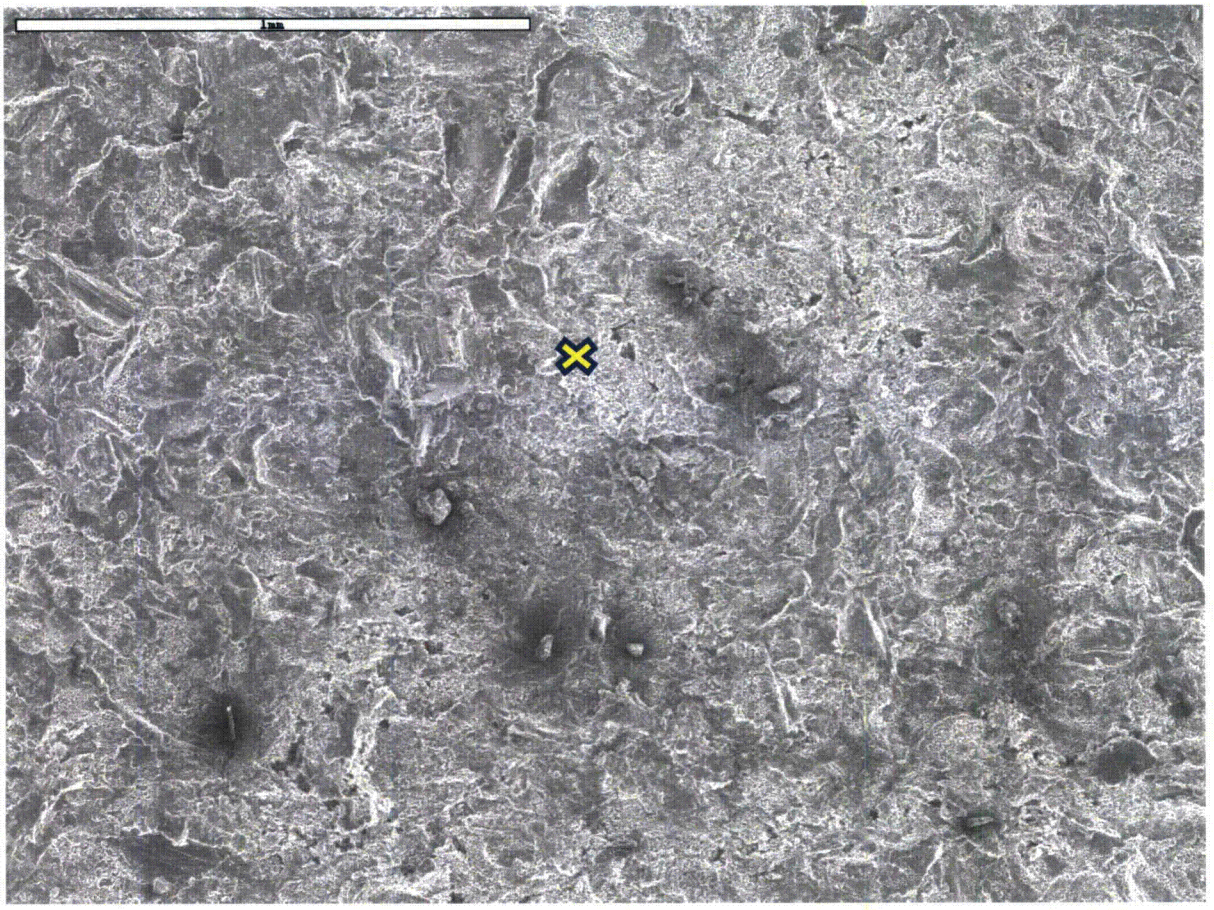

Figure 80 - "Used Submerged, Acid Washed, 1"

Elmt	Element %	Atomic %
O	5.372327	8.731379
Mg	0.723003	0.773273
Al	93.90467	90.49535

Used Submerged, Acid Washed, 2

Figure 81 - "Used Submerged, Acid Washed, 2" Particulate on surface

Elmt	Element %	Atomic %
O	56.49949	77.71421
Al	3.341963	2.725689
Si	2.877982	2.255002
P	0.707126	0.502398
Ti	36.57345	16.8027

Used Submerged, Acid Washed, 3

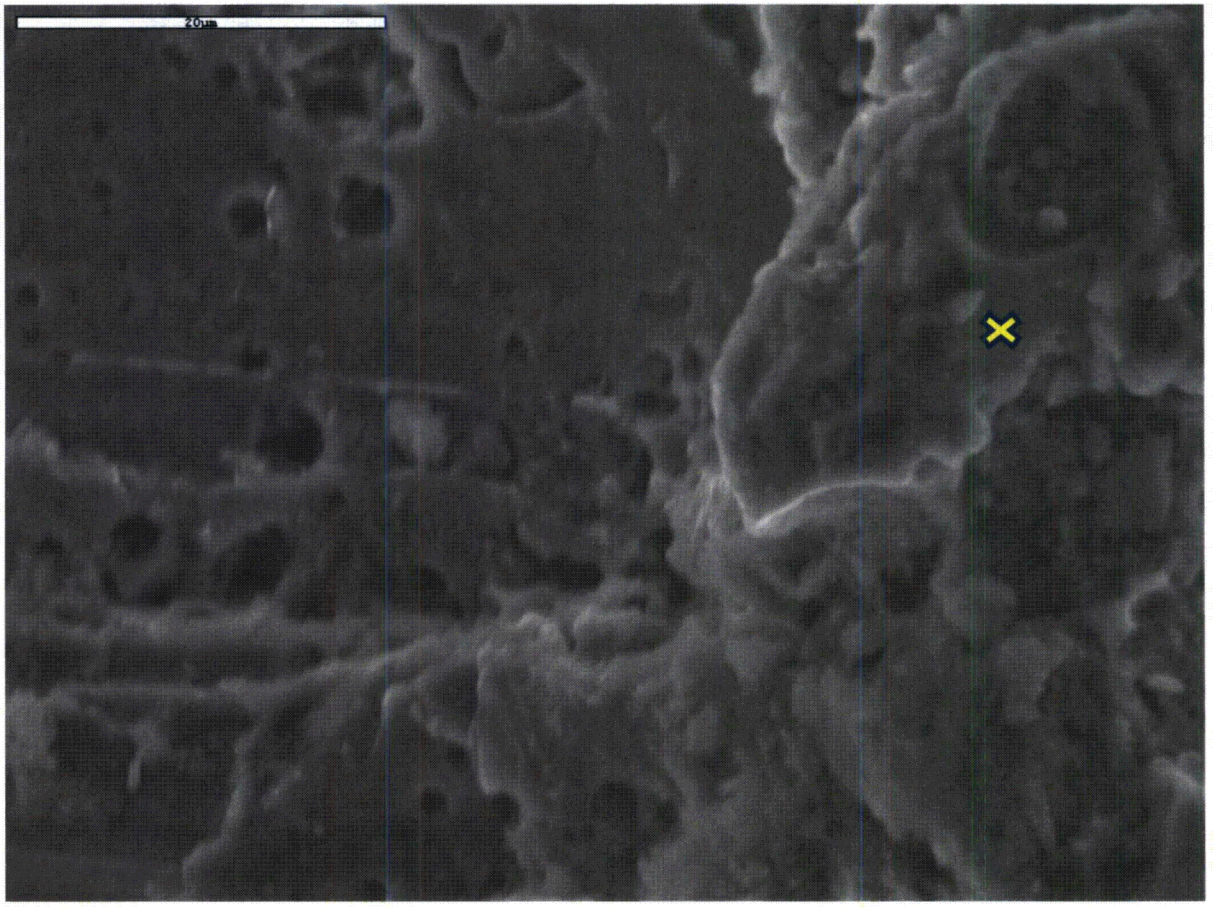

Figure 82 - "Used Submerged, Acid Washed, 3"

Elmt	Element %	Atomic %
O	5.693635	9.241012
Al	94.30636	90.75899

Unused Submerged, Acid Washed, 1

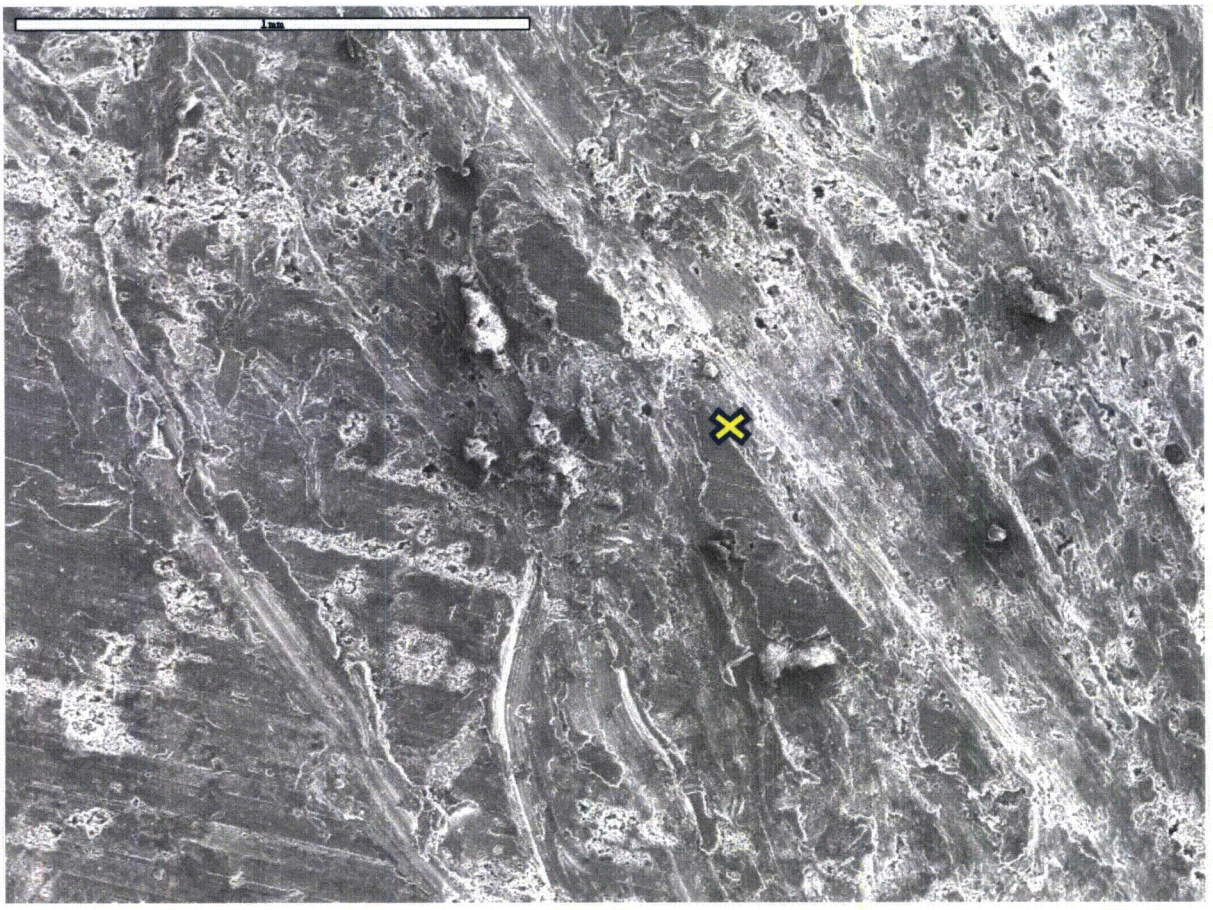

Figure 83 - "Unused Submerged, Acid Washed, 1"

Elmt	Element %	Atomic %
C	19.28571	33.93004
O	5.485235	7.244866
Al	72.2487	56.58273
Si	2.980362	2.242369

Note: carbon accidentally got checked in this EDS and is probably not correct due to the way that oxygen was being calculated by changing some carbon readings.

Unused Submerged, Acid Washed, 2

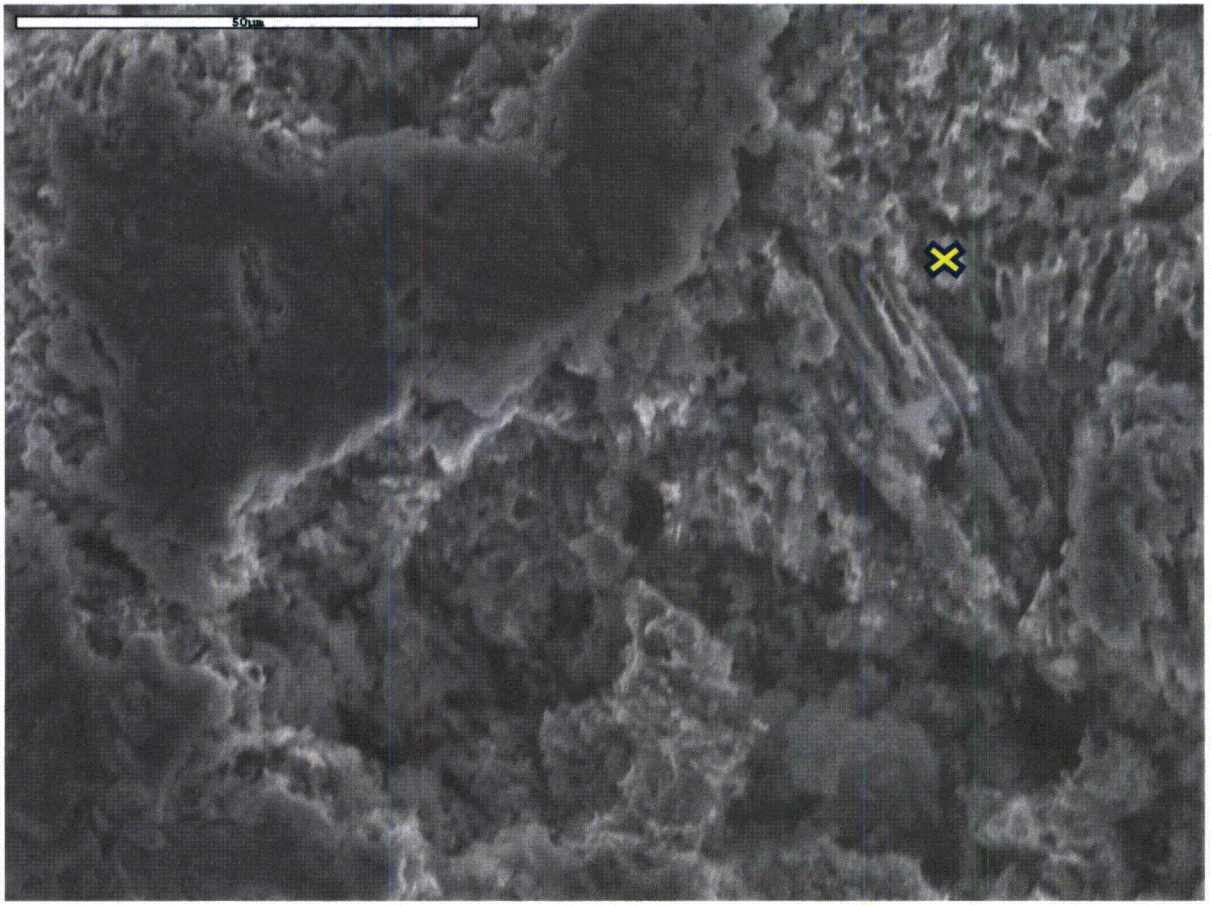

Figure 84 - "Unused Submerged, Acid Washed, 2"

Elmt	Element %	Atomic %
O	7.747664	12.41073
Al	91.32348	86.74169
Si	0.928858	0.847577

Unused Submerged, Not Washed, 1

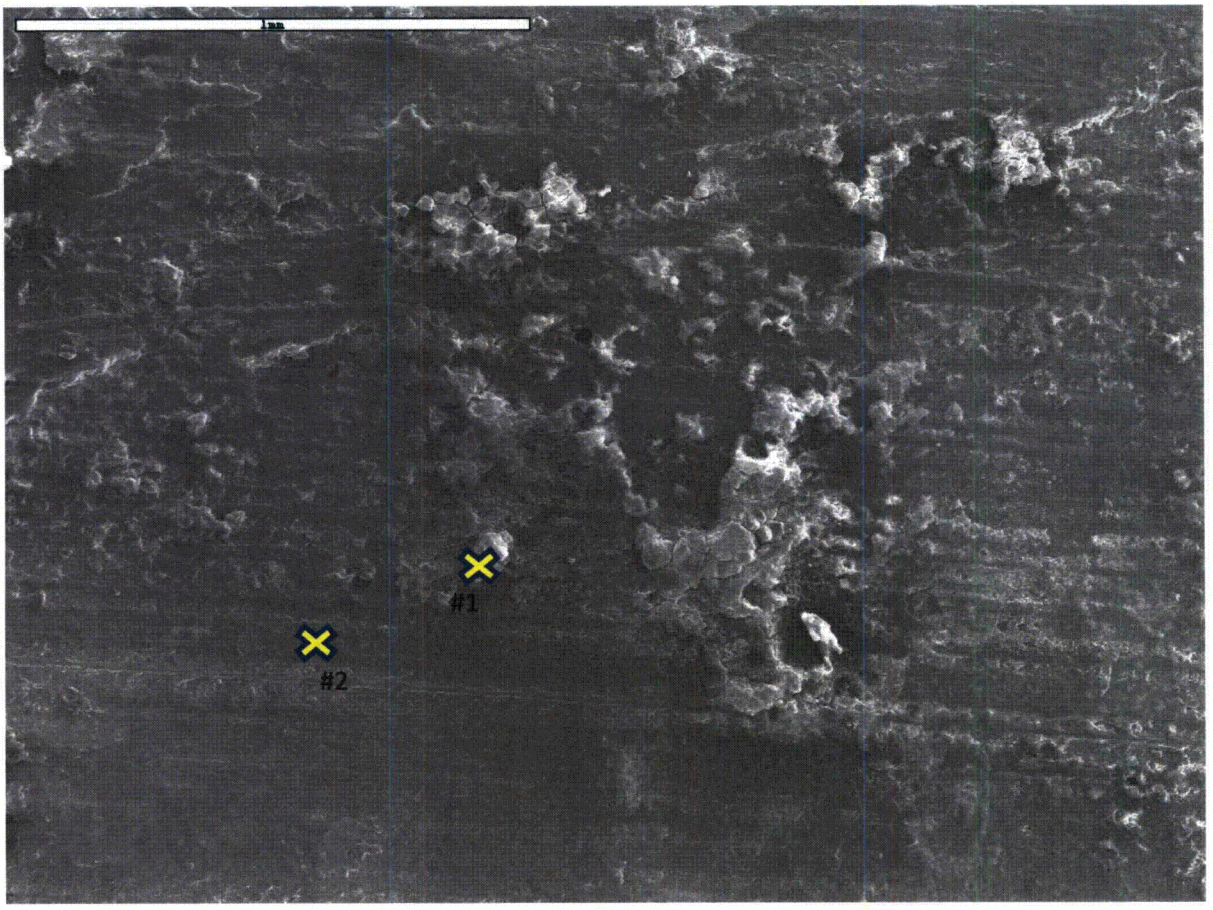

Figure 85 - "Unused Submerged, Not Washed, 1"

#1 EDS of particle

Elmt	Element %	Atomic %
O	52.90488	66.05394
Na	1.922631	1.670524
Al	34.75129	25.7272
P	6.952252	4.483571
S	2.695725	1.679398
Ca	0.773231	0.385369

#2 EDS of Face

Elmt	Element %	Atomic %
O	37.43722	50.60629
Na	1.295838	1.219006
Al	49.83636	39.94533
Si	5.181171	3.989623
P	3.366714	2.35073
S	2.472522	1.667694
Ca	0.410188	0.221334

Unused Submerged, Not Washed, 2

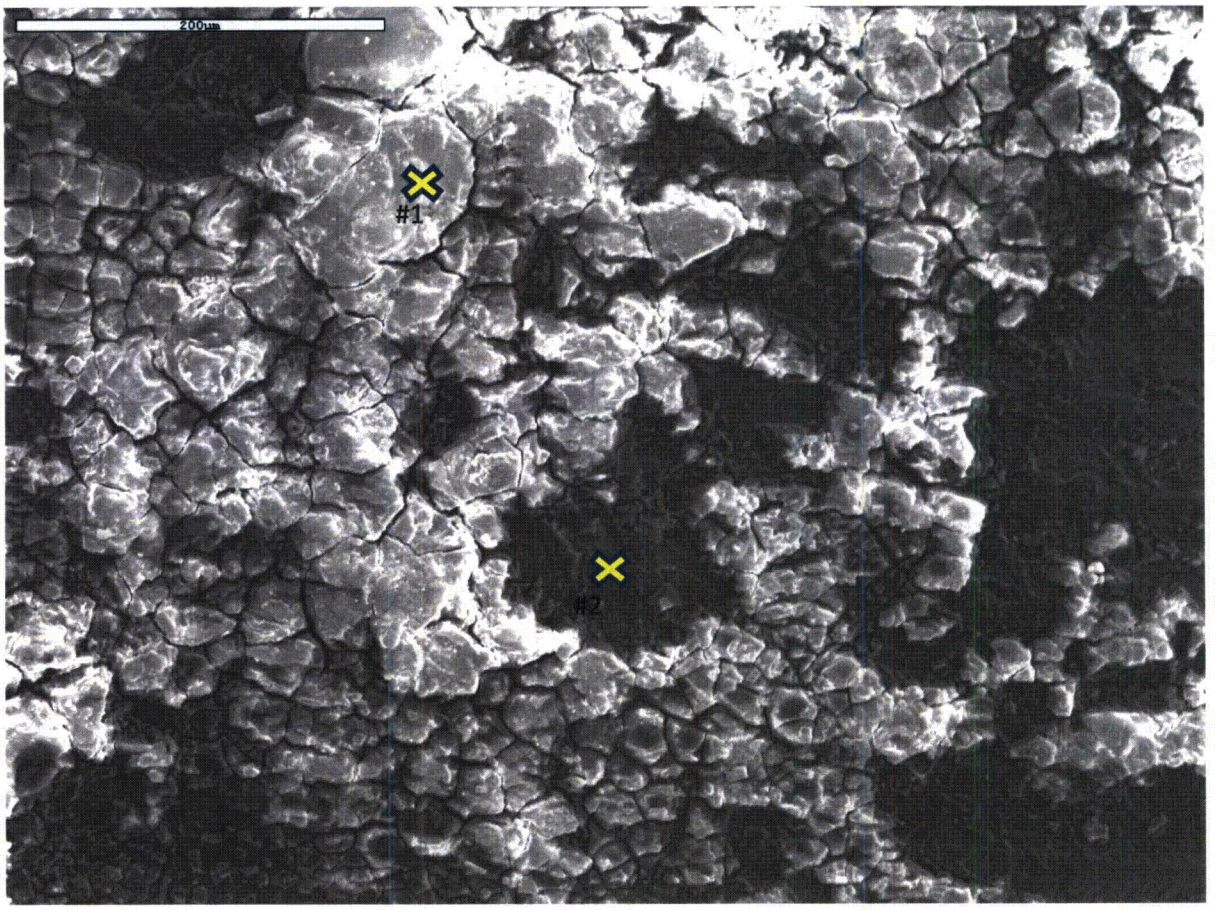

Figure 86 - "Unused Submerged, Not Washed, 2" Shale

#1

Elmt	Element %	Atomic %
O	57.54915	70.0183
Al	36.39483	26.25615
Si	0.570515	0.395405
S	5.485495	3.330148

#2

Elmt	Element %	Atomic %
O	37.02751	50.01065
Al	57.94616	46.40678
Si	2.04494	1.573336
S	2.981392	2.009242

Unused Vapor, Acid Washed, 1

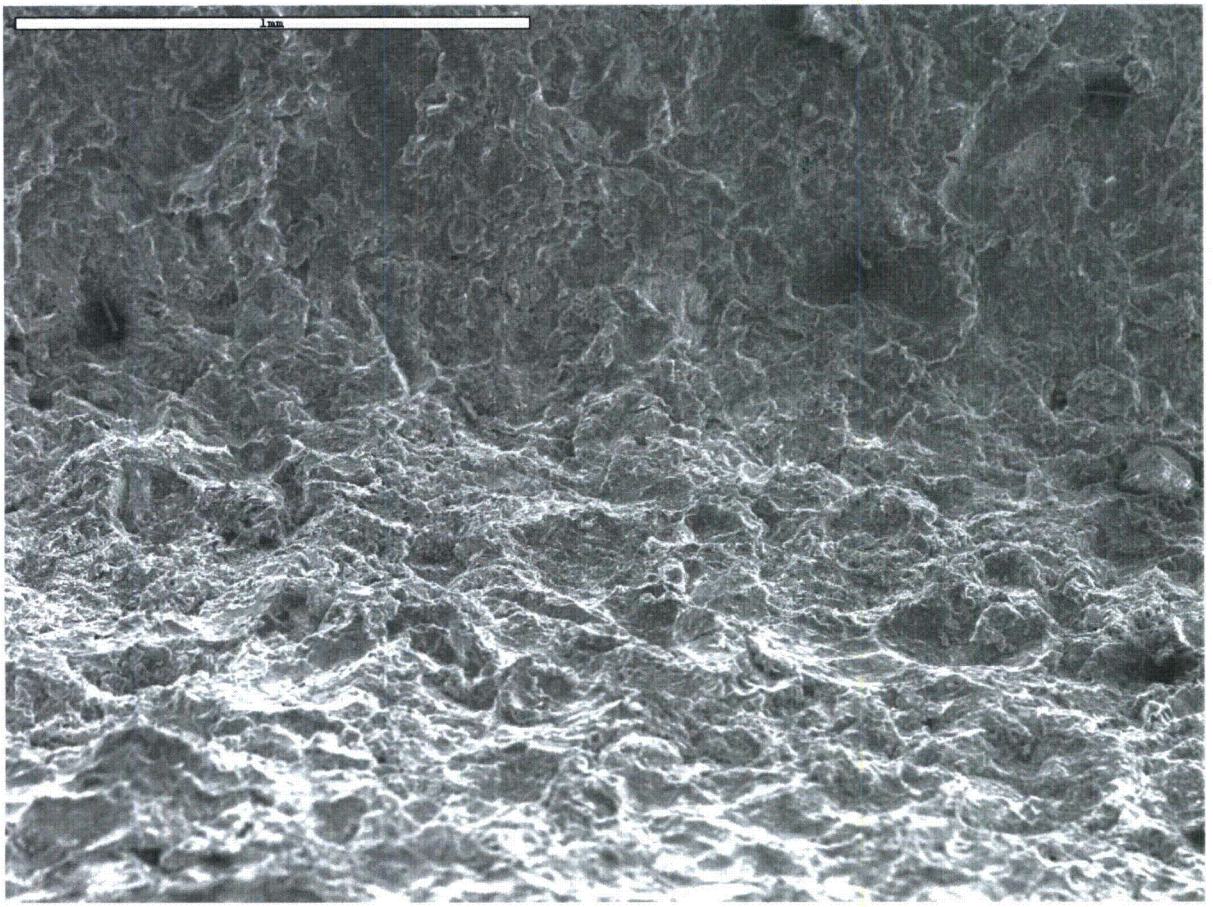

Figure 87 - "Unused Vapor, Acid Washed, 1"

Unused Vapor, Acid Washed, 2

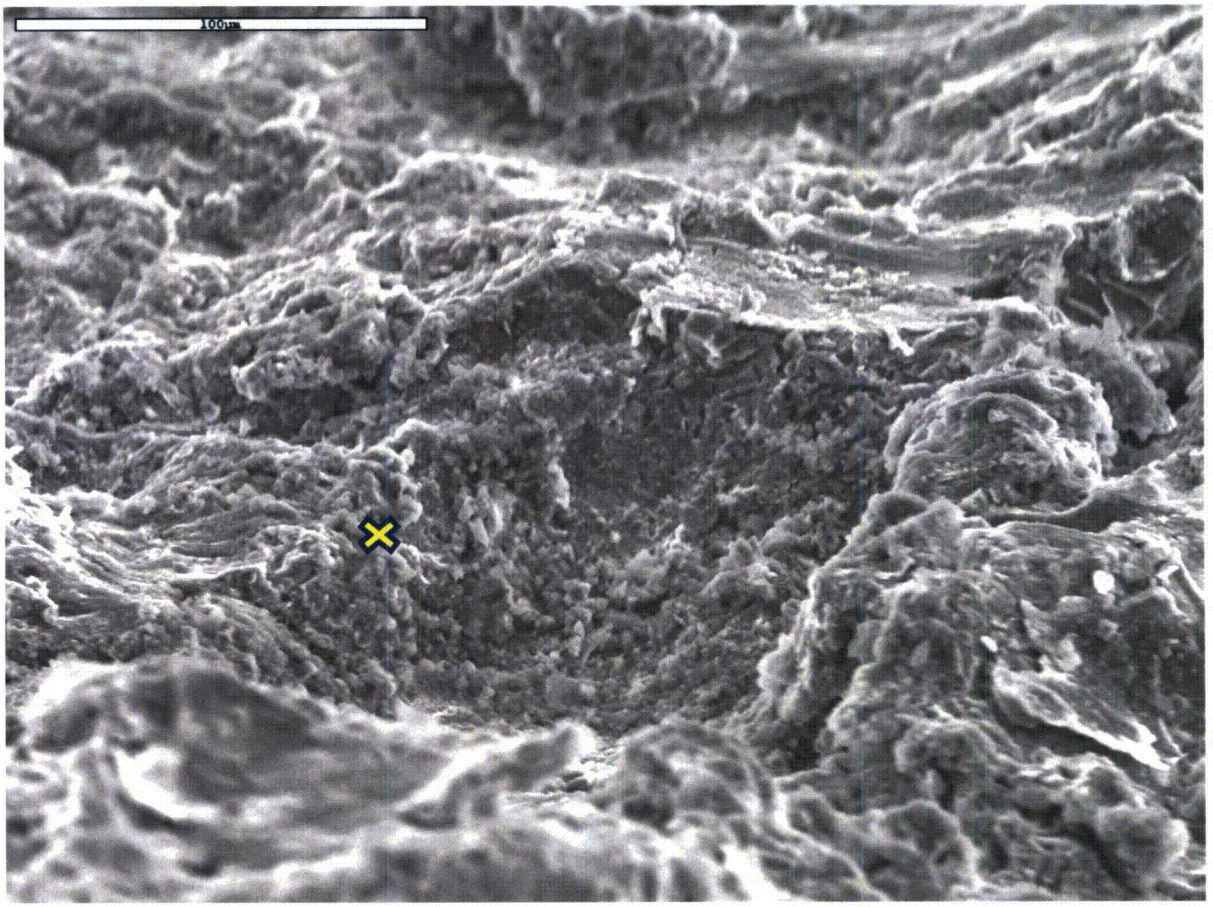

Figure 88 - "Unused Vapor, Acid Washed, 2" Rough slope of sample

Elmt	Element %	Atomic %
O	26.18998	37.81557
Al	59.55833	50.99136
Si	11.96874	9.844341
K	2.282946	1.34873

Unused Vapor, Acid Washed, 3

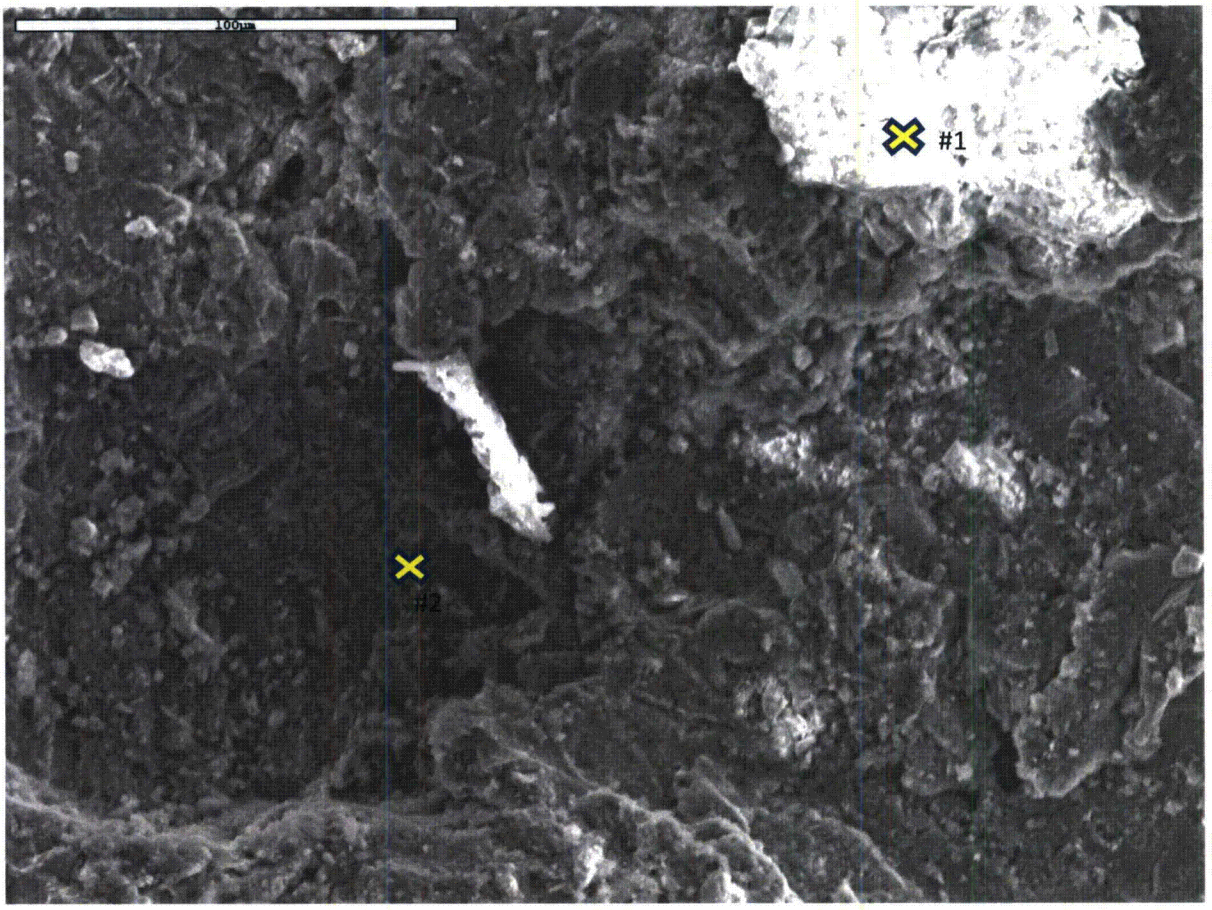

Figure 89 - "Unused Vapor, Acid Washed, 3"

#1

Elmt	Element %	Atomic %
O	50.9611	64.47919
Al	5.971625	4.480144
Si	43.06727	31.04067

#2

Elmt	Element %	Atomic %
O	22.30666	32.73701
Al	67.56657	58.79698
Si	10.12677	8.466

Used Vapor, Not Washed, 1

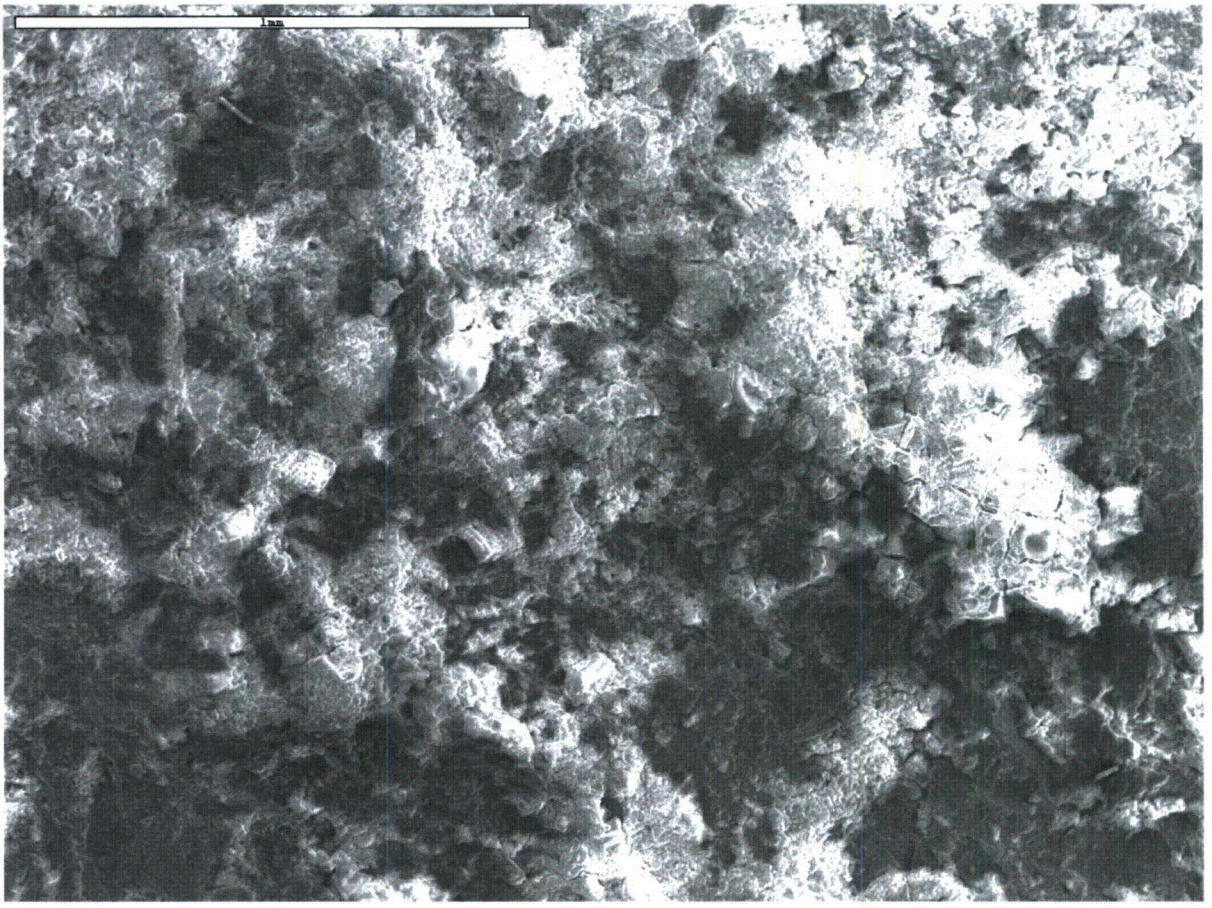

Figure 90 - "Used Vapor, Not Washed, 1"

Used Vapor, Not Washed, 2

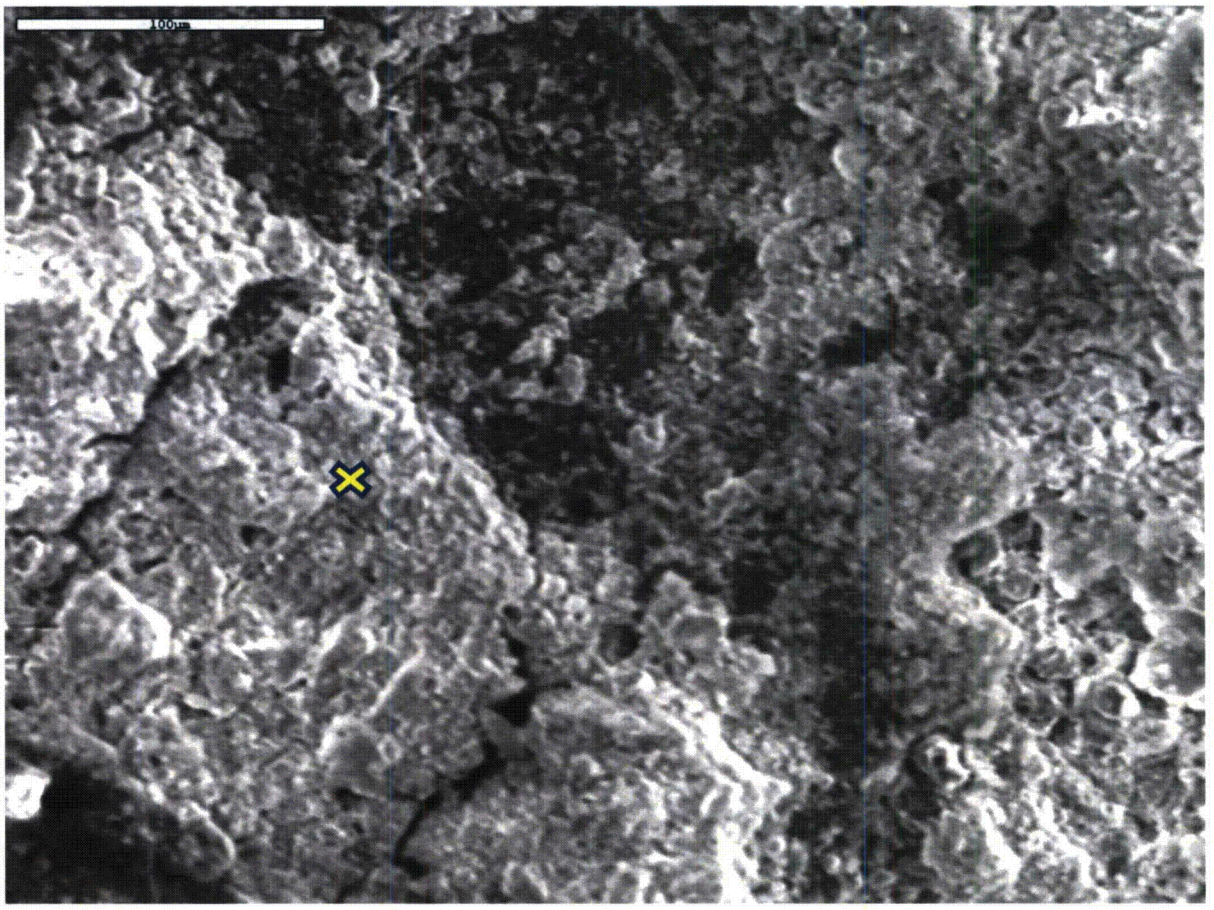

Figure 91 - "Used Vapor, Not Washed, 2"

Elmt	Element %	Atomic %
O	50.54052	65.42443
Na	2.121558	1.911213
Al	19.7753	15.17896
Si	10.50073	7.743242
P	8.120576	5.429785
S	0.888045	0.573602
Ca	5.156328	2.66444
Fe	2.896936	1.074316

Used Vapor, Not Washed, 3

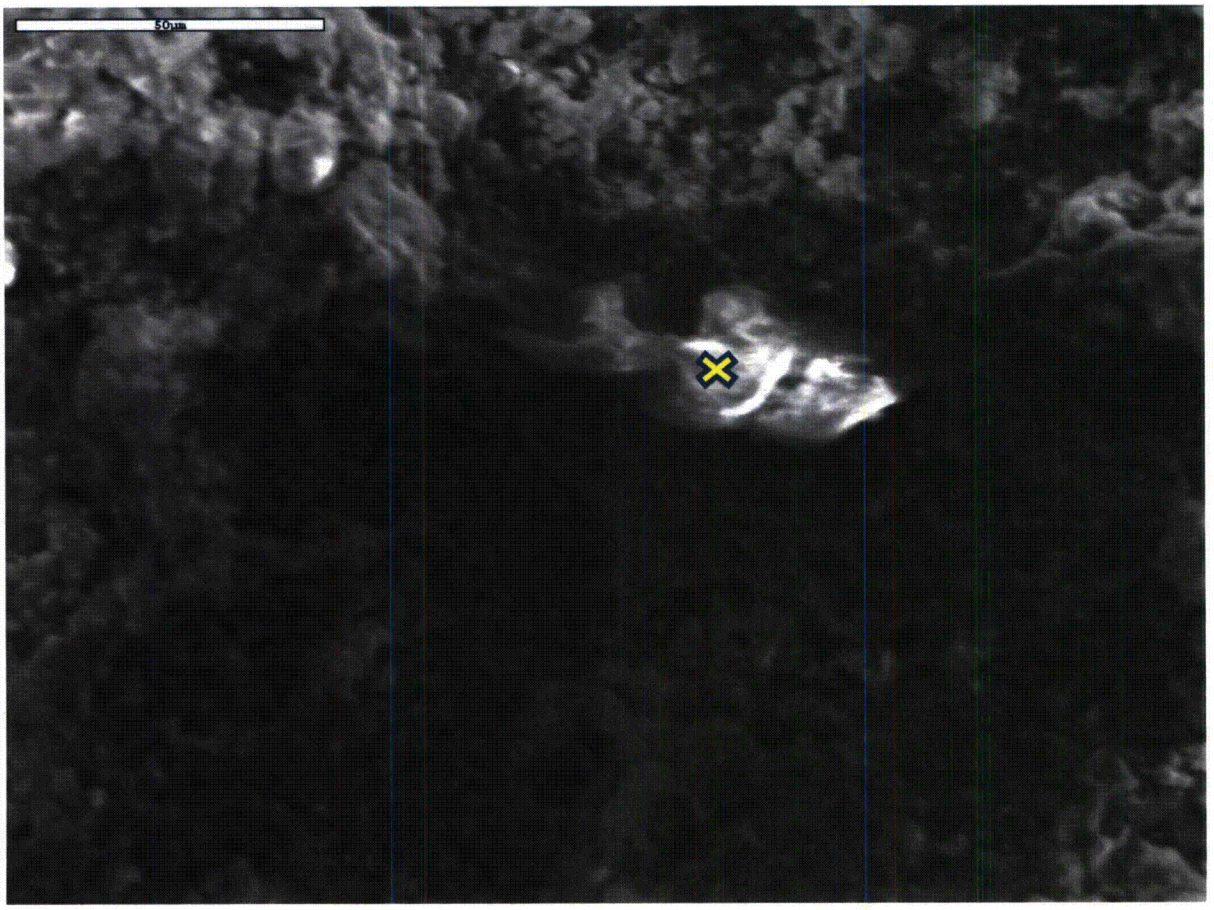

Figure 92 - "Used Vapor, Not Washed, 3"

Elmt	Element %	Atomic %
O	60.19044	72.63639
Na	5.997493	5.036749
Al	16.02977	11.47024
Si	5.435722	3.736689
P	4.377243	2.728493
S	4.587612	2.762412
Ca	3.381714	1.629029

Used Vapor, Acid Washed, 1

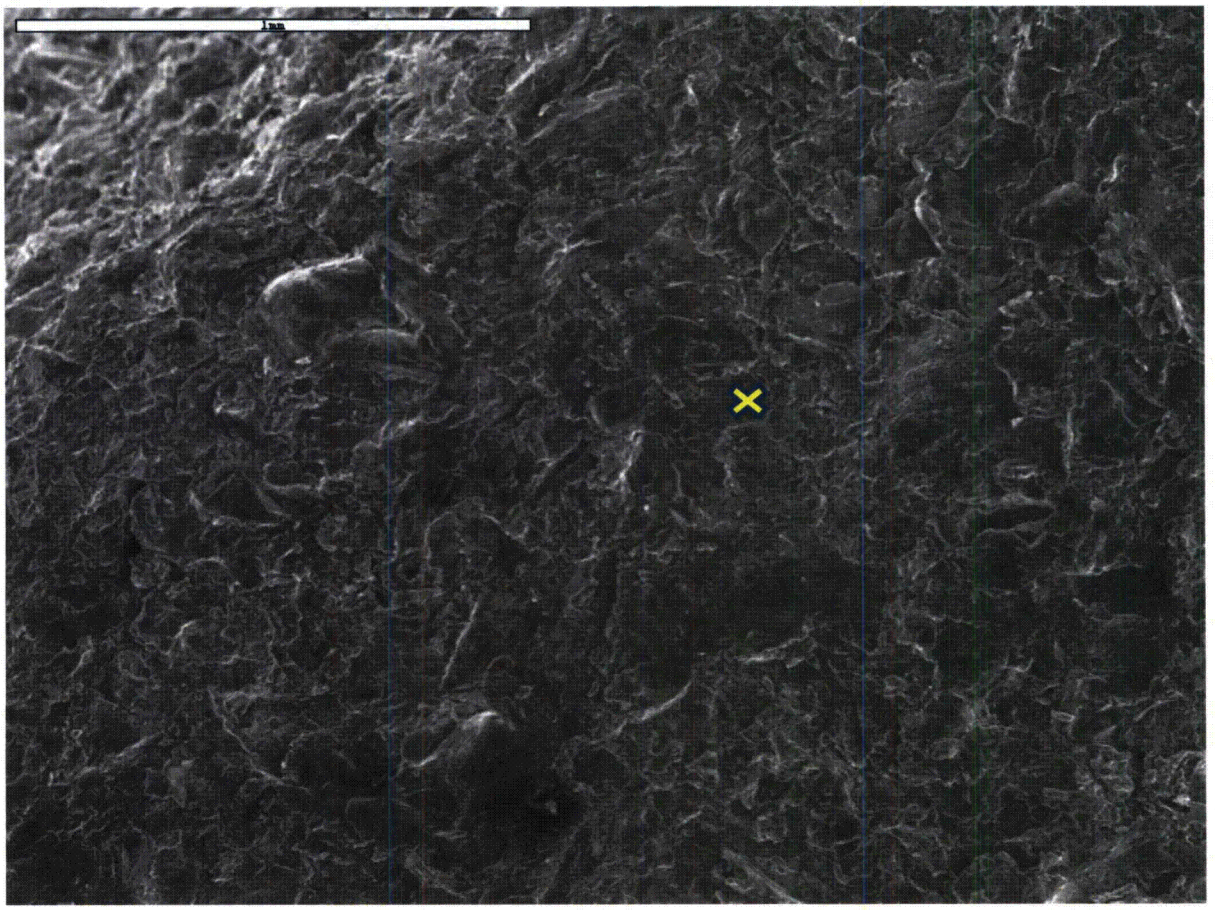

Figure 93 - "Used Vapor, Acid Washed, 1"

Elmt	Element %	Atomic %
O	54.62689	67.24589
Al	32.65743	23.83746
Si	12.71568	8.916649

Used Vapor, Acid Washed, 2

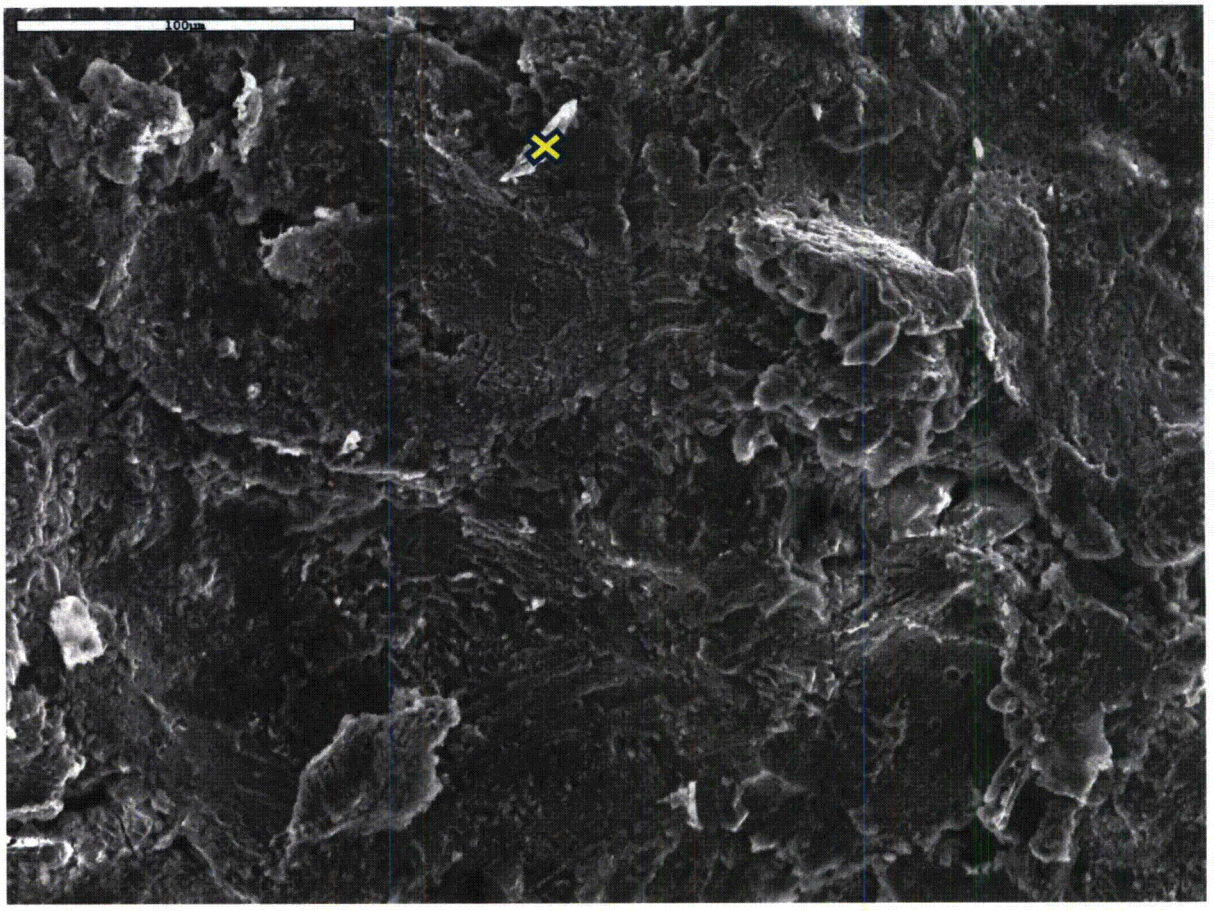

Figure 94 - "Used Vapor, Acid Washed, 2"

Elmt	Element %	Atomic %
O	28.34927	40.30083
Al	59.47025	50.12918
Si	10.89308	8.821161
K	1.287398	0.748822

Unused Vapor, Not Washed, 1

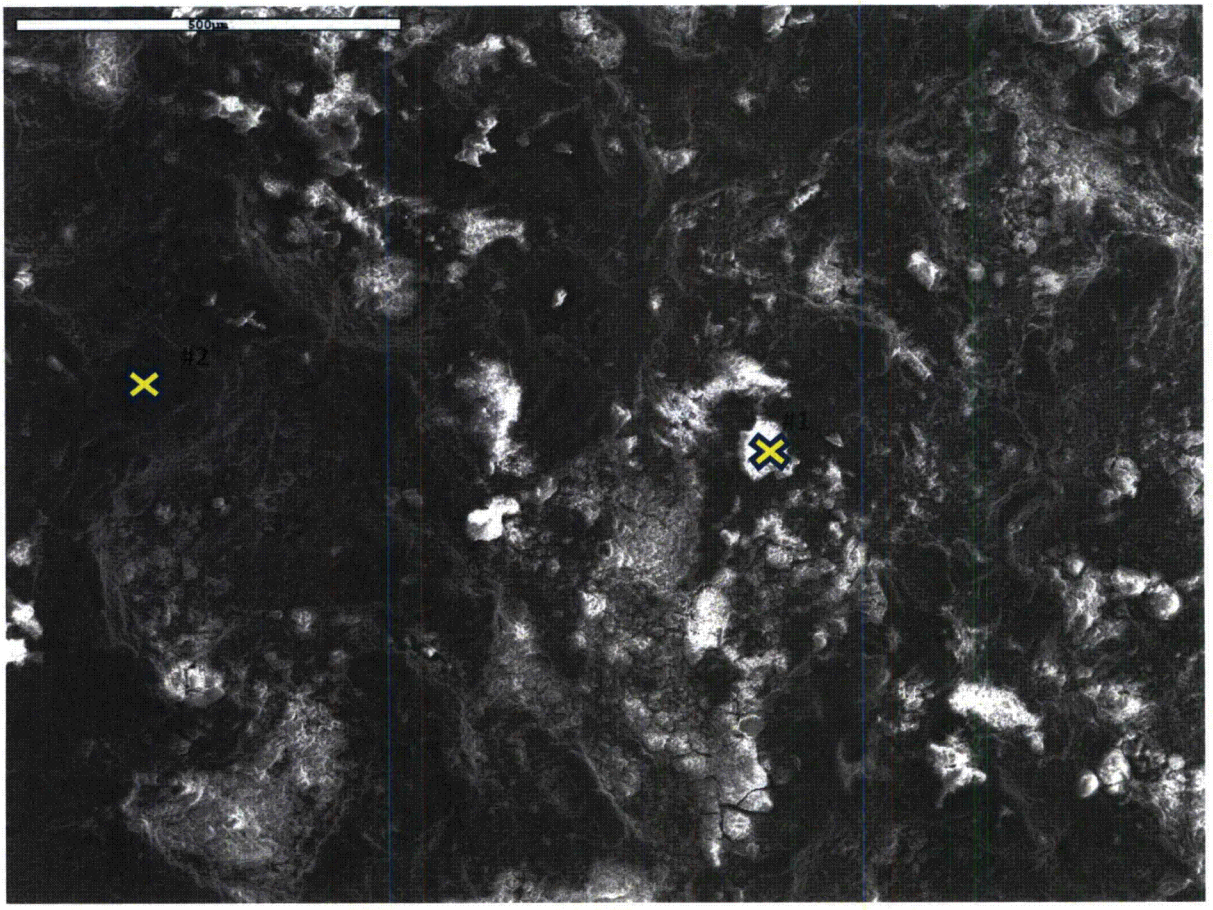

Figure 95 - "Unused Vapor, Not Washed, 1"

#1

Elmt	Element %	Atomic %
O	59.15316	73.00966
Na	0.63718	0.547291
Mg	0.419918	0.341066
Al	14.66136	10.72989
Si	11.93555	8.391659
P	6.691381	4.265929
Cl	0.591235	0.329308
Ca	2.694184	1.327378
Fe	1.676081	0.592639
Zn	1.539939	0.465179

#2

Elmt	Element %	Atomic %
O	29.14538	41.61925
Na	0.486218	0.48318
Mg	0.621621	0.584147
Al	58.73953	49.73632
Si	5.083239	4.134928
P	1.69262	1.248474
Cl	0.34045	0.219391
K	1.333805	0.779311
Ca	0.925179	0.52737
Fe	1.631967	0.667619

Unused Vapor, Not Washed, 2

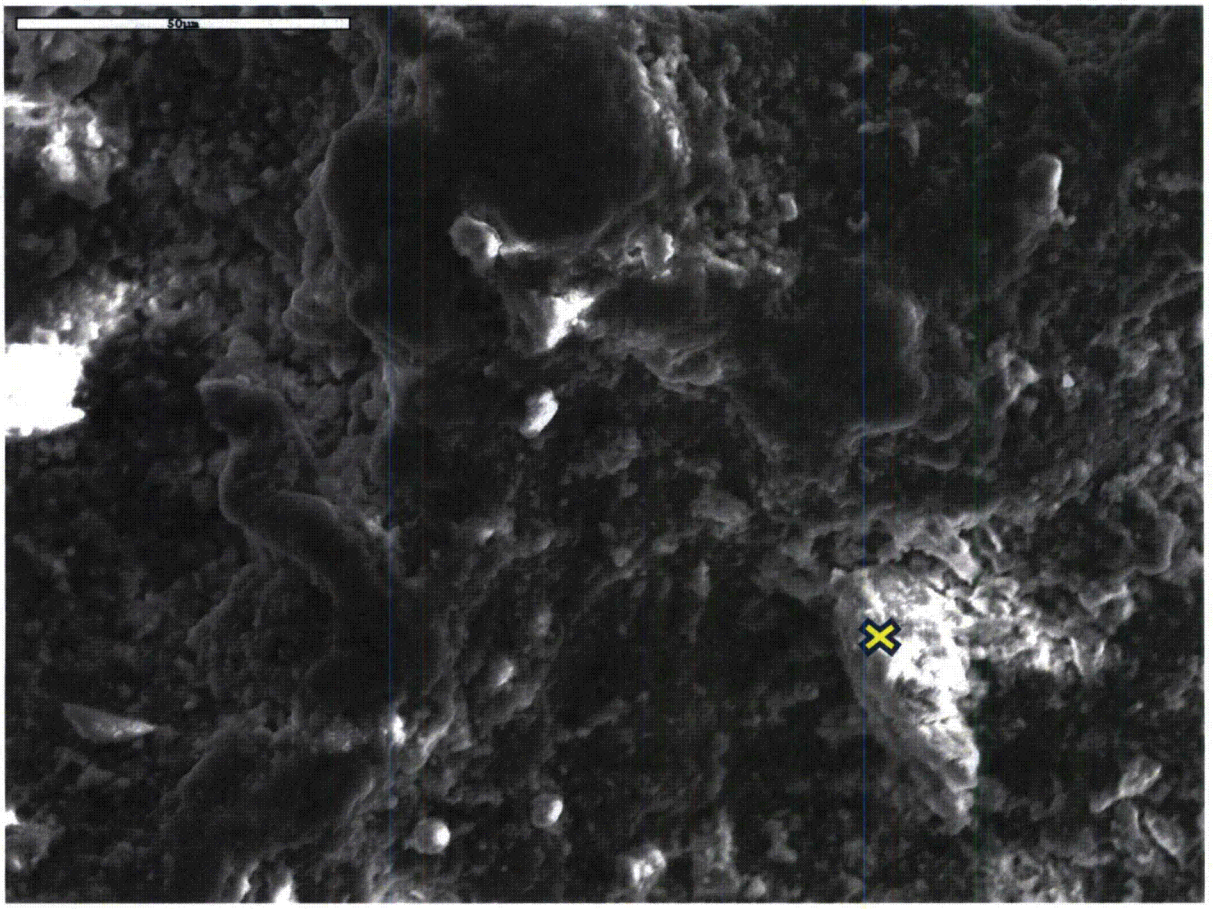

Figure 96 - "Unused Vapor, Not Washed, 2"

Elmt	Element %	Atomic %
O	31.00385	47.66272
Al	12.4003	11.30353
Si	21.75179	19.04852
P	5.832083	4.631081
Cl	0.62965	0.43682
K	18.24822	11.4783
Ca	5.632656	3.45654
Fe	4.501449	1.982478

Appendix 2 – Aluminum Corrosion, WCAP-16530-NP material release, XPS Summary results

Aluminum Corrosion Calculation

Test Sample Scale Analysis					
Aluminum	Surface Area (m^2)	Pre-Acid treatment (g)	Post- Acid treatment weight (g)	Scale (g)	Scale (g/m2)
Submerged 1	0.02	63.68	63.21	0.47	21.94
Submerged 2	0.02	64.05	N/A	0.49	21.94
Segment Vapor space	0.009	28.34	28.11	0.23	26.66

Pre-test Scale Estimation					
Aluminum	Surface Area (m^2)	Pre-Acid Wash Weight (g)	Post-Acid Wash weight (g)	Scale (g)	Scale (g/m2)
Vapor Rib Unsued	0.0102	32.65	32.42	0.23	23.04
Submerged Unused	0.01376	41.22	40.97	0.25	17.84

Samples	Surface Area (m2)	Scale (g/m2)	Scale (g)
Post Test Submerged 1	0.0214	21.9438	6.936
Post Test Submerged 2	0.0224	21.9438	0.468
Post Test Vapor space Segment	0.0088	26.6629	0.491
Pre Test Vapor space Segment	0.0102	23.04	0.235
Pre Test Submerged	0.0138	17.84	0.2455

	Scale (%)		Case 1 AlPO4-Al(OH)3 Scale		Case 2 AlPO4-Al2O3 Scale	
Sample	AlPO4	Al2O3/Al(OH)3	Mw of scale	Mol Al/mol scale	Mw of scale	Mol Al/mol scale
Post Test Sumbmerged	51	49	100	1.00	112	1.5
Pre Test Submerged	58	42	104	1.00	114	1.4
Post Test Vapor	87	13	116	1.00	119	1.1
Pre Test Vapor	83	17	115	1.00	119	1.2

compound	molecular weight
AlPO4	122
Al2O3	102
Al(OH)3	78

Aluminum Corrosion											
Case 1	Pre-test Aluminum Scale (g)	Al wt of scale (g)	Pre-test "Pure" Material (g)	Pretest Total Mass (g)	Al total associated with Pre test sample (g)	Post-test Aluminum Scale (g)	Post Test Al wt of scale (g)	Post test "Pure Material" (g)	Posttest Total Mass (g)	Al total associated with post test sample (g)	release
Vapor	5.993	1.412	834.107	840.100	835.52	6.936	1.613	833.524	840.460	835.137	0.382
submerged 1	0.381	0.099	63.364	63.745	63.46	0.468	0.126	63.207	63.675	63.333	0.130
submerged 2	0.399	0.104	63.715	64.114	63.82	0.491	0.132	63.558	64.049	63.690	0.129
ChLE tank test(L)	1135.5	1.616	961.186	967.959	962.801	7.895	1.871	960.289	968.184	962.161	0.641
Case 2	Pre-test Aluminum Scale (g)	Al wt of scale (g)	Pre-test "Pure" Material (g)	Pretest Total Mass (g)	Al total associated with Pre test sample (g)	Post-test Aluminum Scale (g)	Post Test Al wt of scale (g)	Post test "Pure Material" (g)	Post Test mass (g)	Al total associated with post test sample (g)	release
Vapor	5.993	1.594	834.107	840.100	835.701	6.936	1.780	833.524	840.460	835.305	0.396
submerged 1	0.381	0.129	63.364	63.745	63.492	0.468	0.168	63.207	63.675	63.375	0.117
submerged 2	0.399	0.135	63.715	64.114	63.850	0.491	0.176	63.558	64.049	63.734	0.115
ChLE tank test(L)	1135.5	1.857	961.186	967.959	963.043	7.895	2.125	960.289	968.184	962.414	0.629

	Pre-Test			Post-Test			Scale Gain		Aluminum Mass Loss	
Aluminum Sample	Al wt of scale 1	Al wt of scale 2	Non-Scale Al (g)	Al wt of scale 1	Al wt of scale 2	Non-Scale Al (g)	Al Scale 1	Al Scale 2	Case 1 (g)	Case 2 (g)
Vapor	1.41	1.59	834.11	1.61	1.78	833.52	0.20	0.19	0.38	0.40
submerged 1	0.10	0.13	63.36	0.13	0.17	63.21	0.03	0.04	0.13	0.12
submerged 2	0.10	0.13	63.72	0.13	0.18	63.56	0.03	0.04	0.13	0.12

Case 1 -Aluminum phosphate-aluminum hydroxide scale							
Case 1	Pre-test		Post-test		Aluminum Corrosion		
	Al metal (g)	Al scale 1 (g)	Al metal (g)	Al scale 1 (g)	Release into solution (g)	Converted to Scale (g)	Total Corrosion
Vapor	834.11	1.41	833.524	1.61	0.38	0.20	0.58
submerged 1	63.36	0.10	63.207	0.13	0.13	0.03	0.16
submerged 2	63.72	0.10	63.558	0.13	0.13	0.03	0.16
Total	961.19	1.62	960.29	1.87	0.64	0.26	0.90
Case 2 - Aluminum phosphate-aluminum oxide scale							
Case 2	Pre-test		Post-test		Aluminum Corrosion		
	Al metal (g)	Al scale 1 (g)	Al metal (g)	Al scale 1 (g)	Release into solution (g)	Converted to Scale (g)	Total Corrosion
Vapor	834.11	1.59	833.524	1.78	0.40	0.19	0.58
submerged 1	63.36	0.13	63.207	0.17	0.12	0.04	0.16
submerged 2	63.72	0.13	63.558	0.18	0.12	0.04	0.16
Total	961.19	1.86	960.29	2.12	0.63	0.27	0.90

Case 1	Total Corrosion (g)	surface area (m2)	min	mg/m2-min
Vapor	0.58	0.260128512	390	5.742846
submerged 1	0.16	0.0214	43200	0.169987
submerged 2	0.16	0.0224	43200	0.162457
Case 2	Total Corrosion (g)	surface area (m2)	min	mg/m2-min
Vapor	0.58	0.260128512	390	5.742846
submerged 1	0.16	0.02135	43200	0.169987
submerged 2	0.16	0.02236	43200	0.162457

	A	B	C	D	E
1	Class	Material	Amount	Notes	
2	Coolant	Sump Pool Volume (ft3)	73400.0	Should run sensitivities with both maximum and minimum	
3	Metallic Aluminum	Aluminum Submerged (sq ft)	556.7		
4		Aluminum Submerged (lbm)	1983.24375		
5		Aluminum Not-Submerged (sq ft)	5010.3		
6		Aluminum Not-Submerged (lbm)	17849.19375		
7	Calcium Silicate	CalSil Insulation(ft3)	0	Other class members include Marinite and MUDD	
8		Asbestos Insulation (ft3)	0		
9		Kaylo Insulation (ft3)	0		
10		Unibestos Insulation (ft3)	0		
11	E-glass	Fiberglass Insulation (ft3)	60		
12		NUKON (ft3)	0		
13		Temp-Mat (ft3)	0		
14		Thermal Wrap (ft3)	0		
15	Silica Powder	Microtherm (ft3)	0		
16		Min-K (ft3)	0		
17	Mineral Wool	Min-Wool (ft3)	0		
18		Rock Wool (ft3)	0		
19	Aluminum Silicate	Cerablanket (ft3)	0		
20		FiberFrax Durablanket (ft3)	0		
21		Kaowool (ft3)	0		
22		Mat-Ceramic (ft3)	0		
23		Mineral Fiber (ft3)	0		
24		PAROC Mineral Wool (ft3)	0		
25	Concrete	Concrete (ft2)	0		
26	Trisodium Phosphate (TSP)	Trisodium Phosphate Hydrate (lbm)	1	Flag=0 if no TSP, ≠0 if use TSP as buffering agent	
27	Interam	Interam (ft3)	0		
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					

	A	B	C	D	E	F	G	H	I	J
1	Time (sec)	min	hr	days	Sump pH	Sump Temp. (°F)	Sump Mixed 1=Yes	Steam or Spray pH	Containment Temp. (°F)	Notes
2	0	0	0	0	4.65	119.6	0	4.5	119.6	temps increased by 5 deg
3	300	5.0	0	0	6.46	119.8	0	4.5	119.8	
4	350	5.8	0	0	6.46	191.4	0	4.5	191.4	
5	400	7	0	0	6.46	183.5	0	4.5	183.5	
6	450	8	0	0	6.46	179.8	0	4.5	179.8	
7	515	9	0	0	6.46	175.9	0	4.5	175.9	
8	550	9	0	0	6.46	173.8	0	4.5	173.8	
9	600	10	0	0	6.73	161.4	0	4.5	161.4	
10	800	13	0	0	6.73	152.5	0	4.5	152.5	
11	900	15	0	0	6.88	159.4	0	4.5	159.4	
12	1200	20	0	0	6.99	165.8	0	6.99	165.8	
13	1800	30	1	0	7.15	167.7	0	7.15	167.7	
14	2400	40	1	0	7.2	166.9	0	7.2	166.9	
15	3000	50	1	0	7.2	163.1	0	7.2	163.1	
16	3600	60	1	0	7.2	161.6	0	7.2	161.6	
17	3900	65	1	0	7.2	162.2	0	7.2	162.2	
18	4920	82	1	0	7.2	164.1	0	7.2	164.1	
19	7000	117	2	0	7.2	163.6	0	7.2	163.6	
20	9000	150	3	0	7.2	161.6	0	7.2	161.6	
21	10000	167	3	0	7.2	161.7	0	7.2	161.7	
22	12000	200	3	0	7.2	162.2	0	7.2	162.2	
23	13000	217	4	0	7.2	162.3	0	7.2	162.3	
24	14400	240	4	0	7.2	162.3	0	7.2	162.3	Stop sprays at 6.5 hours
25	18000	300	5	0	7.2	161.6	0	7.2	161.6	Sump Temp at 6 hrs = 222.1, temp at 7 hrs = 215.3, so 6.5 hr T = 218.7
26	21600	360	6	0	7.2	159.9	0	7.2	159.9	Containment temp
27	23400	390	6.5	0	7.2	159.6	0	7.2	159.6	Sump Temp at 6 hrs = 186.3, temp at 7 hrs = 177.2, so 6.5 hr T = 181.8
28	28800	480	8	0	7.2	159.4	0			
29	86400	1440	24	1	7.2	144.5	0			
30	172800	2880	48	2	7.2	132.6	0			
31	259200	4320	72	3	7.2	124.1	0			
32	432000	7200	120	5	7.2	113.6	0			
33	864000	14400	240	10	7.2	104.1	0			
34	1728000	28800	480	20	7.2	98.1	0			
35	2592000	43200	720	30	7.2	94	0			
36	Do not enter data below row 35.									
37										
38										
39										
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Calculated Material Release

MBLOCA WCAP Calculation-kjh.xlsx 11/19/20121:07 PM

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	S	T	U
1			Interval Duration (min)	Start of Interval (hrs)	End of Interval (hrs)	Time (d)	Average Interval pH	Average Temp (F)	Ca Release (kg)	Si Release (kg)	Al Release (kg)	$NaAlSi_3O_8$ Precipitate (kg)	AlOOH Precipitate (kg)	$Ca_3(PO_4)_2$ Precipitate (kg)	Ca conc in solutIOn (mg/L)	Si conc in solutIOn (mg/L)	Al conc in solution (mg/L)
2			5.0	0.00	0.1	0.00347222	5.555	119.7	0.0037	0.0014	0.0007	0.004	0.001	0.010	0.00	0.00	0.00
3			0.8	0.08	0.1	0.00405093	6.46	155.6	0.00	0.00	0.00	0.0	0.0	0.01	0.00	0.00	0.00
4			0.8	0.10	0.1	0.00462963	6.46	187.45	0.01	0.00	0.00	0.0	0.0	0.02	0.00	0.00	0.00
5			0.8	0.11	0.1	0.00520833	6.46	181.65	0.01	0.01	0.01	0.0	0.0	0.02	0.00	0.00	0.00
6			1.1	0.13	0.1	0.00596065	6.46	177.85	0.01	0.01	0.01	0.0	0.0	0.02	0.00	0.00	0.00
7			0.6	0.14	0.2	0.00636574	6.46	174.85	0.01	0.01	0.01	0.0	0.0	0.03	0.00	0.00	0.00
8			0.8	0.15	0.2	0.00694444	6.595	167.6	0.01	0.01	0.01	0.0	0.0	0.03	0.01	0.01	0.00
9			3.3	0.17	0.2	0.00925926	6.73	156.95	0.01	0.02	0.01	0.0	0.0	0.04	0.01	0.01	0.01
10			1.7	0.22	0.3	0.01041667	6.805	155.95	0.02	0.02	0.01	0.1	0.0	0.04	0.01	0.01	0.01
11			5.0	0.25	0.3	0.013888889	6.935	162.6	0.02	0.03	0.02	0.1	0.0	0.06	0.01	0.01	0.01
12			10.0	0.33	0.5	0.020833333	7.07	166.75	0.04	0.05	0.04	0.1	0.1	0.10	0.02	0.02	0.02
13			10.0	0.50	0.7	0.027777778	7.175	167.3	0.05	0.07	0.07	0.2	0.1	0.13	0.02	0.03	0.03
14			10.0	0.67	0.8	0.034722222	7.2	165	0.06	0.09	0.09	0.3	0.1	0.17	0.03	0.04	0.04
15			10.0	0.83	1.0	0.041666667	7.2	162.35	0.08	0.11	0.11	0.3	0.2	0.20	0.04	0.05	0.05
16			5.0	1.00	1.1	0.045138889	7.2	161.9	0.08	0.12	0.12	0.4	0.2	0.22	0.04	0.06	0.06
17			17.0	1.08	1.4	0.056944444	7.2	163.15	0.11	0.15	0.15	0.5	0.2	0.27	0.05	0.07	0.07
18			34.7	1.37	1.9	0.081018519	7.2	163.85	0.15	0.21	0.22	0.7	0.3	0.39	0.07	0.10	0.11
19			33.3	1.94	2.5	0.104166667	7.2	162.6	0.20	0.28	0.29	0.9	0.4	0.50	0.09	0.13	0.14
20			16.7	2.50	2.8	0.115740741	7.2	161.65	0.22	0.31	0.32	1.0	0.5	0.56	0.10	0.15	0.15
21			33.3	2.78	3.3	0.138888889	7.2	161.95	0.26	0.37	0.38	1.1	0.6	0.67	0.13	0.18	0.18
22			16.7	3.33	3.6	0.150462963	7.2	162.25	0.28	0.40	0.41	1.2	0.6	0.73	0.14	0.19	0.20
23			23.3	3.61	4.0	0.166666667	7.2	162.3	0.31	0.44	0.46	1.4	0.7	0.80	0.15	0.21	0.22
24			60.0	4.00	5.0	0.208333333	7.2	161.95	0.39	0.55	0.58	1.7	0.9	1.00	0.19	0.27	0.28
25			60.0	5.00	6.0	0.250000000	7.2	160.75	0.46	0.66	0.69	2.0	1.1	1.20	0.22	0.32	0.33
26			30.0	6.00	6.5	0.270833333	7.2	159.75	0.50	0.71	0.74	2.2	1.1	1.29	0.24	0.34	0.36
27			90.0	6.50	8.0	0.333333333	7.2	159.5	0.61	0.86	0.76	2.7	1.1	1.58	0.29	0.41	0.36
28			960.0	8.00	24.0	1.000000000	7.2	151.95	1.70	2.18	0.90	6.8	0.4	4.39	0.82	1.05	0.43
29			1440.0	24.00	48.0	2.000000000	7.2	138.55	2.35	3.48	1.02	9.9	0.0	6.07	1.13	1.68	0.49
30			1440.0	48.00	72.0	3.000000000	7.2	128.35	2.35	4.40	1.09	10.6	0.0	6.07	1.13	2.12	0.53
31			2880.0	72.00	120.0	5.000000000	7.2	118.85	2.35	5.71	1.19	11.6	0.0	6.07	1.13	2.75	0.57
32			7200.0	120.00	240.0	10.000000000	7.2	108.85	2.35	7.91	1.34	13.0	0.0	6.07	1.13	3.80	0.65
33			14400.0	240.00	480.0	20.000000000	7.2	101.1	2.35	10.83	1.55	15.0	0.0	6.07	1.13	5.21	0.74
34			14400.0	480.00	720.0	30.000000000	7.2	96.05	2.35	12.76	1.70	16.5	0.0	6.07	1.13	6.14	0.82
35																	
36			Pool volume	73399.987	ft3												
37				2078.4562	m3												
38				2078456.2	L												
39																	
40			NOTE: This calculation adjusts only the pool volume and aluminum quantity, and eliminates the marinite														

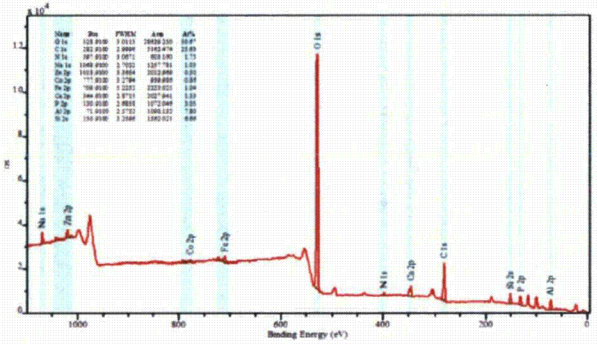
XPS Summary

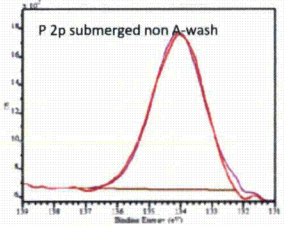
Sample Identifier	Al 2p %	O 1s %	C 1s %	SiO2 154.0 Si 2s %	N 1s %	P 2p %	Na2CO3 1071.7 Na 1s %
Sub A-wash	12.6	48.1	29.8	4.7	2.3	2.1	0.5
unused sub A-wash	10.4	33.5	50.2	1.4	2.1	1.9	0.6
vapor A-wash	6.8	31.1	54.7	4.2	1.4	1.3	0.3
unused vap A-wash	8.2	47.7	31.6	9.1	1.5	1.2	0.7
Sub non A-wash	8.9	50.3	31.2	3.5	2.1	3.3	0.8
Sub unused not A-wash	5.8	33.8	52.6	1.8	3.3	1.8	0.8
vap non A-wash	9.5	44.7	32.7	8.4	2.3	1.7	0.6
unused vap non A-wash	4.7	45.3	34.7	11.2	2.2	1.4	0.5

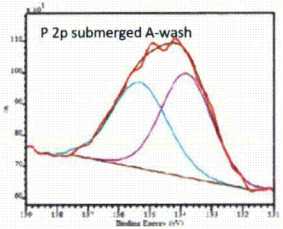
Sample Identifier	Al 2p %	O 1s %	C 1s %	Si 2s %	N 1s %	P 2p %	Na 1s %	Zn 2p %	Cl 2p %	S 2p %	Ca 2p %	Fe 2p %	Co 2p %	F 1s %
Sub A-wash	11.4	47.2	31.0	4.7	2.5	2.2	0.6	0.2	0.1					
unused sub A-wash	9.8	32.8	50.6	1.8	2.1	2.1	0.5	0.2	0.1					
vapor A-wash	6.4	30.4	54.5	5.0	1.2	1.5	0.4	0.2						0.6
unused vap A-wash	7.8	48.0	30.2	9.8	1.9	1.0	0.7	0.2		0.2	0.2			
Sub non A-wash	8.1	49.3	29.7	4.0	2.0	2.9	0.8	0.5			1.2	1.1	0.3	
Sub unused not A-wash	5.5	33.5	51.0	2.9	3.0	1.5	0.8	0.4	0.2	0.5	0.8			
vap non A-wash	7.6	49.4	29.7	7.8	1.9	1.1	0.5	0.2			0.9	1.4		
unused vap non A-wash	4.3	44.5	33.1	11.0	2.3	1.1	0.6	0.4	0.3	0.4	1.5	0.5		

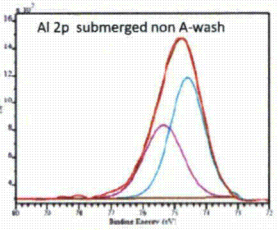
	Al 2p %	O 1s %	Si 2s %	N 1s %	P 2p %	Na 1s %
Sub A-wash	17.9	68.4	6.7	3.2	3.0	0.7
unused sub A-wash	20.4	67.1	3.0	4.4	3.8	1.3
vapor A-wash	15.1	68.8	9.3	3.1	3.0	0.8
unused vap A-wash	11.9	69.7	13.3	2.3	1.8	1.1
Sub non A-wash	12.6	72.7	5.8	2.9	4.8	1.2
Sub unused not A-wash	12.2	71.3	3.8	7.1	3.9	1.7
vap non A-wash	14.2	66.2	12.6	3.5	2.6	1.0
unused vap non A-wash	7.2	69.5	17.1	3.4	2.1	0.8

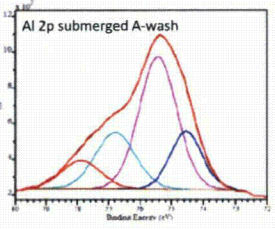
Sample Type	Al 2p %	O 1s %	Si 2s %	N 1s %	P 2p %	Na 1s %	
Submerged	12.2	71.3	3.8	7.1	3.9	1.7	100.0
Vapor space	7.2	69.5	17.1	3.4	2.1	0.8	100.0











Sample Identifier	C-N=O	NO	NO2	NO/Al, NO3/N2O		C-C	C-N	C-N=O/ COOH	P C-O-PO AlPO4	AlSiPOx Na3PO4	Al2O3/Al(OH)3 AlPO4	aluminun	AlO(OH)	Al2O3
	400.24083	402.5605	405.2	407.677	409.636	284.896	286	288.58	134	135.74	74.467	75.2926	76.8307	77.922
Sub A-wash	30.5527	11.33939		43.0909	15.017	54.8923	34.8	10.335	49.52	50.477	21.995	46.6889	22.8212	8.4952
unused sub A-wash	42.216967	9.84835		45.7659	5.44528	60.0041	33.9		59.15	40.855	34.882	35.2147	21.5717	8.3317
vapor A-wash	45.4369	20.6921		30.7312	3.13969	52.6608	40.1	7.2684	23.17	76.834	8.5054	39.4153	26.9466	25.133
unused vap A-wash	67.631133	9.450227		21.2466	1.67211	55.0534	31.9	13.068	81.47	18.527	56.602	32.6624	10.7359	
Non-acid washed samples														
Submerged Test sample	70.6241	9.884277		19.3874	0.1042	57.4947	30	12.504	100	0	50.859	49.1406		
Submerged background sar	91.5441	8.455885				61.0174	26.8	12.21	100	0	57.971	42.0288		
Vapor Test sample	35.3401	21.68825	34.9259	8.04576		51.7989	28.5	19.732	100	0	86.562	13.4376		
Vapor backgound sample	100					65.7832	22.8	11.399	100	0	83.147	16.8532		
Sub unused not A-wash	91.5441	8.455885				61.0174	26.8	12.21	100	0	57.971	42.0288		
unused vap non A-wash	100					65.7832	22.8	11.399	100	0	83.147	16.8532		