EASTMOUNT ENVIRONMENTAL SERVICES, LLC
Air Quality Specialists

Final Report

Collection and Analysis of Particulate Fallout Samples near Coal-Fired Power Plant in Alexandria, VA

Prepared for . . .

Schnader, Harrison, Segal & Lewis LLP

Prepared by . . .

Eastmount Environmental Services, LLC
October 13, 2006
Project No.06-082

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1.0 INTRODUCTION

1.1 General

The City of Alexandria, Virginia has expressed concerns regarding the operation of a coal-fired power plant located within the city perimeter. One of the concerns is that particulate fallout is being deposited on the buildings located near the power plant. The City is interested in determining how much of the particulate fallout is attributed to plant operations, either from coal fly ash (stack emissions), coal ash, (stack emissions), or coal dust (coal piles, conveyors). The legal office of Schnader, Harrison, Segal & Lewis LLP (Schnader), representing the City of Alexandria, has asked Eastmount to develop a technical approach to collecting and analyzing particulate samples to establish the extent of particulate contribution by the coal-fired power plant operations.

1.2 Program Overview

An Eastmount Environmental representative traveled to Alexandria, Virginia to perform sample collections in the area of the coal–fired power plant. The Eastmount representative, Joseph Brady, Environmental Engineer, was accompanied by two representatives from Schnader. Twenty-seven samples were taken from different areas using the following procedure:

Analytical Procedure:

1) Samples were collected on opaque-type (transparent brand) scotch tape by rolling the tape into a 1 inch loop with the sticky side out, and then rolling the tape loop onto the particulate-laden surface, causing any particulate to stick to the tape. Care was taken to avoid getting fingerprints on the tape adhesive. The Eastmount engineer wore nitrile gloves during the collection procedure to eliminate the possibility of fingerprints obscuring the sample, and to generally preserve sample integrity. This procedure was repeated for each sample.

2) Each tape sample was placed into a clean film canister. Each canister was labeled with identifying remarks, and sealed tamper-proof evidence tape. The samples were brought back to Eastmount Environmental Services, entered into a sample log, and then shipped to Aerotech/P & K laboratories of N. Billerica, Massachusetts for analysis.

3) Aerotech analyzed the samples as follows: a) A portion of each sample was mounted in index oil and examined by Polarized Light Microscopy (PLM) to identify the components (percent biological, mineral, soot, fibers, etc.) making up the sample; b) Suspect particles were examined by Scanning Electron Microscopy (SEM). This technique further confirmed the identification of any coal soot, coal ash, and/or coal fly ash initially identified by PLM; c) Energy dispersive x-ray (EDX) spectra were plotted for the selected particle types. This established the main elemental constituents of the suspect particles; d) A final report summarizing the lab findings was submitted. The report includes both PLM and SEM microscope images of each sample, as well as EDX graphs.

2.0 RESULTS

2.1 Results Table

Sample	Location	Soot (%)	Fly Ash	Coal Ash	Oil Soot	Coal	Wood Char
1	Marina #1410 Bedroom Shelf	N/D	N	N	N	N	N
2	Marina #1410 Bedroom Table	Trace	Y	N	N	N	N
3	Marina #1410 Living Shelf	Trace	Y	N	N	N	N
4	Marina #1410 Balcony Doorframe	3%	Y	Y	N	N	N
5	Marina #1410 Balcony Railing	10%	Y	Y	Y	N	N
6	Marina #1402 Balcony Table Legs	10%	Y	Y	N	N	N
7	Marina #1402 Balcony Railing	3%	Y	Y	N	N	N
8	Marina #1402 Balcony Table Top	15%	Y	Y	N	Y	Y
9	1200 N. Pitt Deck Table Top	5%	Y	Y	N	N	N
10	1200 N. Pitt Deck Awning Joint	5%	Y	Y	N	Y	N
11	1202 N. Pitt Doorway	5%	Y	Y	N	N	Y
12	1206 N. Pitt Side Doorway	5%	Y	Y	N	N	N
13	529 Bashford #1 Inside Sill	5%	Y	Y	N	Y	N
14	1317 E. Abingdon Lamp	3%	Y	Y	N	Y	N
15	1317 E. Abingdon Exhaust	Trace	Y	Y	N	N	N
16	Harbor Terrace Meter Box	10%	Y	Y	N	Y	N
17	Harbor Terrace Conduit Box	10%	Y	Y	N	N	N
18	400 N. Royal Windowsill	10%	Y	Y	N	Y	N
19	400 N. Royal Door	1%	Y	Y	N	N	N
20	317 Hearthstone Window	5%	Y	Y	Y	Y	N
21	1114 N. Pitt Filter	N/D	N	N	N	N	N
22	1114 N. Pitt Alternate Dust Site	Trace	N	N	Y	N	N
23	Mirant Entrance Trash Can	10%	Y	Y	N	N	N
24	Coal Pile Trash Can	3%	Y	N	N	Y	N
25	1603B Patio Hunting Creek Door	2%	Y	N	N	N	N
26	1603B Patio Hunting Creek Wall	5%	Y	N	N	Y	N
27	1603B Hunting Creek Windowsill	2%	Y	Y	N	N	N

N/D - Not Detected

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2.2 Discussion

The table shows that Coal Ash and Coal Fly Ash are present in the majority of locations. The following is a description of the items found in the samples.

Fly Ash – is the finely divided mineral residue resulting from the combustion of powdered coal in electric generating plants. Fly ash consists of inorganic, incombustible matter present in the coal that has been fused during combustion into a glassy, amorphous structure. Coal can range in ash content from 2%-30%, and of this around 85% becomes fly ash. Fly ash particles are generally spherical in shape and range in size from 0.5 μm to 100 μm. They consist mostly of silicon dioxide (SiO_2), aluminium oxide (Al_2O_3) and iron oxide (Fe_2O_3). Fly ash also contains some heavy metals

Coal Ash – partially burned coal. It is heavier than fly ash and under analysis it is uniquely shaped with many pits and craters.

Coal – non-combusted coal.

2.3 Conclusion

Results of this program indicate that post-combustion coal particulate (flyash and/or coal ash) was present in fallout samples collected at 24 out of 27 sites. Coal particulate represented between <1% to 15% of the total particulate in these samples, with thirteen of these samples containing between 5% to 10% post-combustion coal particulate.

The information contained in this report is true and accurate to the best of my knowledge.

Joseph Brady
Environmental Engineer

Anthony Stratton
Vice President / Technical Services

APPENDIX A

Aerotek/P&K Analytical Report

AEROTECH P&K
An Affiliate of Severn Trent Laboratories, Inc.

Joseph Brady
Eastmount Environmental, LLC
65 Parker Street
Newburyport, MA 01950

October 12, 2006

Dear Joseph:

As requested, here is our lab's definition of fly ash.

Fly ash or coal fly ash (either term) is a very fine powdery ash produced by the combustion of coal. This material would "fly" out of the power plant's stacks, carried off with the flue gases.

When using the light microscope, the fly ash appears as clear or amber glassy spheres with opaque highlights. By scanning electron microscopy, fly ash typically appears as smooth opaque spheres, sometimes with pits or voids. The chemical composition by Energy Dispersive X-ray analysis (EDS) would typically demonstrate a strong concentration of silicon, a moderate concentration of aluminum, with minor amounts of potassium, calcium, titanium and iron.

Should you have further questions, or need additional information, please feel free to contact Client Services or me at any time.

Sincerely,

Ernest T. Dobi

Ernest T. Dobi, Ph.D.
Manager, Microscopy Services

Eastmount Environmental, LLC
65 Parker Street
Newburyport, MA 01950

AEROTECH P&K
An Affiliate of Severn Trent Laboratories, Inc.

Attention: Joseph Brady
Aerotech P&K #: 760-609-0034
Billing Ref.: Project #: 06-082

September 28, 2006

Dear Joseph:

Please find enclosed twenty-seven (27) PLM color photomicrographs, fifty-eight (58) SEM photomicrographs and fifty-nine (59) EDX spectra of the six samples, which you submitted for examination and identification of the dust composition.

METHODS:

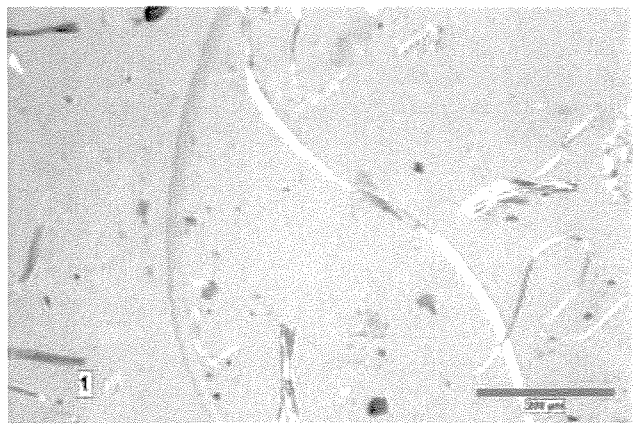
Each tape sample was removed from its respective film canister. Representative portion was mounted in index oil (n=1.605) on a glass slide for an initial PLM examination. Another portion of each sample was mounted on double-sided tape and coated with evaporated graphite for the SEM analysis. Average composition photos were taken of each dust sample by PLM. Percentages of the material composing the dust samples were made by visual estimate under the PLM. Suspect particle types were confirmed and photographed with the SEM. Energy Dispersive X-Ray (EDX) spectra were plotted out for the selected particle types.

FINDINGS:

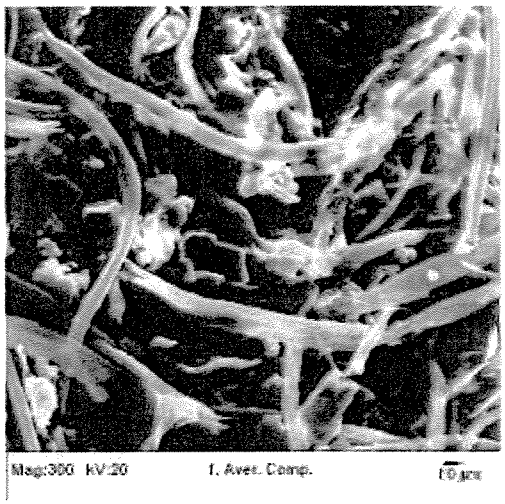
Please refer to the PLM color photomicrographs, SEM photomicrographs, and the EDX spectra. The following are the results of the PLM visual estimates. *N/D means not detected. Dark opaque elongated particles with curving sides and rounded tapered ends were classified under non-soot opaques as vehicle dust. This particle type is morphologically suggestive of vehicle emission dust. This form is also associated with rubber dust from tires or industrial residue.

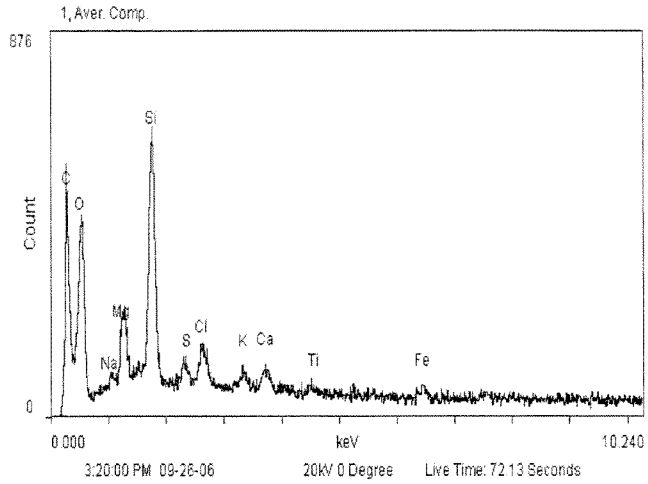
1:

45%	Cellulose (paper, cotton fibers)
37%	Biologicals (organic debris-skin scales/plant tissue, animal fiber/wool, trichome, spore/spore related materials, starch grains)
8%	Synthetic fibers
7%	Mineral grains
3%	Opaques (non-soot organic/inorganic, paint residue/spheres, metallic chip, rust)
*N/D	Coal/Industrial Soot



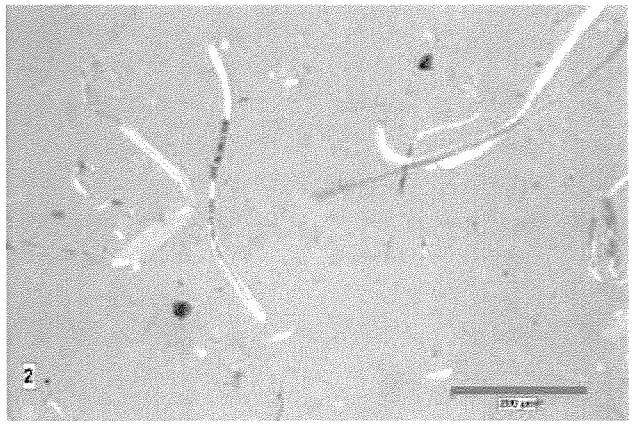
Sample 1 consisted primarily of fibrous material, biological debris and some mineral matter. Industrial soot particles and coal were not detected in this sample. The average composition image and spectra demonstrates both the organic and inorganic content that characterizes this sample.





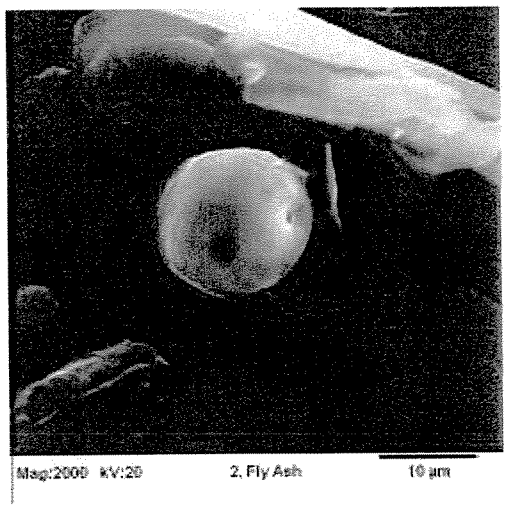
2:

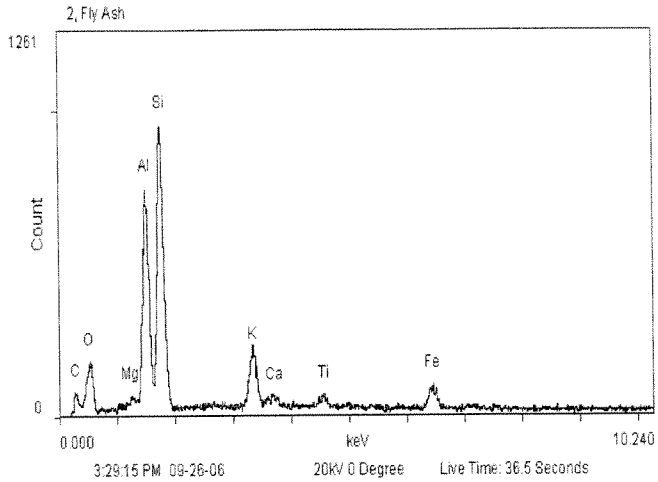
38%	Biologicals (organic debris-plant, trichome, hair, starch grains, pollen, spore/spore related material)
25%	Cellulose (paper, cotton fibers)
18%	Synthetic fibers
10%	Mineral grains
7%	Glass fibers
2%	Opaques (non-soot organic/inorganic, paint sphere)
Trace	Soots (fly ash)



Sample 2 consisted primarily of biological debris, fibrous material and some mineral matter. A few straight glass fibers were found together in one deposit. Particles demonstrating morphology suggestive of combusted soot material and coal were not detected with the PLM.

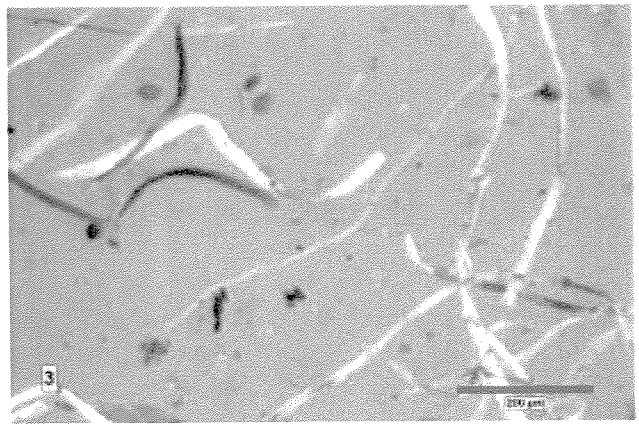
SEM analysis documents the presence of fly ash. No coal particles were detected with the SEM in this sample. The smooth spherical fly ash contains strong peak concentrations of aluminum and silicon with moderately strong to lower peak concentrations of carbon, oxygen, magnesium, potassium, calcium, titanium and iron. No coal was confirmed in this sample.





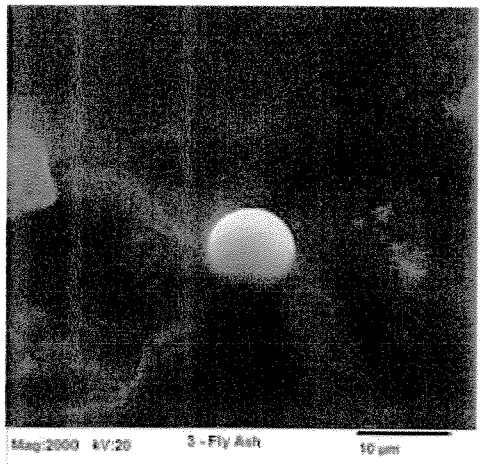
3:

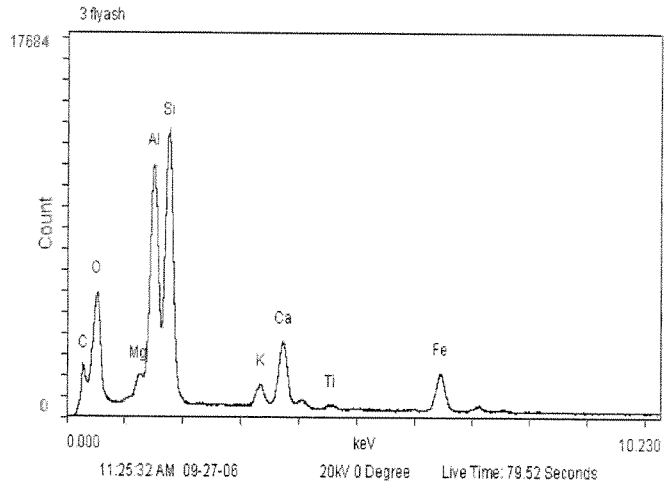
55% Cellulose (paper, cotton fibers)
25% Biologicals (organic debris, trichome, pollen, hair, spore/spore related material)
8% Synthetic fibers
7% Mineral grains
5% Opaques (non-soot organic/inorganic, paint residue/sphere)
Trace Soot (fly ash)



Sample 3 consisted of a noticeable concentration of cellulose fibers with several synthetic fiber strands. A quarter of the sample area was estimated to represent biological debris. Minerals and some particles consistent for paint residue were observed. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM

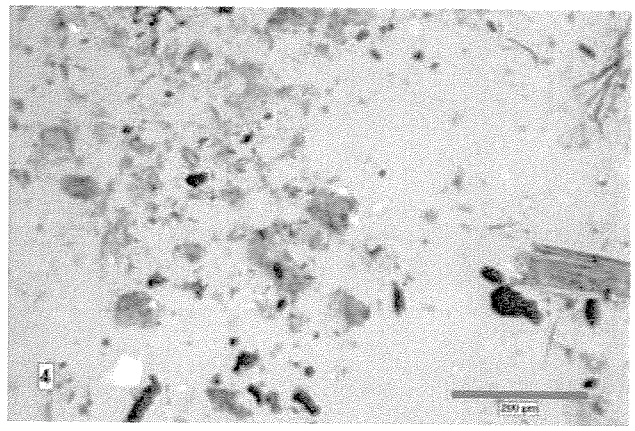
SEM analysis confirms the presence of fly ash. No coal particles were confirmed with the SEM in this sample. The smooth spherical fly ash contains peak concentrations of carbon, oxygen, magnesium, aluminum, silicon, potassium, calcium, titanium and iron. No coal was confirmed in this sample.





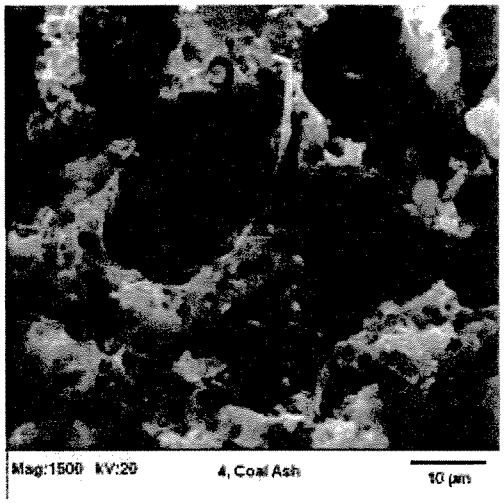
4:

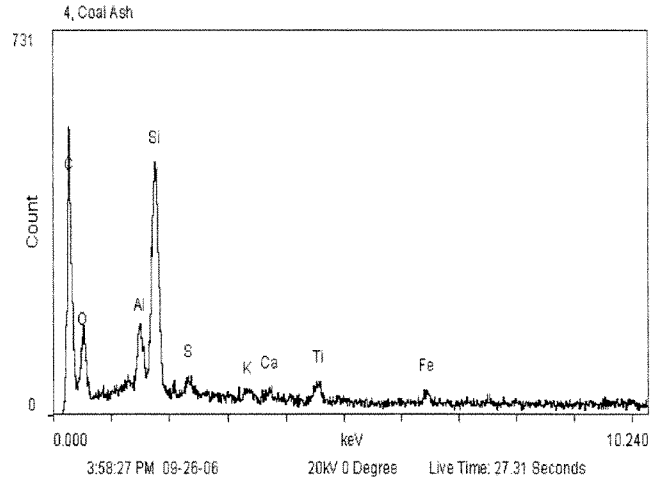
40%	Mineral grains/aluminum oxide
37%	Biologicals (insect body/waste, hair, plant, organic debris trichome, pollen, spore/spore related material)
15%	Opaques (non-soot organic/inorganic, vehicle dust, rust)
5%	Cellulose (vegetative, paper fibers)
3%	Soots (flyash, coal ash)
Trace	Synthetic fiber



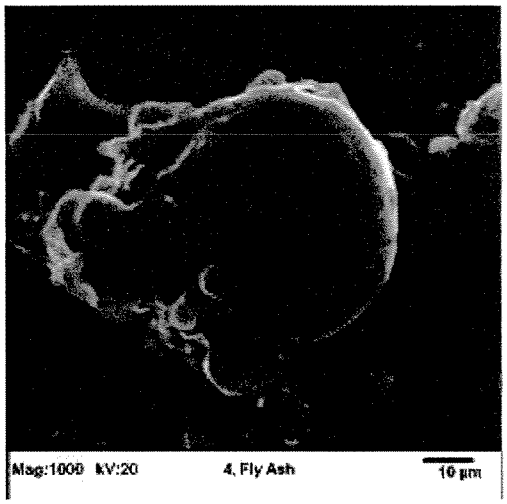
Biological material was estimated to represent over half the sample area in 4 with non-soot dark opaques, mineral grains and aluminum oxide estimated at a third. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM.

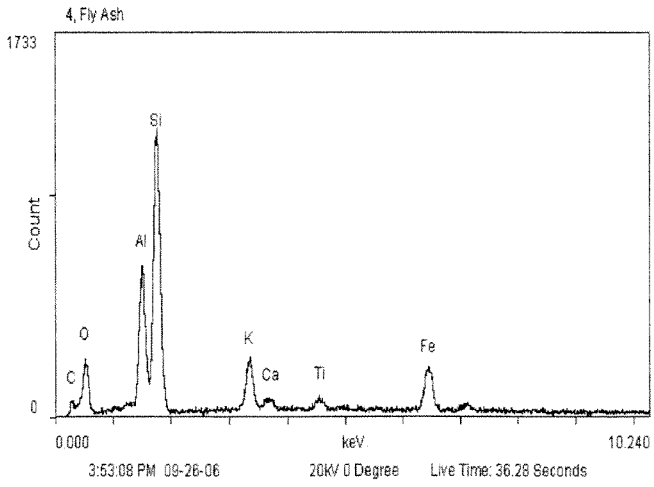
SEM analysis confirms the presence of coal ash and fly ash. No coal was confirmed with the SEM in this sample. The coal ash specimen shows texture laced with numerous pits and craters. The particle is irregular in shape and has several included fly ash spheres. Chemistry from the coal ash shows strong peak concentrations of carbon and silicon with moderately strong to lower peak concentrations of oxygen, aluminum, sulfur, potassium, calcium, titanium and iron.





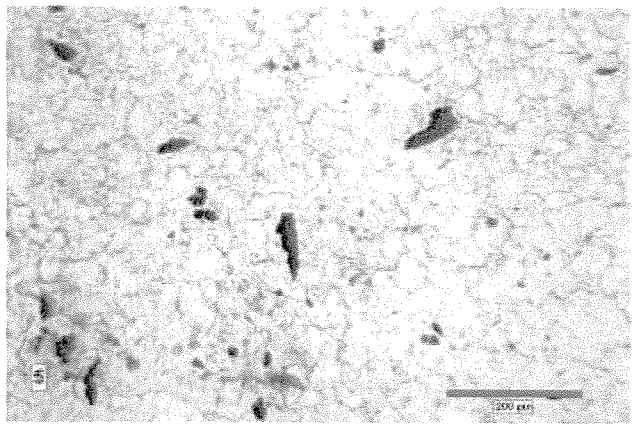
The smooth spherical fly ash is partly embedded in related debris. Other fly ash nodules are seen protruding from the bulk binding material. Chemistry of the fly ash shows strong peak concentrations of aluminum and silicon with lower peak concentrations of carbon, oxygen, potassium, calcium, titanium and iron.





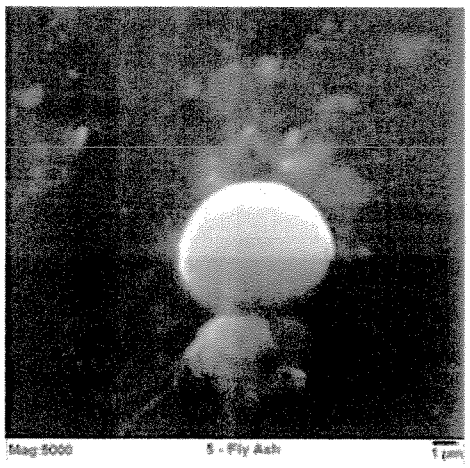
5:

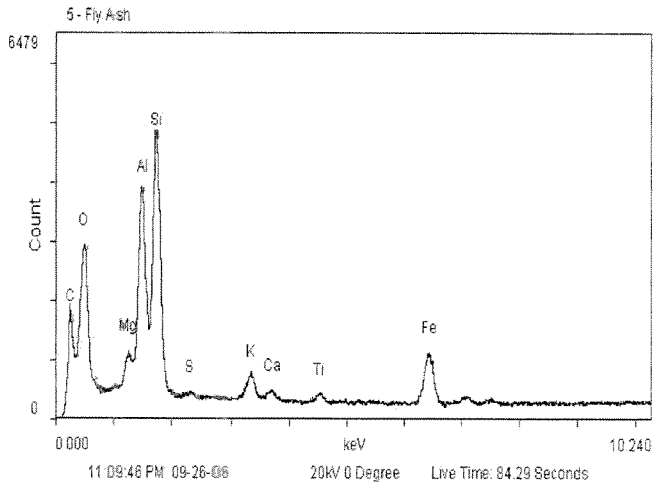
55% Opaques (paint residue/spheres, vehicle dust, non-soot organic/inorganic, rust)
20% Cellulose (paper fibers)
10% Soot (fly ash, coal ash, oil soot)
5% Mineral grains
5% Synthetic fibers
3% Glass fibers
2% Biologicals (organic debris, starch grains, trichome, spore/spore related material)



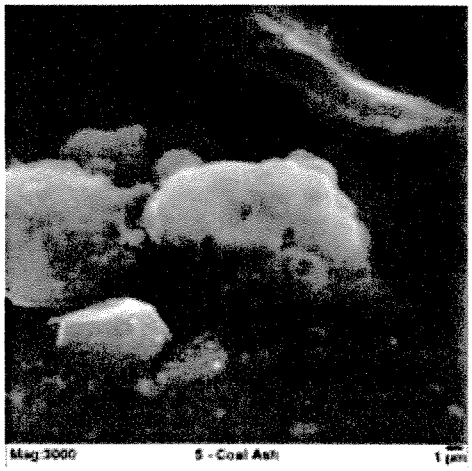
Sample 5 consisted of a noticeable concentration of dark opaques. Fibrous material included one main cellulose fiber deposit, two synthetic fiber strands and two straight glass fibers were observed. Mineral grains and biological particles were also noted. Particles demonstrating morphology suggestive of combusted soot material were observed with the PLM

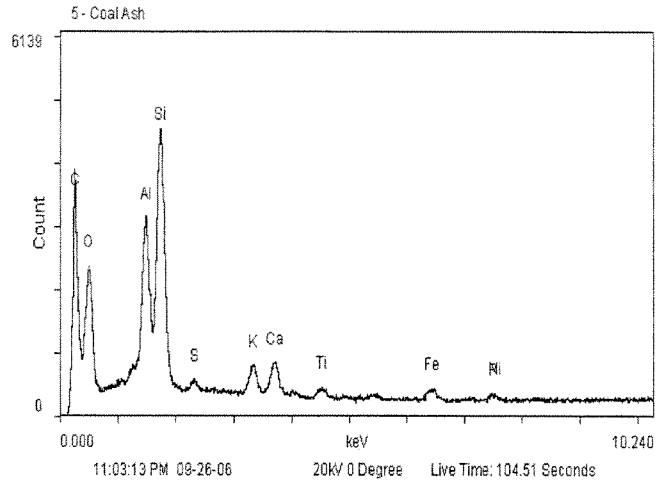
SEM analysis confirms the presence of fly ash, coal ash and oil soot. No coal particles were confirmed with the SEM in this sample. The smooth spherical fly ash contains a strong peak concentrations of carbon, oxygen, aluminum, silicon and iron with magnesium, sulfur, potassium, calcium and titanium.



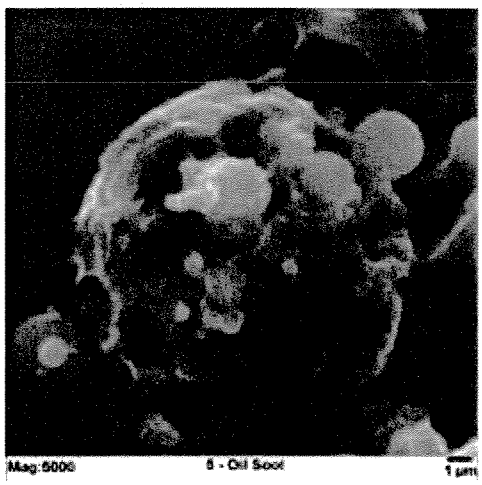


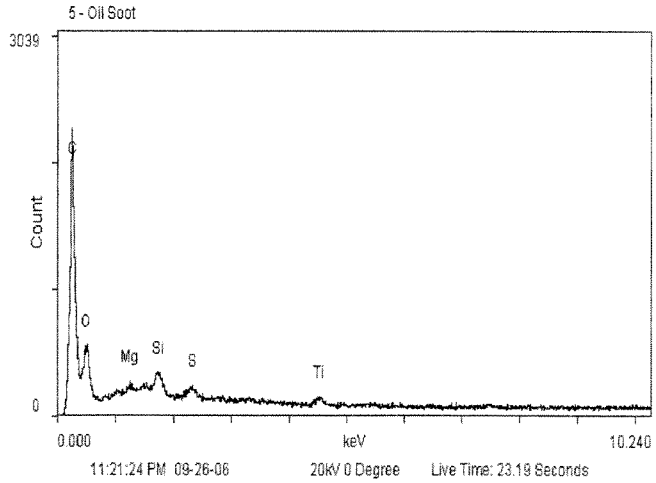
The irregularly shaped coal ash particle fragment recorded in the SEM image demonstrates several crater markings. Chemistry fro the coal ash particle shows strong peak concentrations of carbon, oxygen, aluminum and silicon with lower peak concentrations of sulfur, potassium, calcium, titanium, iron and nickel.





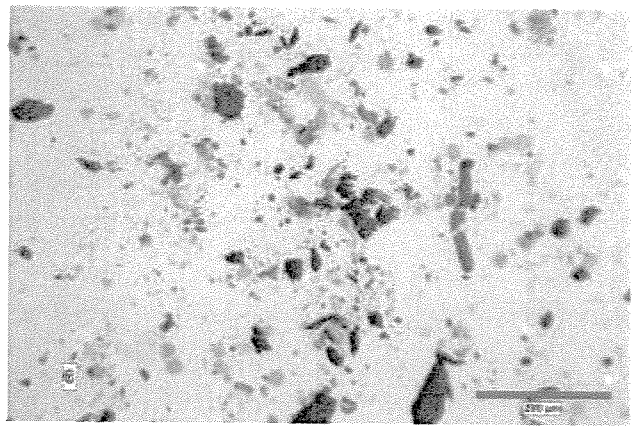
The heavily cratered oil soot spheroid has several smooth spherical flyash on and included in the particle surface. The underlying oil soot demonstrates a strong peak concentration of carbon with moderately strong to lower peak concentrations of oxygen, magnesium, silicon, sulfur and titanium.





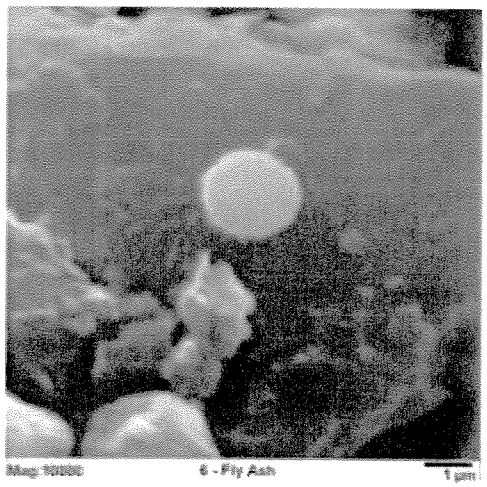
6:

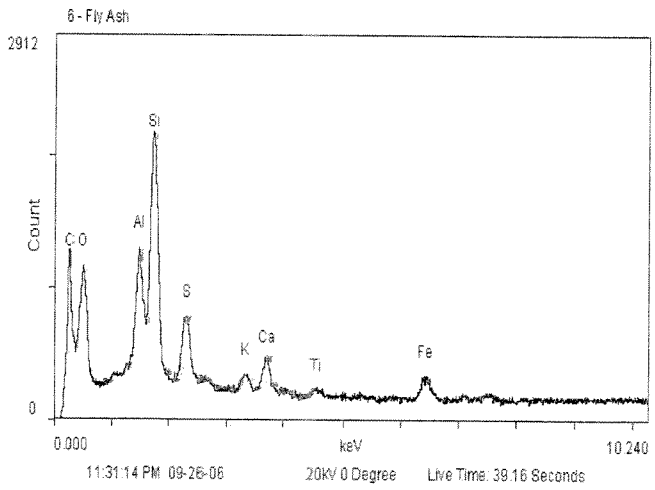
40%	Mineral grains
32%	Biologicals (organic debris, pollen, trichome, insect parts, spore/spore related material)
15%	Opaques (non-soot organic/inorganic, vehicle dust, paint residue/spheres)
10%	Soot (fly ash, coal ash)
3%	Cellulose (paper fibers)



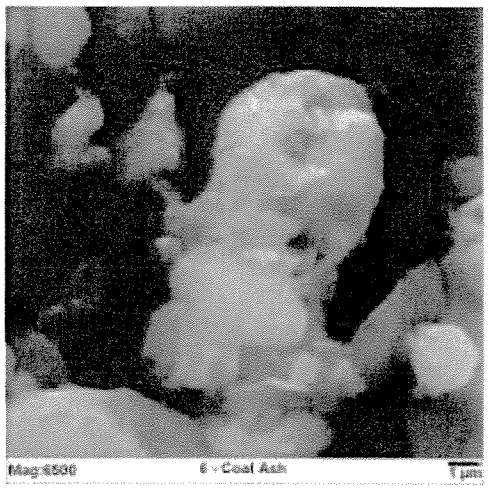
Sample 6 consisted of mineral matter, biological debris and non-soot opaques. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM.

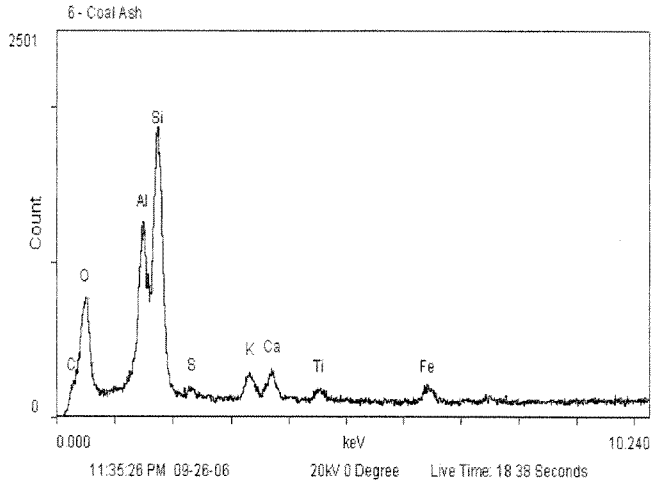
SEM analysis confirms the presence of fly ash and coal ash. No coal fragments were confirmed in this sample. Chemistry from the smooth spherical fly ash particle shows peak concentrations of carbon, oxygen, aluminum, silicon, sulfur, potassium, calcium, titanium and iron.





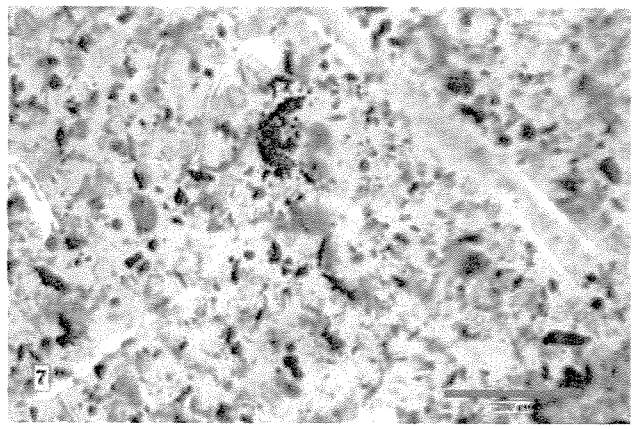
The coal ash specimen is well eroded; showing only rounded contours suggestive of remnant crater form. SEM/EDX of the coal ash shows strong peak concentrations of oxygen, aluminum and silicon with lower peaks of carbon, sulfur, potassium, calcium, titanium and iron.





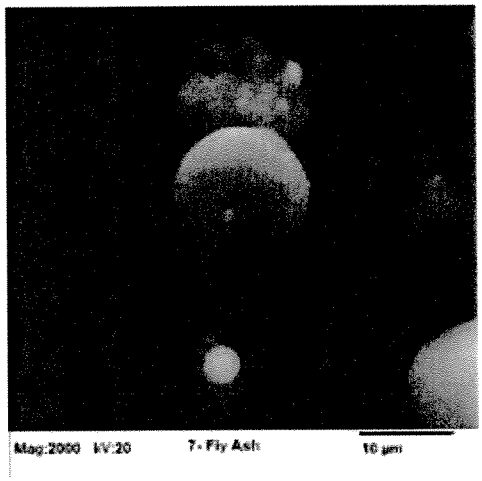
7:

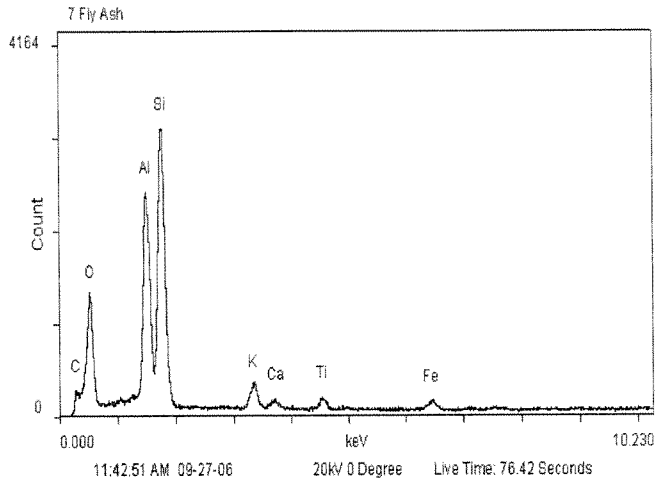
45%	Biologicals (pollen, trichome, insect parts/waste, organic debris, hair, spore/spore related material)
20%	Cellulose (vegetative, paper fibers)
17%	Mineral grains
15%	Opaques (non-soot organic/inorganic, vehicle dust, rust, metallic particles)
3%	Soot (fly ash, coal ash)



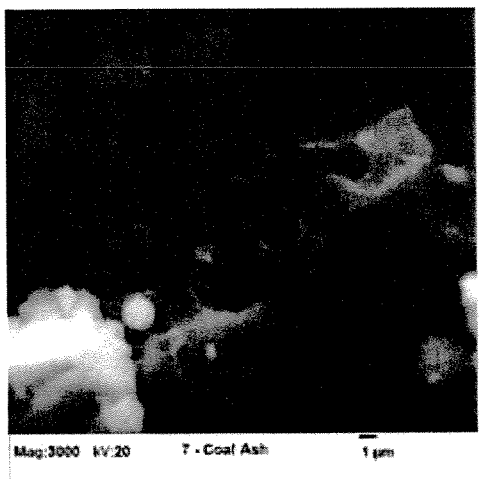
Sample 7 consisted primarily of biological material with cellulose, mineral matter and non-soot opaques. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM.

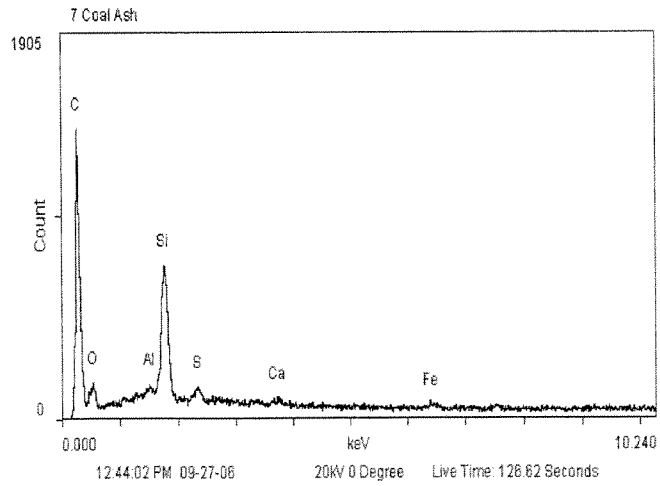
SEM analysis confirms the presence of fly ash and coal ash. No coal fragments were confirmed with the SEM in this sample. The smooth spherical fly ash contains strong peak concentrations of oxygen, aluminum and silicon with lower peak concentrations of carbon, potassium, calcium, titanium and iron.





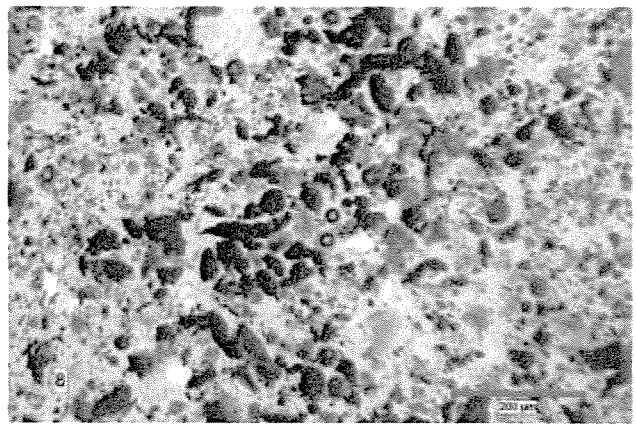
The irregularly shaped coal ash fragment demonstrates numerous pits and craters. Fly ash particles are visible around the parameter of the coal ash particle. The coal ash shows strong peak concentrations of carbon and silicon with lower peak concentrations of oxygen, aluminum, sulfur, calcium and iron.





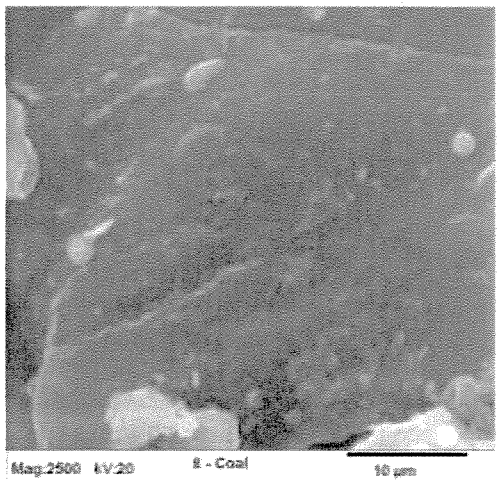
8:

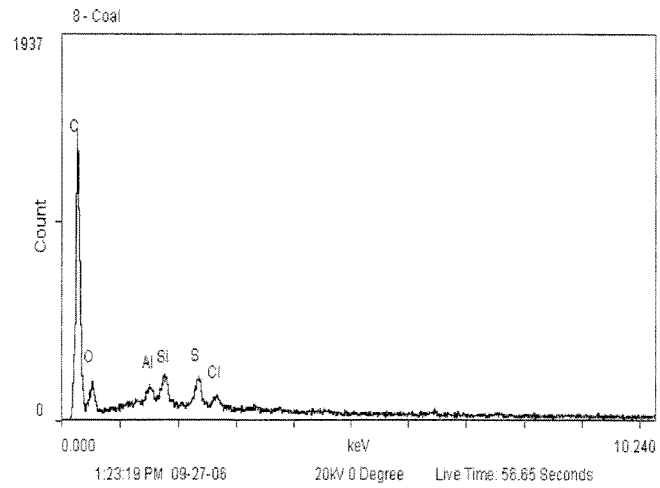
53%	Mineral grains
15%	Opaques (vehicle dust, non-soot organic/inorganic, paint residue/spheres)
15%	Soot (coal, coal ash, fly ash, wood char)
12%	Biologicals (organic debris, plant, trichome, spore/spore related material, starch grains)
3%	Plastic fragments
2%	Cellulose (vegetative, paper fibers)
Trace	Synthetic fiber
Trace	Glass fibers



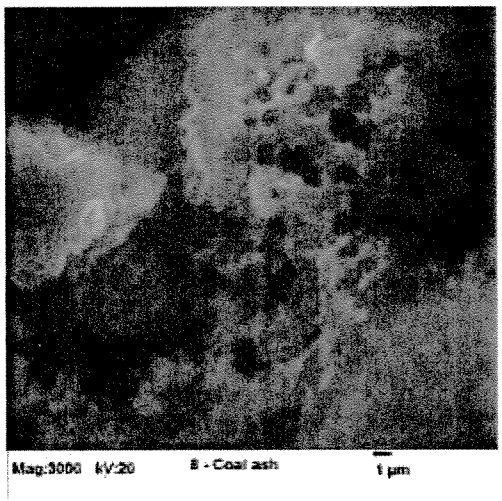
Mineral matter was estimated to represent approximately half the area in 8. Non-soot opaques and biologicals were prevalent as well. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM.

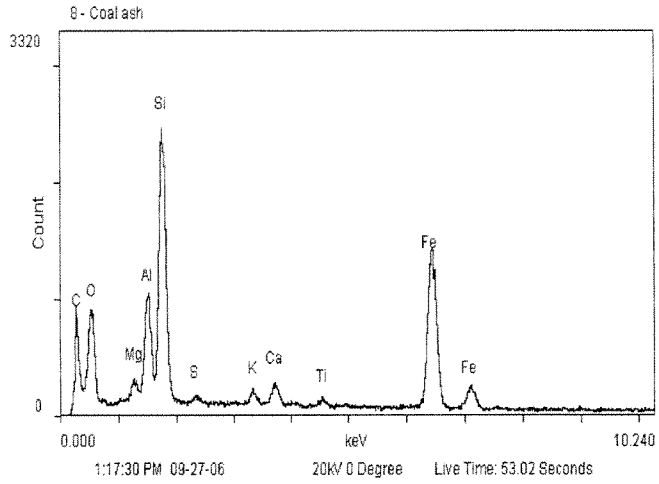
SEM analysis confirms the presence of coal, coal ash, fly ash and wood char. The mineral-like coal particle demonstrates a strong carbon peak with lower peak concentrations of oxygen, aluminum, silicon, sulfur and chlorine.



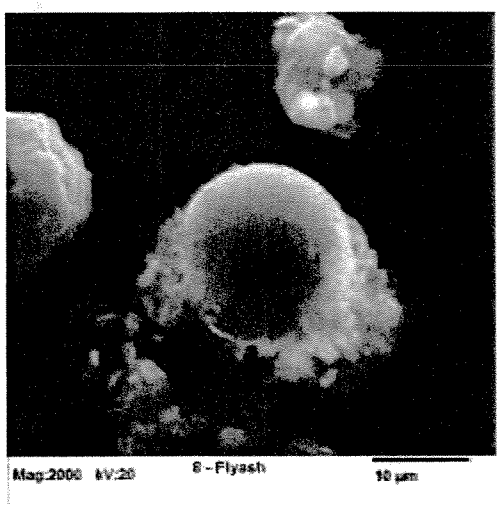


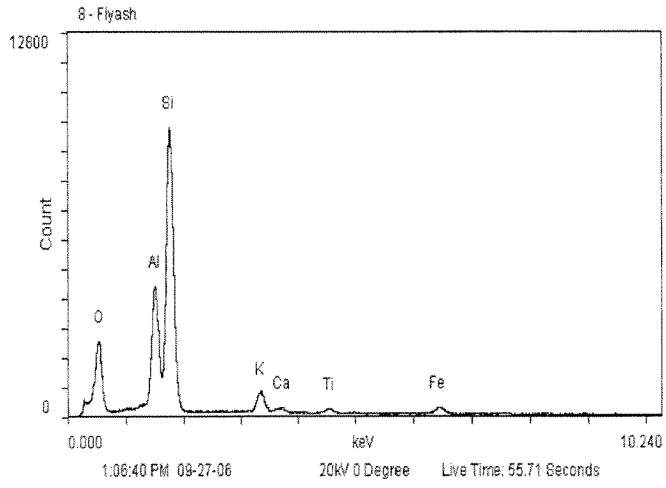
The irregularly shaped coal ash particle demonstrated numerous pits and craters marking its surface. Chemistry from the coal ash shows strong peak concentrations of carbon, oxygen, aluminum, silicon and iron with lesser peak concentrations of magnesium, sulfur, potassium, calcium and titanium.



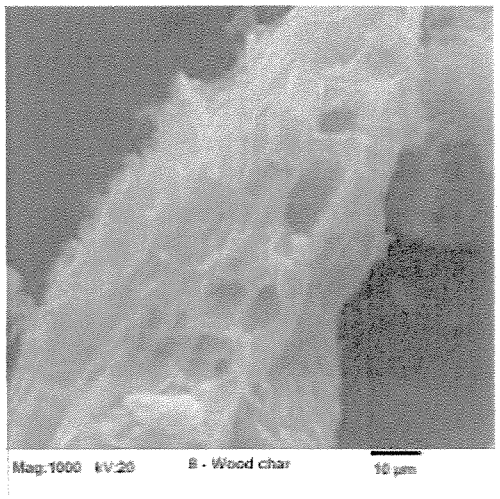


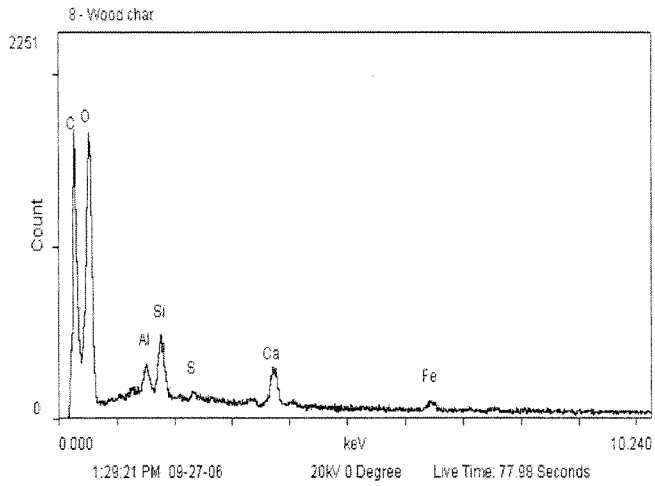
The smooth spherical fly ash shows a strong peak concentration of silicon, moderately strong oxygen and aluminum and lower peak concentrations of potassium, calcium, titanium and iron.





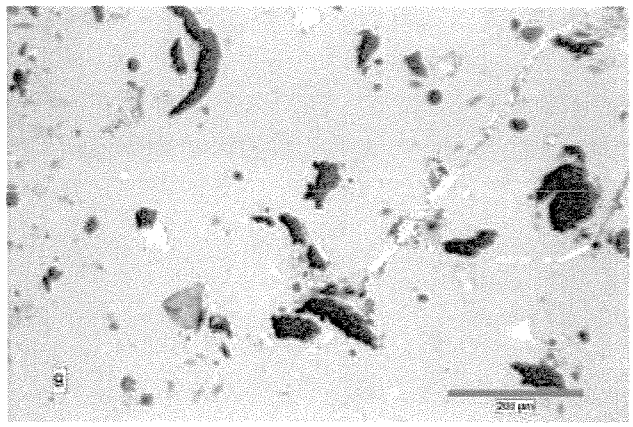
The wood char specimen demonstrates some remnant cellular structure. Chemistry from the wood char shows strong peak concentrations of carbon and oxygen with lower peaks of aluminum, silicon, sulfur, calcium and iron.





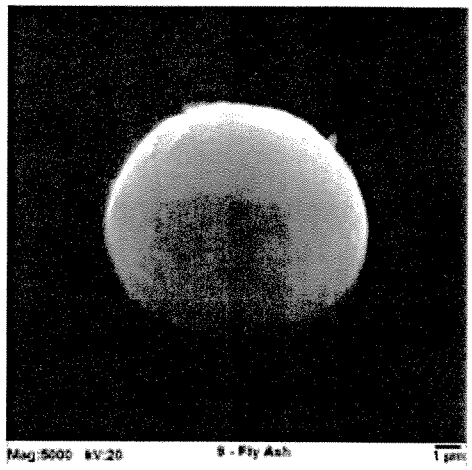
9:

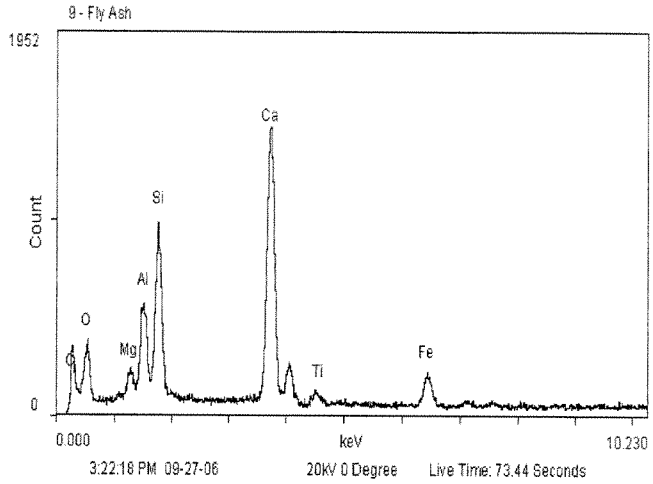
30% Opaques (non-soot organic/inorganic, vehicle dust)
30% Biologicals (trichome, organic debris, plant, pollen, insect part, hair, spore/spore related material)
22% Mineral grains
10% Cellulose (vegetative, paper fibers, cotton)
5% Soot (fly ash, coal ash)
3% Synthetic fiber



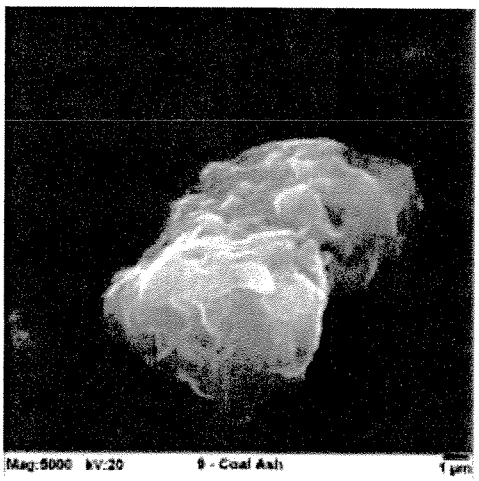
Sample 9 consisted of non-soot opauqes, biologicals and mineral grains. Some fibrous material also was observed. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM.

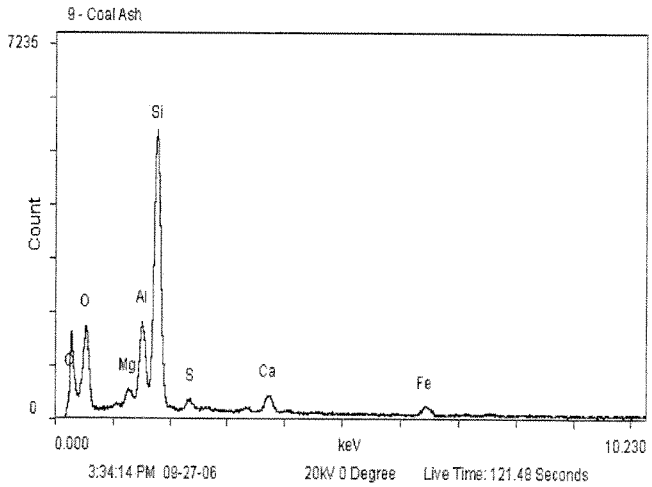
SEM analysis confirms the presence of fly ash and coal ash. No coal fragments were confirmed with the SEM in this sample. The smooth spherical fly ash contains a strong peak concentrations of silicon and calcium with moderately strong peak concentrations of carbon, oxygen, magnesium, aluminum, titanium and iron.



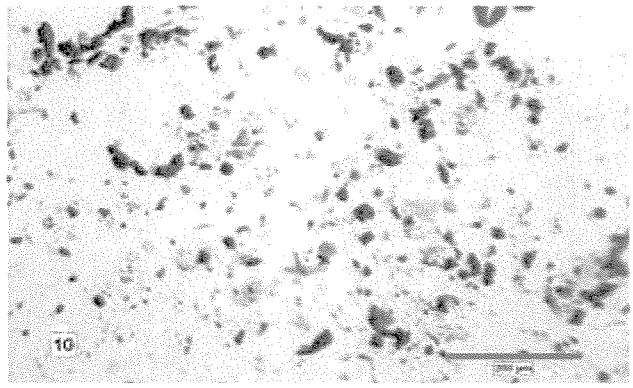


The irregularly shaped, highly eroded coal ash particle demonstrates a strong peak concentration of silicon and moderate to lower peak concentrations of carbon, oxygen, magnesium, aluminum, sulfur, calcium and iron.





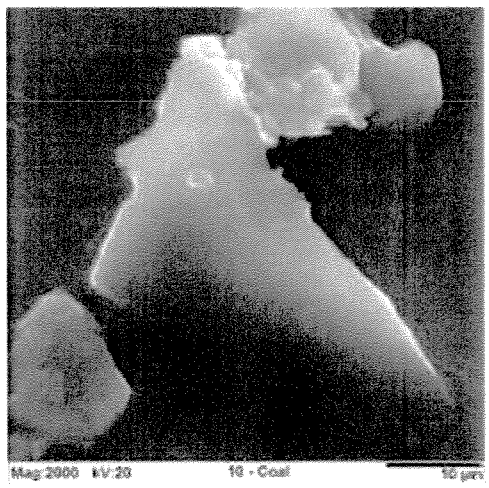
10:

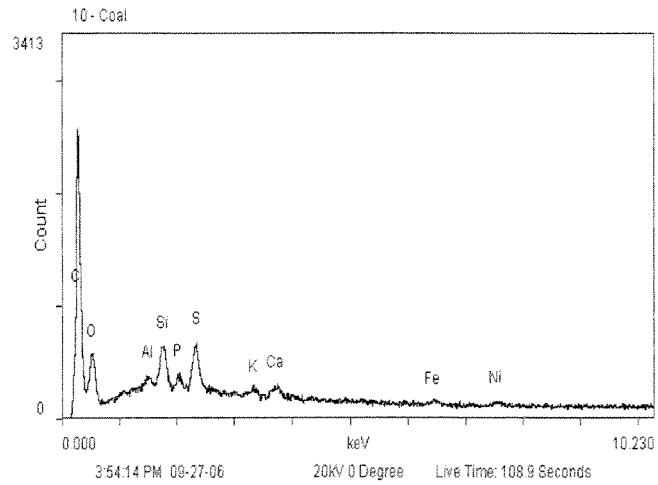


37% Mineral grains
30% Biologicals (organic debris, plant, pollen, spore/spore related material, starch grains, trichome)
25% Opaques (non-soot organic/inorganic, vehicle dust)
5% Soot (coal, fly ash, coal ash)
3% Cellulose (vegetative paper fibers)

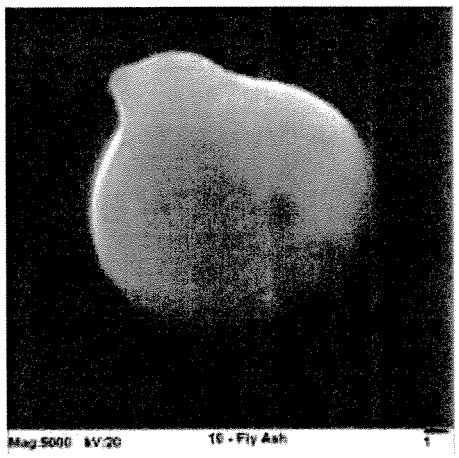
Sample 10 contained a mix of biological matter, mineral grains and non-soot opaque material with some vegetative cellulose fibers. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM.

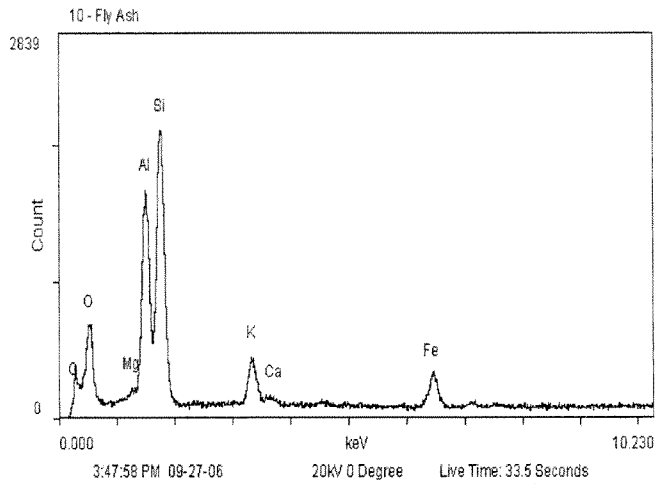
SEM analysis confirms the presence of coal, fly ash and coal ash. The mineral-like coal particle demonstrates straight edges and a smooth surface. The particle demonstrates a strong peak concentration of carbon with moderately strong to lower peak concentrations of oxygen, aluminum, silicon, phosphorous, sulfur, potassium, calcium, iron and nickel over a moderately raised background.



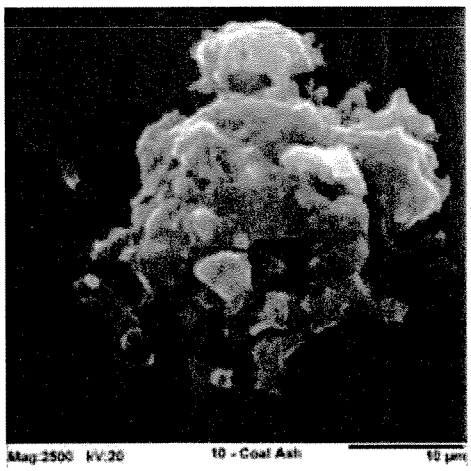


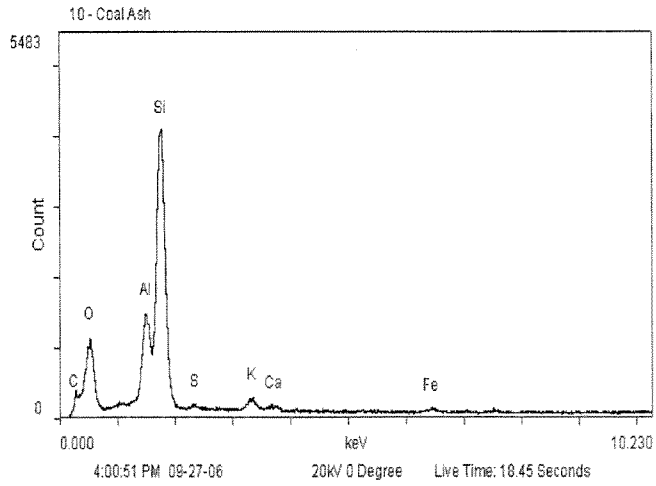
The smooth spherical fly ash contains strong peak concentrations of aluminum and silicon with moderately strong to lower peak concentrations of carbon, oxygen, magnesium, potassium, calcium and iron.





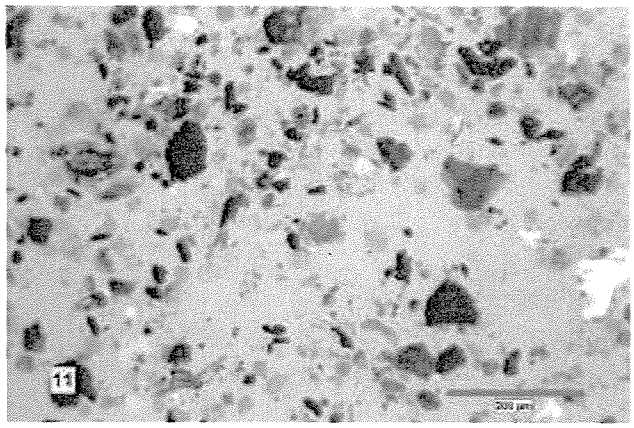
The irregularly shaped, coal ash particle demonstrates some remnant crater-like depressions. Chemistry from the coal ash specimen shows strong peak concentration of silicon, moderate oxygen and aluminum and lower peak concentrations of carbon, sulfur, potassium, calcium and iron.





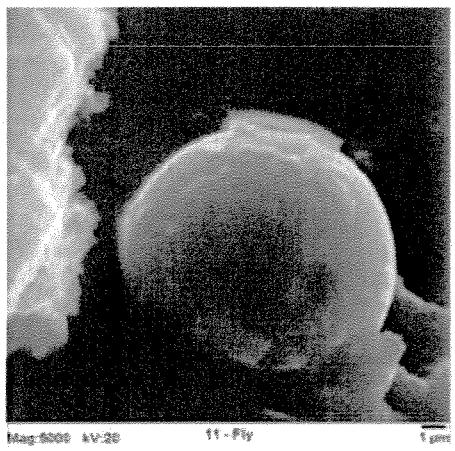
11:

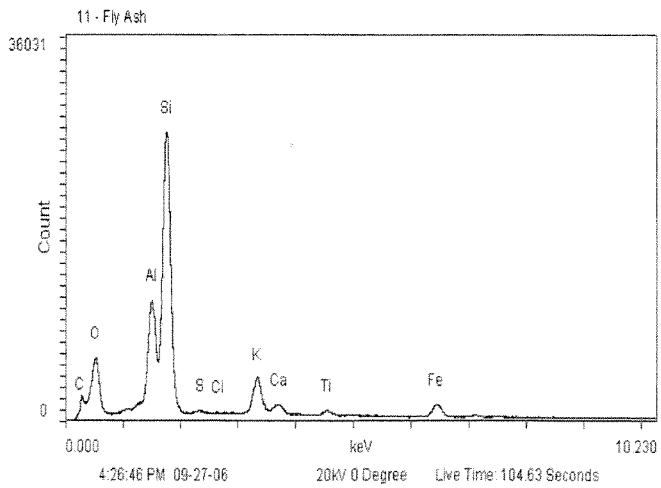
37%	Biologicals (pollen, trichome, organic debris)
35%	Mineral grains
15%	Opaques (non-soot organic/inorganic, vehicle dust)
7%	Cellulose (vegetative, paper fibers)
5%	Soot (fly ash, wood ash, coal ash)
1%	Synthetic fibers
Trace	Glass fiber two



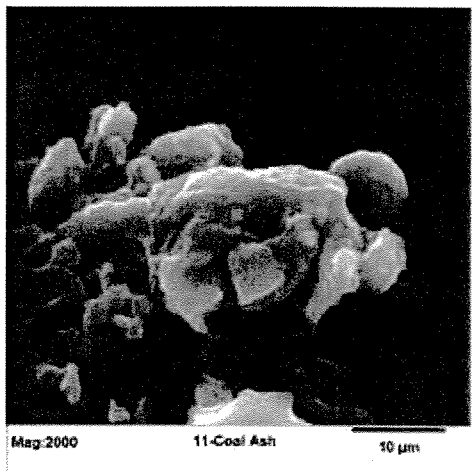
Sample 11 consisted of biological debris and mineral grains with non-soot opaques and fibrous material. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM.

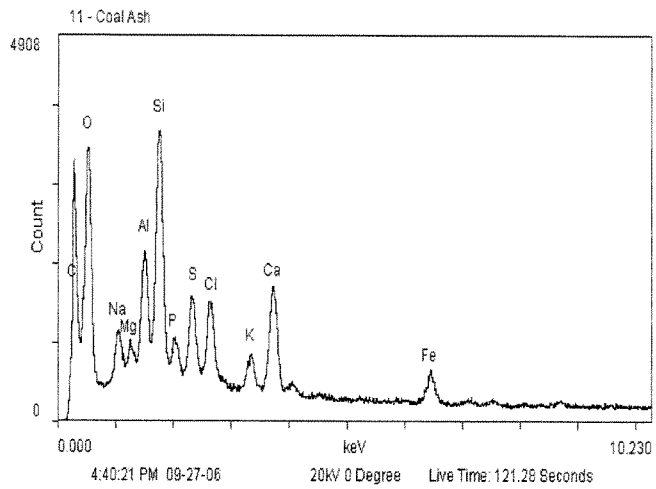
SEM analysis confirms the presence of fly ash, coal ash and wood ash. No coal fragments were confirmed in this sample with the SEM. The smooth spherical fly ash contains a strong peak concentration of silicon, moderately strong oxygen and aluminum and lower peak concentrations of carbon, sulfur, chlorine, potassium, calcium, titanium and iron.



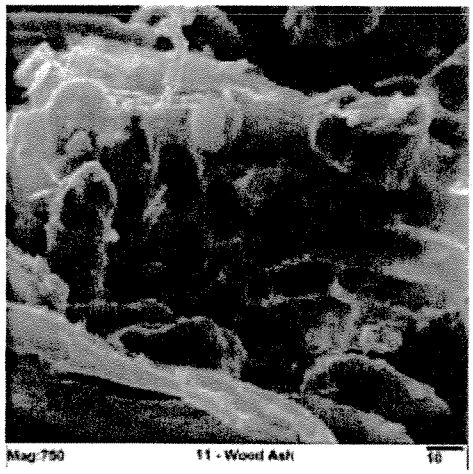


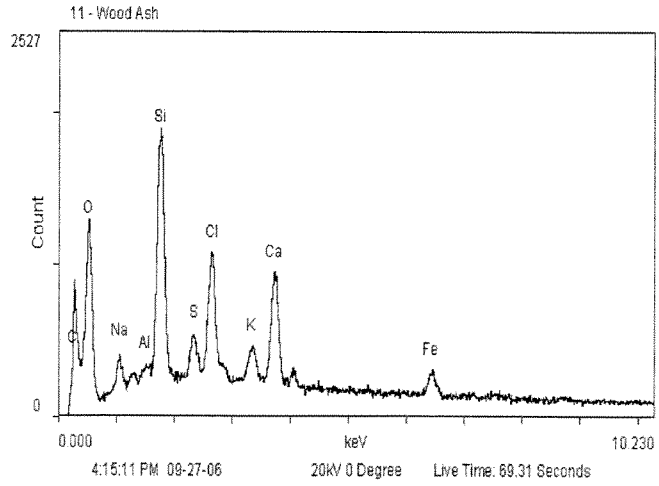
The eroded coal ash fragment demonstrates strong to moderately strong peak concentrations of carbon, oxygen, sodium, magnesium, aluminum, silicon, phosphorous, sulfur, chlorine, potassium, calcium and iron.





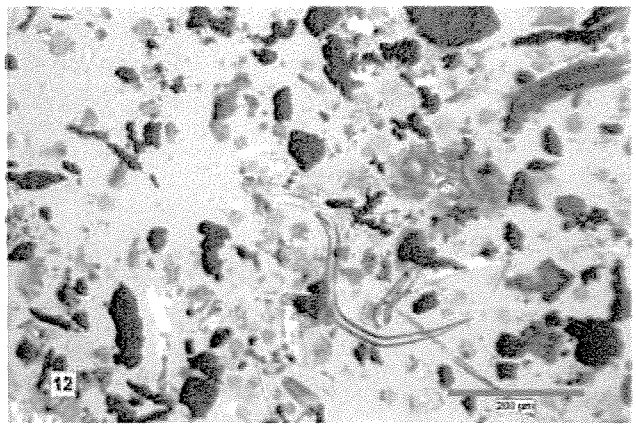
The wood ash particle demonstrates remnant cellular structure. Organic debris is visible on and around the particle. Chemistry from the wood ash shows strong peak concentrations of carbon, oxygen, sulfur, chlorine and calcium with lower peak concentrations of sodium, aluminum, sulfur, potassium and iron over a moderately raised background.





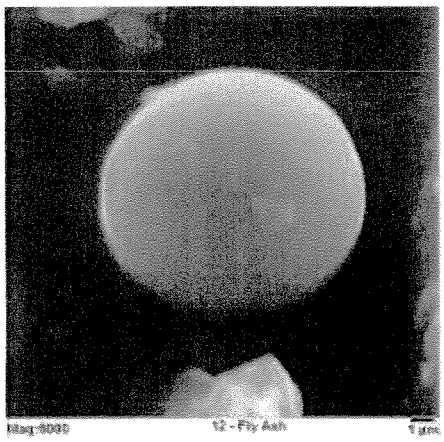
12:

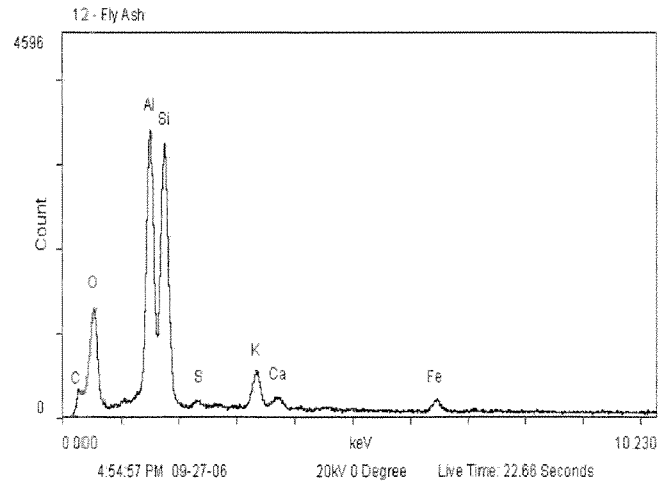
32%	Mineral grains
32%	Biologicals (organic debris, trichome, pollen, spore/spore related material)
20%	Opaques (vehicle dust, non-soot organic/inorganic, rust)
10%	Cellulose (vegetative, paper fibers, wood fine)
5%	Soot (coal ash, fly ash)
1%	Synthetic fiber
Trace	Glass fiber



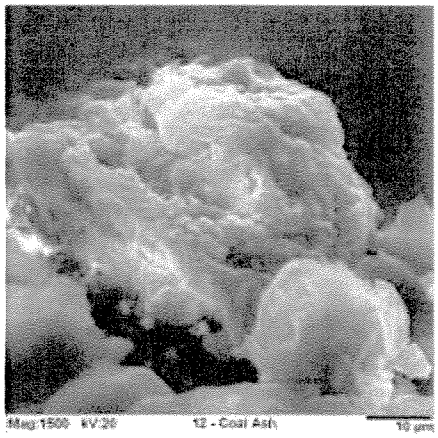
Sample 12 contained a mix of mineral grains, biological debris and non-soot opaques with fibrous material. Particles demonstrating morphology suggestive of combusted soot material were observed with the PLM.

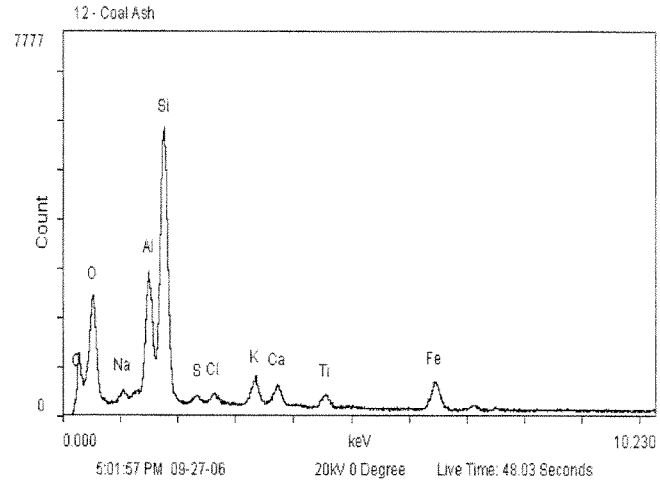
SEM analysis confirms the presence of fly ash and coal ash. No coal fragments were confirmed with the SEM in this sample. The smooth spherical fly ash contains strong peak concentrations of aluminum and silicon, moderate oxygen and lower peak concentrations of carbon, sulfur, potassium, calcium and iron.





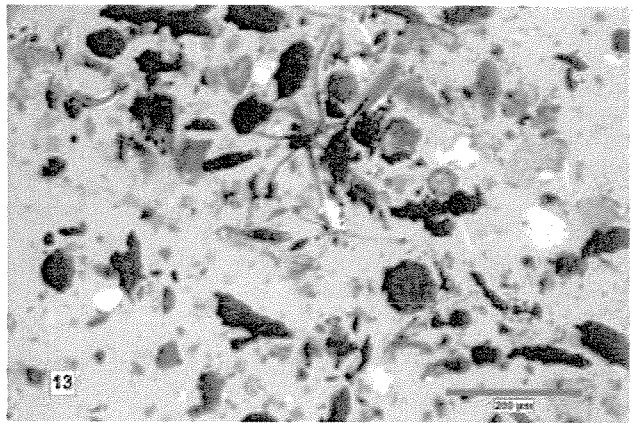
The highly eroded coal ash particle shows faint contours from crater forms typical of this particle type. The coal ash particle demonstrates strong peak concentrations of oxygen, aluminum and silicon with lower peaks of carbon, sodium, sulfur, chlorine, potassium, calcium, titanium and iron.





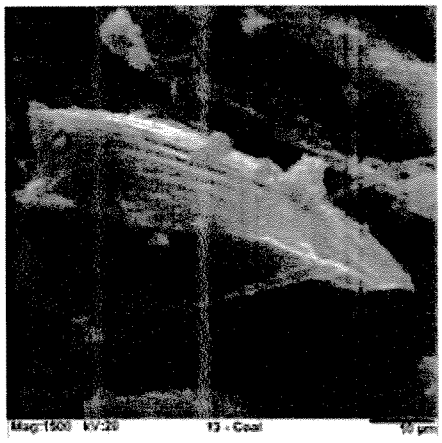
13:

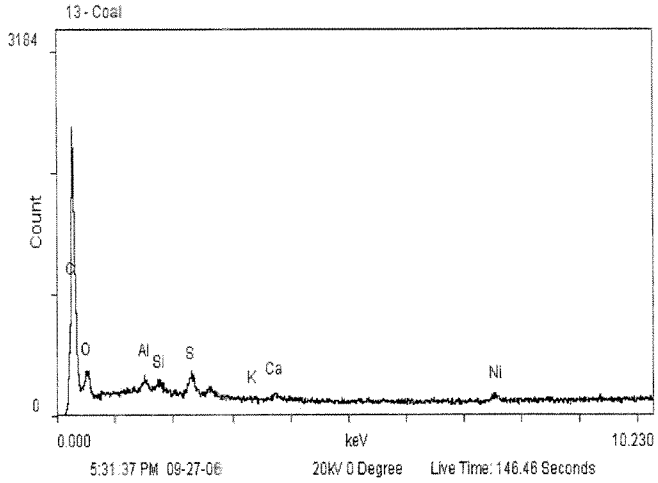
35% Biologicals (organic debris, plant, insect, trichome, spores, organic debris, pollen, spore/spore related material)
30% Mineral grains
20% Opaques (non-soot organic/inorganic, vehicle dust)
7% Cellulose (vegetative, paper fibers)
5% Soot (coal, fly ash, coal ash)
3% Synthetic fibers



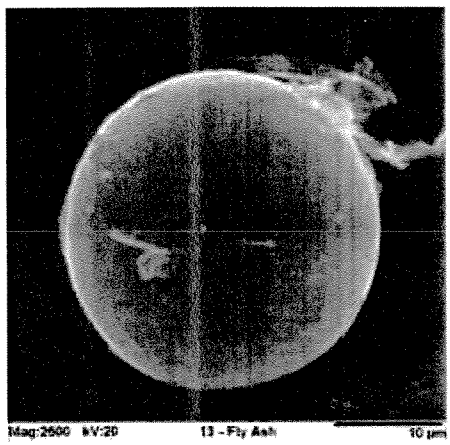
Sample 13 contained a mix of biological debris, mineral grains and non-soot opaque material with some cellulose fibers. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM

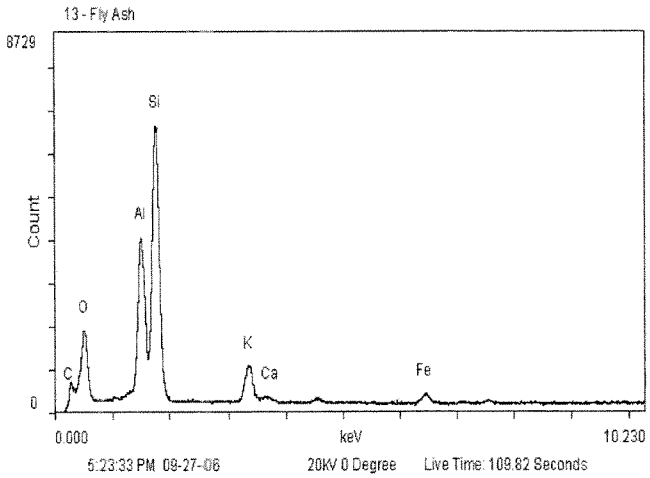
SEM analysis confirms the presence of coal, fly ash and coal ash. The coal particle demonstrates angular mineral-like edges, smooth surface with some light conchoidal fracture lines. Chemistry from the coal particle shows a strong peak concentration of carbon and lower peak concentrations of oxygen, aluminum, silicon, sulfur, potassium, calcium and nickel.



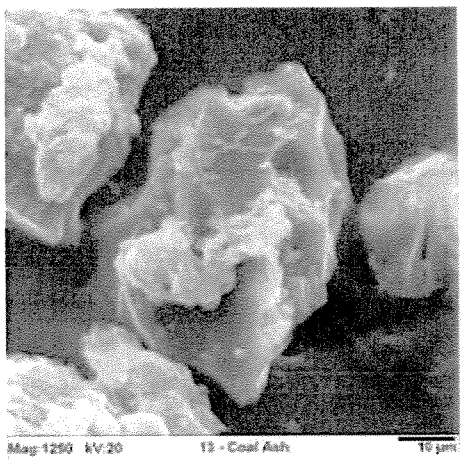


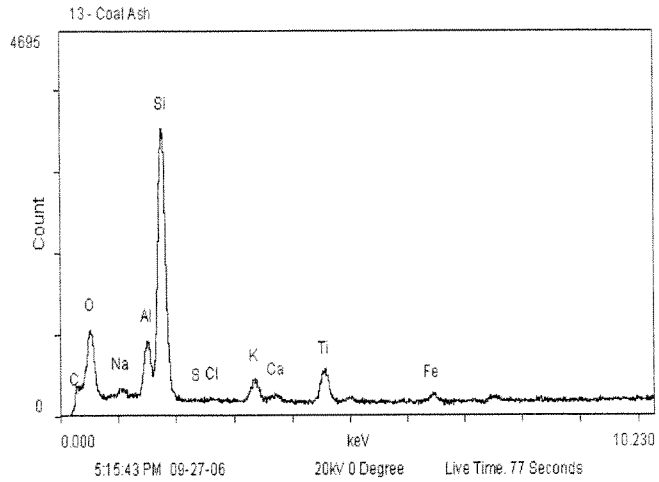
The smooth spherical fly ash contains strong peak concentrations of aluminum and silicon and lower peak concentrations of carbon, oxygen, potassium, calcium and iron.





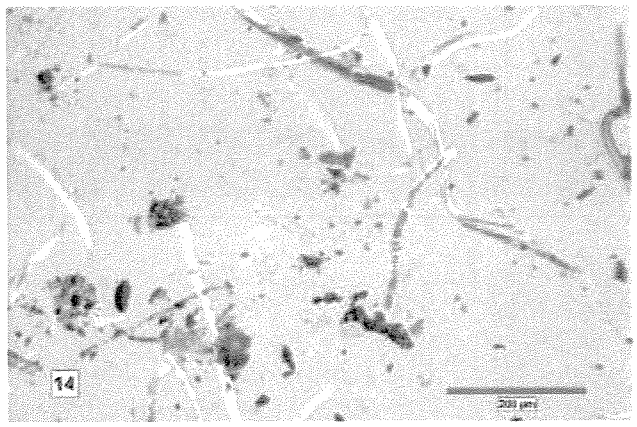
The irregularly shaped coal ash specimen appears eroded, but maintains some of its characteristic crater marks. Chemistry from the coal ash shows a strong peak concentration of silicon and moderately strong to lower peak concentrations of carbon, oxygen, sodium, aluminum, sulfur, chlorine, potassium, calcium, titanium and iron.





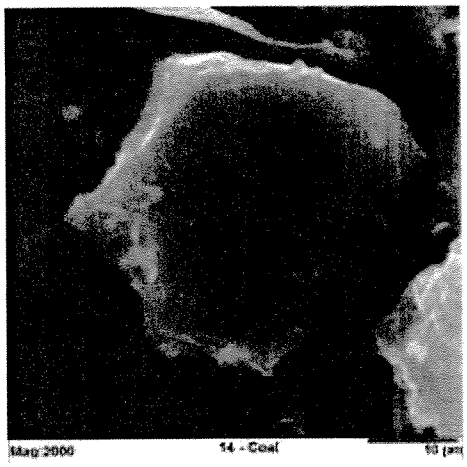
14:

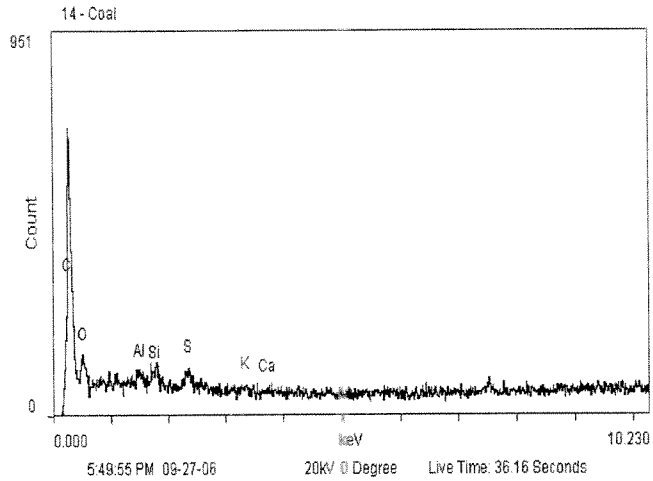
40% Biologicals (trichome, pollen, hair, organic debris, starch grains, cobweb, spore/spore related material, feather)
35% Cellulose (paper fibers)
10% Opaques (non-soot organic/inorganic, vehicle dust, rust, pigmented/paint sphere)
5% Mineral grains/aluminum oxide
5% Synthetic fibers
3% Soot (coal, fly ash, coal ash)
2% Glass fibers



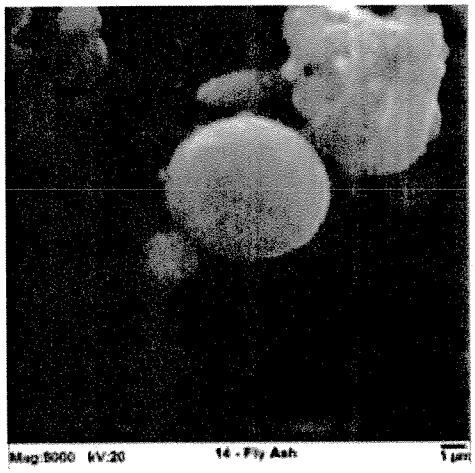
Sample 14 contains mainly biological debris and fibrous material. Also noted were dark non-soot opaques and mineral grains. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM.

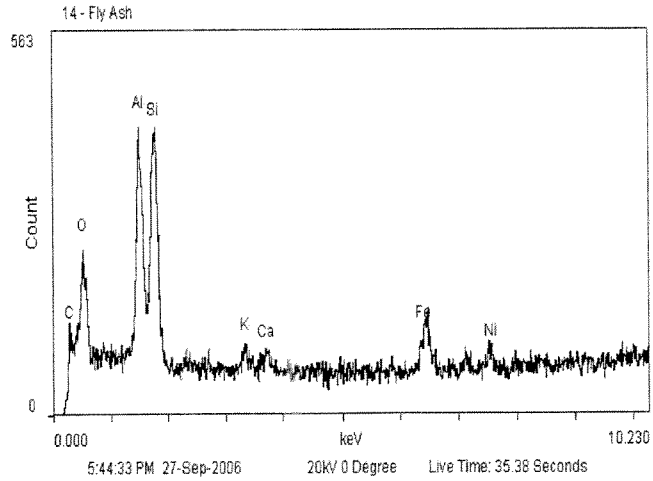
SEM analysis confirms the presence of coal, fly ash and coal ash. The mineral-like coal particle demonstrates a strong carbon peak with lower peak concentrations of oxygen, aluminum, silicon, sulfur, potassium and calcium.



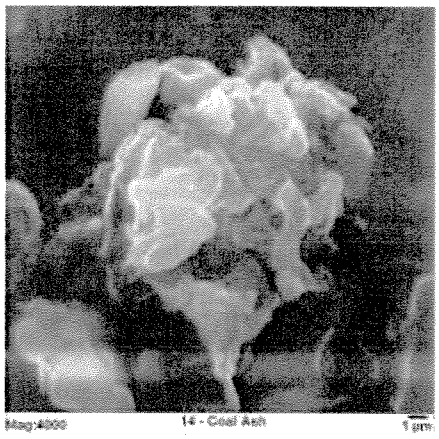


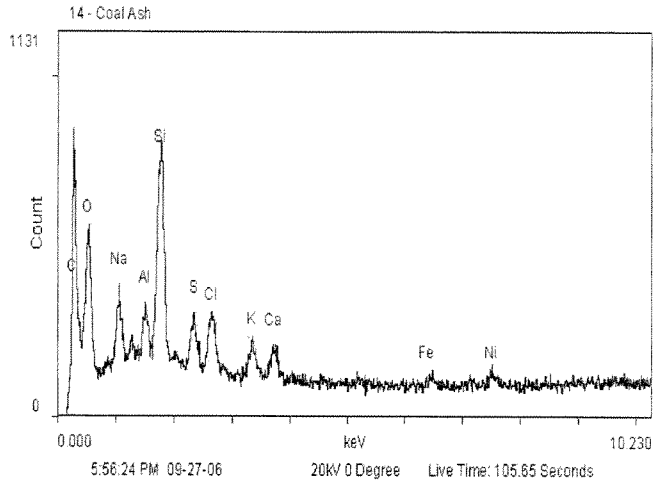
The smooth spherical fly ash contains strong peak concentrations of oxygen, aluminum and silicon with lower peak concentrations of carbon, potassium, calcium, iron and nickel.





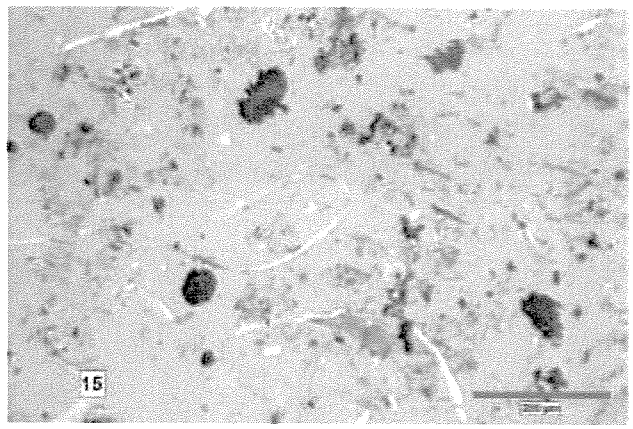
The coal ash particle appears highly eroded with little evidence of crater depressions that characterize this particle type. Corresponding chemistry shows strong to moderately strong peak concentrations of carbon, oxygen, sodium, aluminum, silicon, sulfur, chlorine, potassium, calcium, iron and nickel.





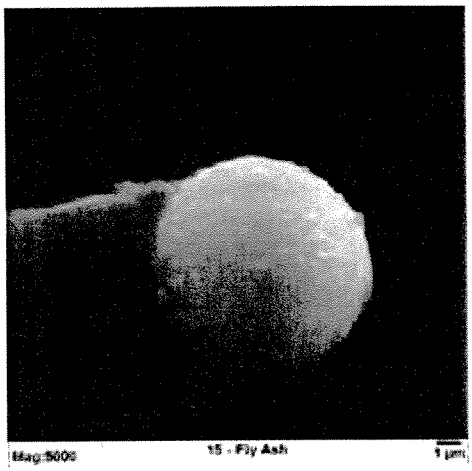
15:

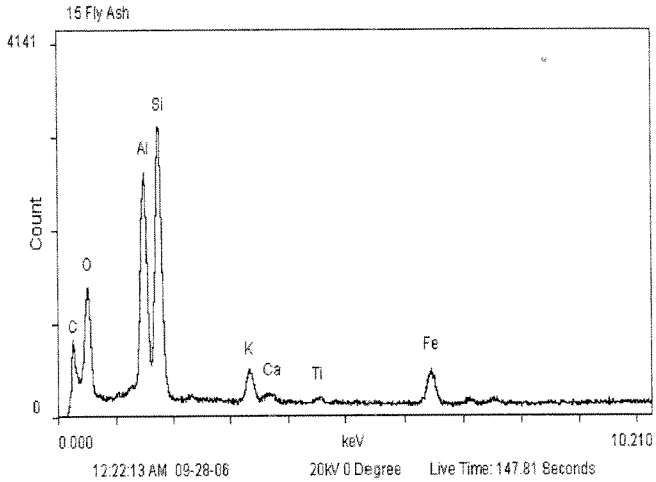
30%	Biologicals (starch grains, organic debris-plant/cellulose tissue, pollen, trichome, cobweb, hair)
30%	Cellulose (paper fibers)
23%	Mineral grains
15%	Opaques (paint residues/spheres, non-soot organic/inorganic, metallic shaving)
2%	Glass fibers
Trace	Soot (fly ash, coal ash)
Trace	Synthetic fiber



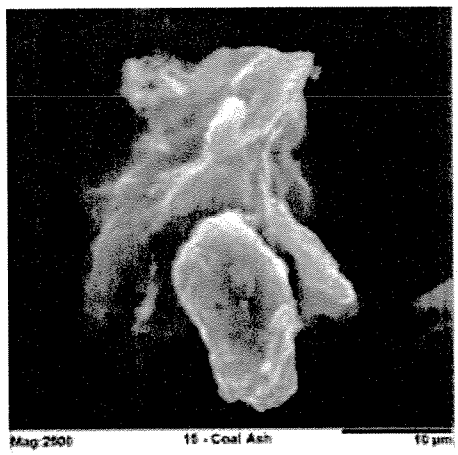
Sample 15 contained a mix of biological debris, fibrous material, mineral grains and dark opaques. Particles demonstrating morphology suggestive of combusted soot material were observed with the PLM

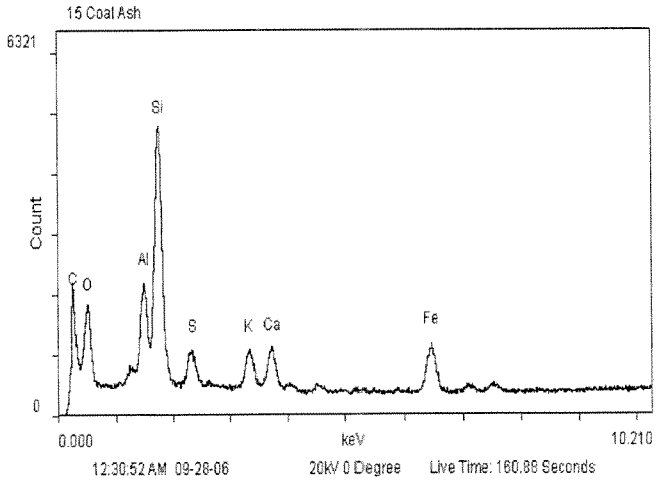
SEM analysis confirms the presence of fly ash and coal ash. No coal was confirmed with the SEM in this sample. The smooth spherical fly ash contains strong peak concentrations of aluminum and silicon and moderately strong to lower peak concentrations of carbon, oxygen, potassium, calcium, titanium and iron.





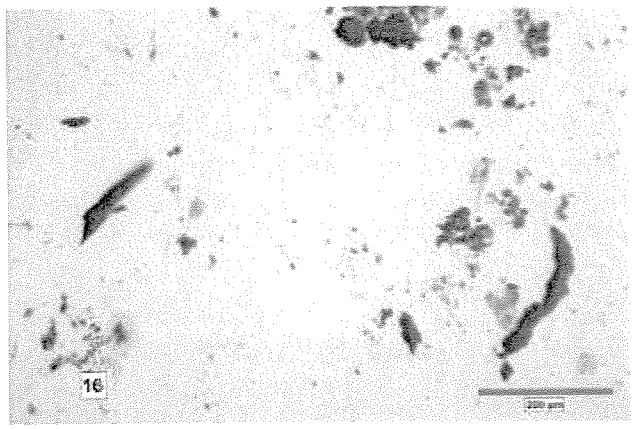
The irregularly shaped coal ash fragment appears eroded with only faint indications of what could have been crater depressions. Chemistry from the coal ash shows strong to moderately strong peak concentrations of carbon, oxygen, aluminum, silicon, sulfur, potassium, calcium and iron.





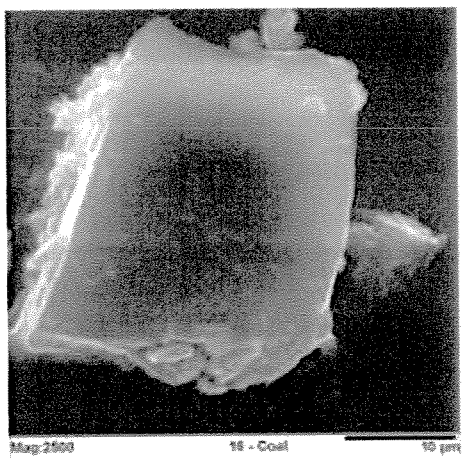
16:

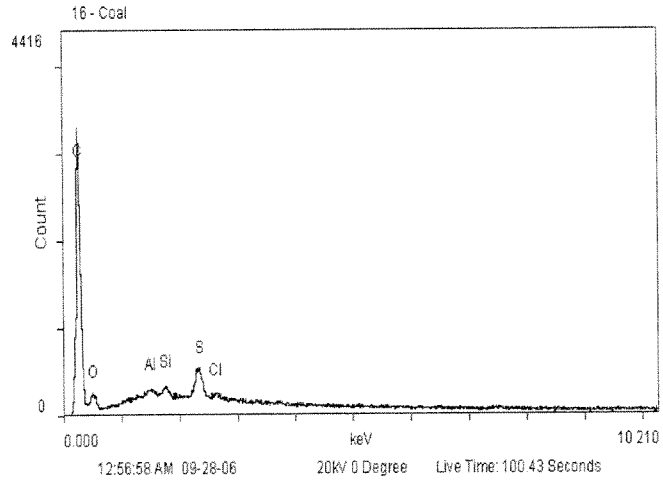
35% Opaques (vehicle dust, non-soot organic/inorganic, iron-containing)
30% Biologicals (spores/spore related material, organic debris, insect parts, trichome)
15% Mineral grains
10% Soot (coal, fly ash, coal ash)
10% Cellulose (vegetative fibers, paper fibers, wood fine)



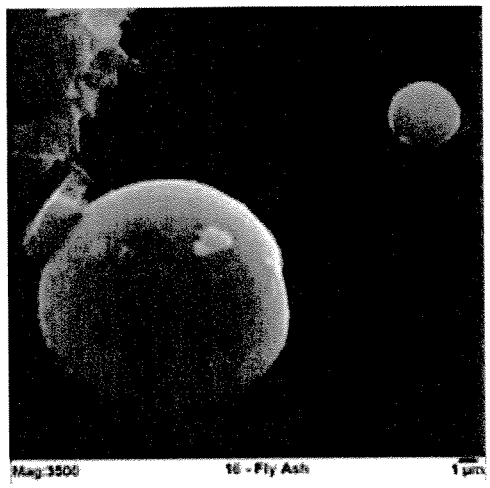
Sample 16 contained a mix of non-soot dark opaques, biologicals, mineral grains and cellulose material. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM.

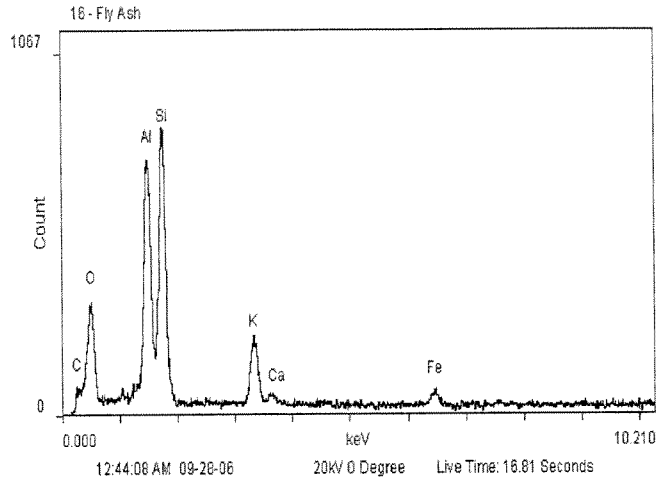
SEM analysis confirms the presence of coal, fly ash and coal ash. The mineral-like coal particle demonstrates a strong carbon peak with lower peak concentrations of oxygen, aluminum, silicon, sulfur and chlorine.



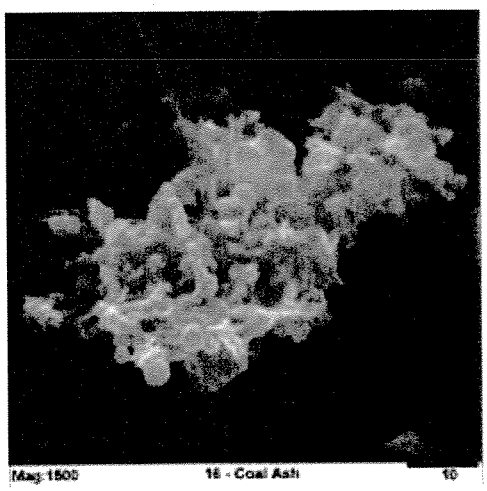


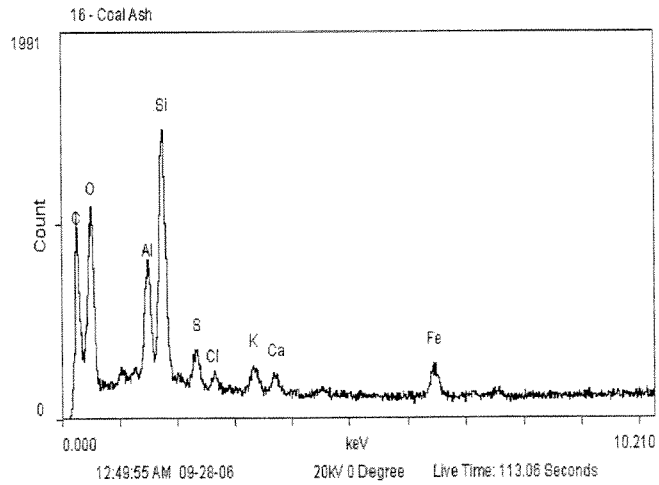
The smooth spherical fly ash contains strong peak concentrations of aluminum and silicon, moderate oxygen, potassium and iron and lower peaks of carbon and calcium.





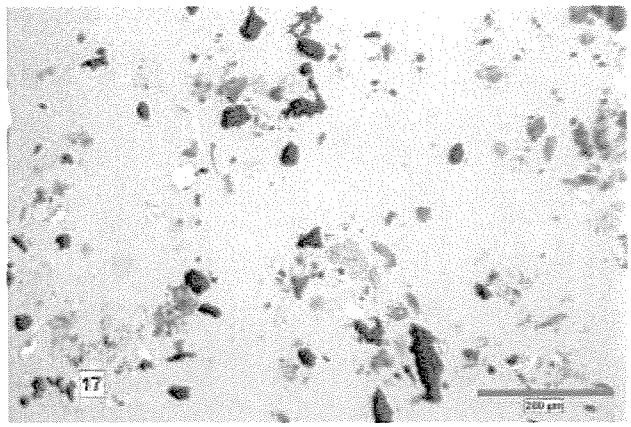
The irregularly shaped coal ash particle demonstrates both remnant crater depressions and a noticeable population of smooth spherical fly ash. Chemistry from the coal ash shows strong peak concentrations of carbon, oxygen, aluminum and silicon and lower peak concentrations of sulfur, chlorine, potassium, calcium and iron.





17:

34%	Mineral grains
30%	Opaques (paint chips, non-soot organic/inorganic, vehicle dust, rust, metallic chips)
25%	Biologicals (organic debris, trichome, pollen, spore/spore related material, starch grains)
10%	Soot (fly ash, coal ash)
1%	Cellulose (paper fibers)
Trace	Glass fiber
Trace	Synthetic fiber



Sample contained a mix of non-soot dark opaque particles, mineral grains and biological material with traces of fibrous material. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM

SEM analysis confirms the presence of fly ash and coal ash. No coal particles were confirmed with the SEM in this sample. The smooth spherical fly ash contains strong peak concentrations of aluminum and silicon and moderately strong carbon, oxygen, potassium, calcium, titanium and iron.

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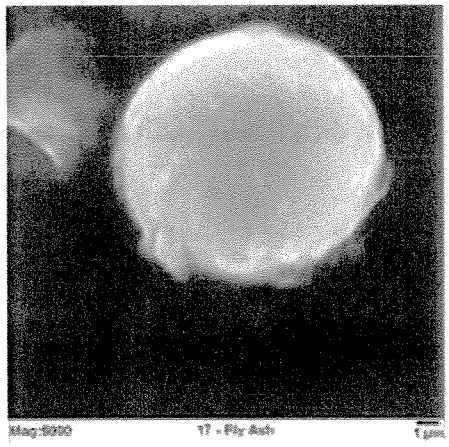
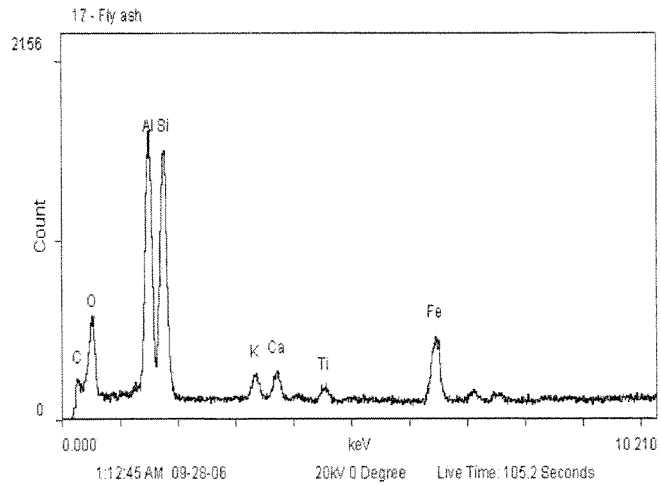
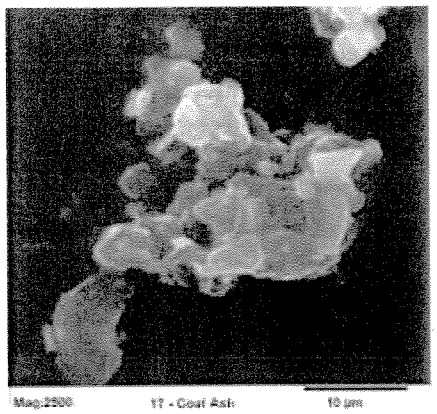
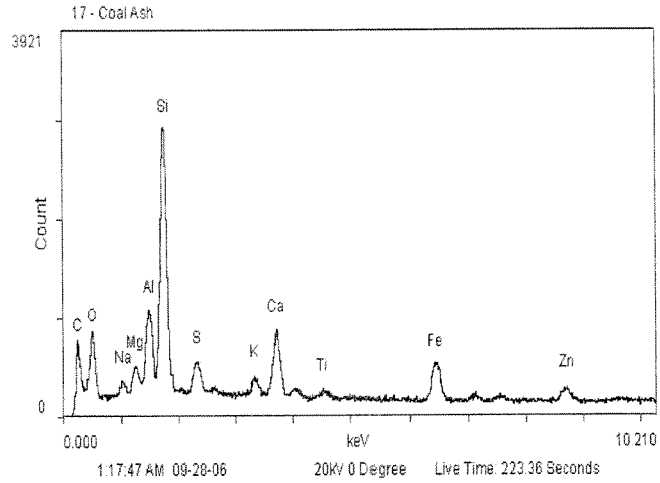




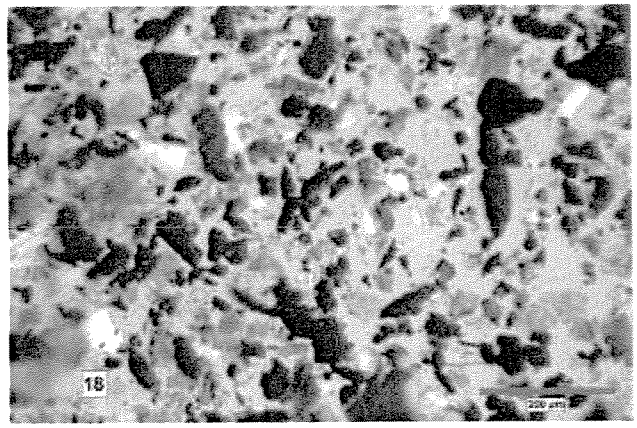
The irregularly shaped, eroded coal ash particle shows a strong peak concentration of silicon and moderately strong to lower peak concentrations of carbon, oxygen, sodium, magnesium, aluminum, sulfur, potassium, calcium, titanium, iron and zinc.





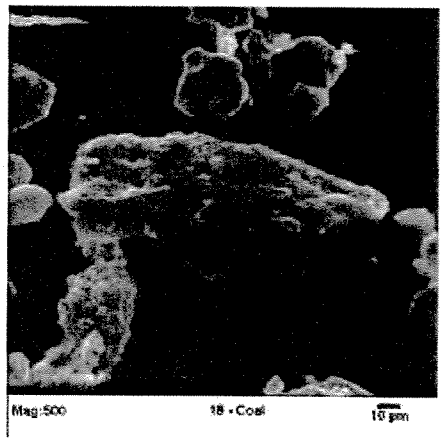
18:

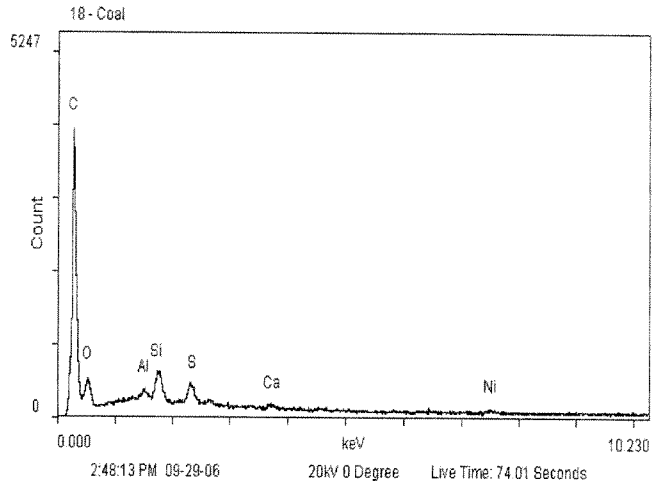
30% Biologicals (organic debris, plant, trichome, pollen)
25% Mineral grains
20% Opaques (vehicle dust, paint chips, non-soot organic/inorganic, rust)
15% Cellulose (vegetative, wood fines, paper fibers)
10% Soot (coal, fly ash, coal ash)



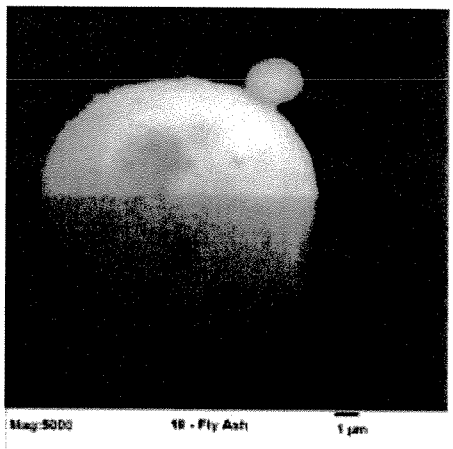
Sample 18 contained a mix of biologicals, mineral grains, cellulose fibers and non-soot dark opaques. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM

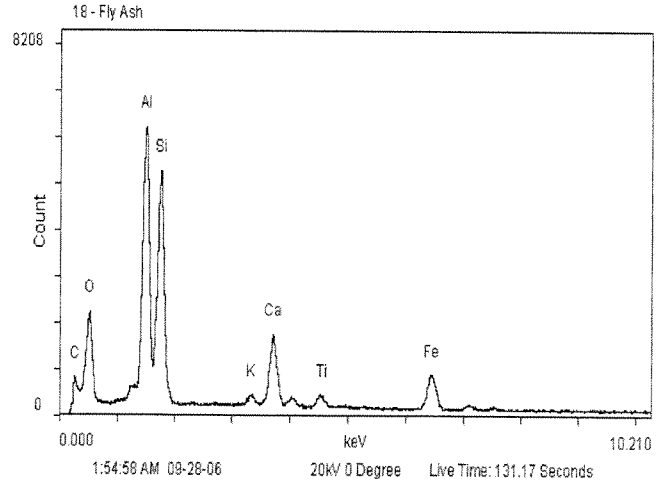
SEM analysis confirms the presence of coal, fly ash and coal ash. The coal ash specimen demonstrated a strong peak concentration of carbon with oxygen, aluminum, silicon, sulfur, calcium and nickel over a slightly raised background.



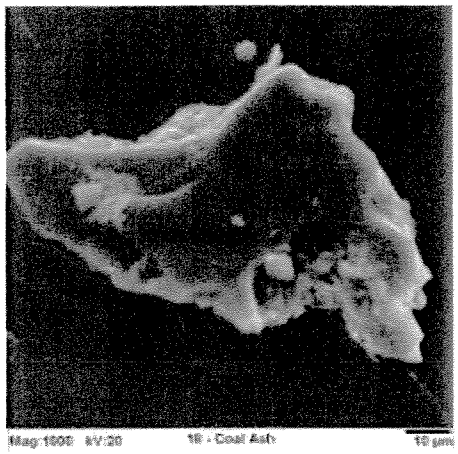


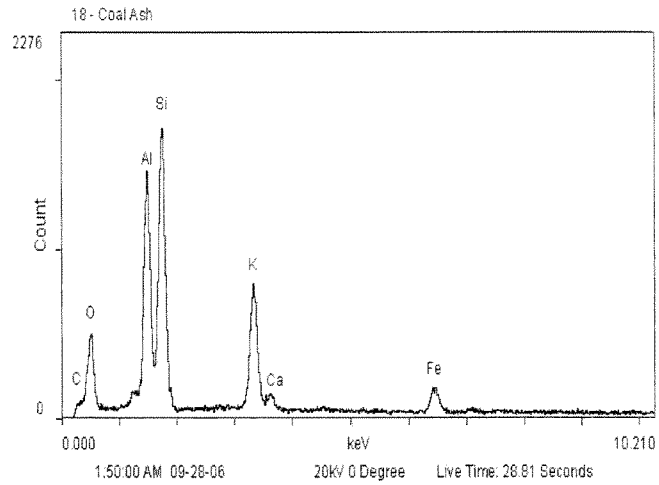
The smooth spherical fly ash contains strong peak concentrations of aluminum and silicon and moderate to lower peak concentrations of carbon, oxygen, potassium, calcium, titanium and iron.





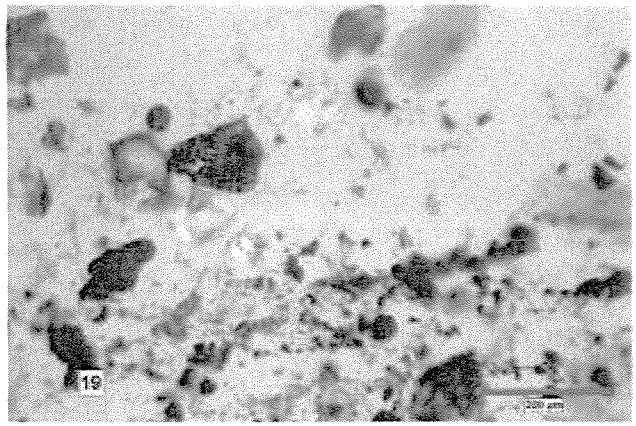
The coal ash specimen shows evidence of some rounded crater depressions around the edges of the particle. Chemistry from the coal ash shows strong peak concentrations of oxygen, aluminum, silicon, potassium and iron with carbon and calcium.





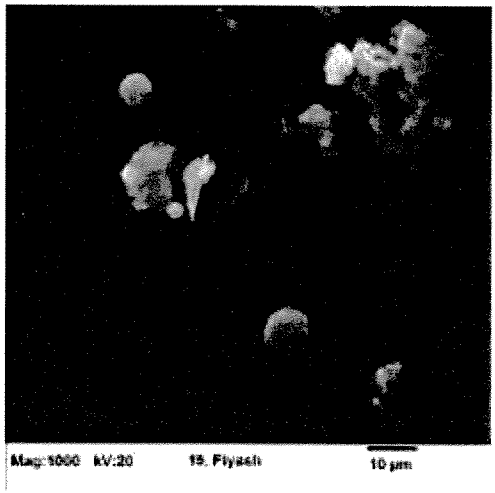
19:

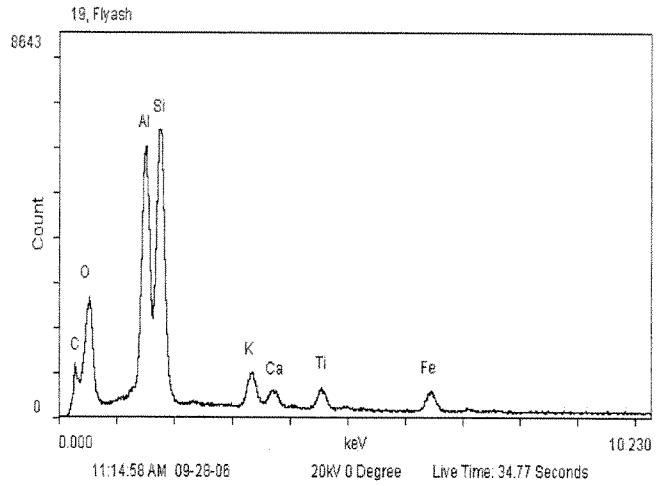
35%	Mineral grains
32%	Biologicals (organic debris, plant insect parts, pollen, spore/spore related material)
25%	Opaques (rust, asphalt/tar, paint chips, non-soot organic/inorganic)
7%	Cellulose (vegetative, paper fibers)
1%	Soot (fly ash, coal ash)
Trace	Glass fiber



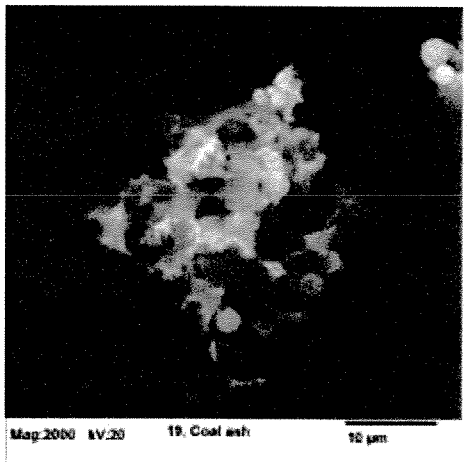
Sample 19 contained minerals, biological debris and non-soot opaques. Particles demonstrating morphology suggestive of combusted soot material were not observed with the PLM

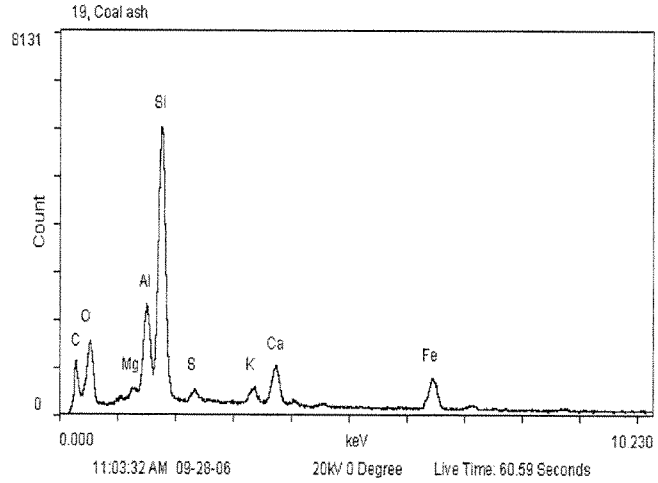
SEM analysis confirms the presence of fly ash and coal ash. Coal particles were not confirmed with the SEM in this sample. The smooth spherical fly ash contains strong peak concentrations of aluminum and silicon, moderately strong oxygen with carbon, potassium, calcium, titanium and iron.





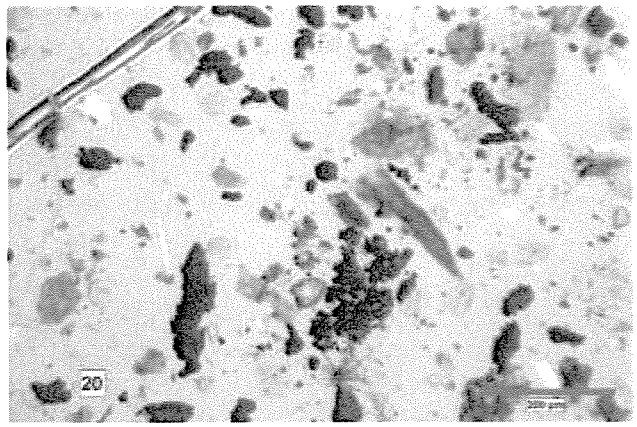
The irregularly shaped, porous coal ash particle demonstrates a strong peak concentration of silicon and moderately strong to lower peak concentrations of carbon, oxygen, magnesium, sulfur, potassium, calcium and iron.





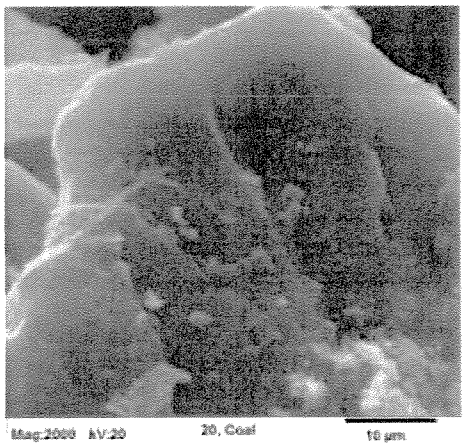
20:

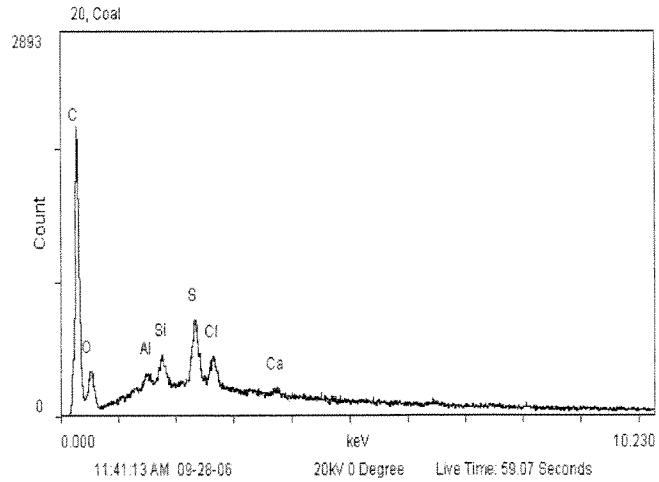
45%	Biologicals (trichome, pollen, organic debris, hair, spore/spore related material)
25%	Mineral grains
20%	Opaques (non-soot organic/inorganic, vehicle dust, paint chip, hair)
5%	Soot (coal, coal ash, fly ash, oil)
5%	Cellulose (vegetative, paper fibers)
Trace	Glass fibers



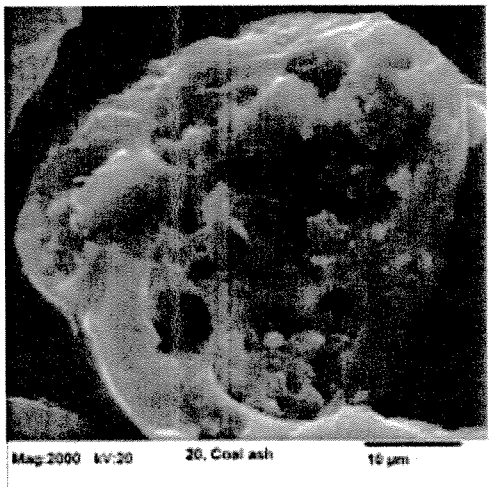
Sample 20 contained a noticeable concentration of biologicals with mineral grains and non-soot opaques. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM.

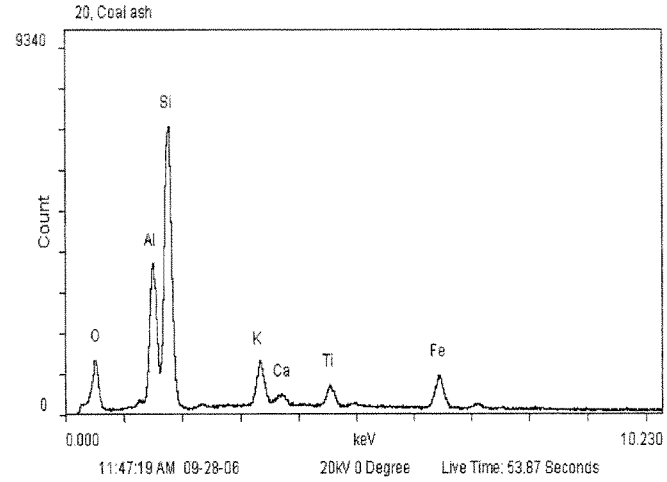
SEM analysis confirms the presence of coal, coal ash, fly ash and oil soot. The mineral-like coal particle demonstrates a strong carbon peak with moderately strong to lower peak concentrations of oxygen, aluminum, silicon, sulfur, chlorine and calcium.



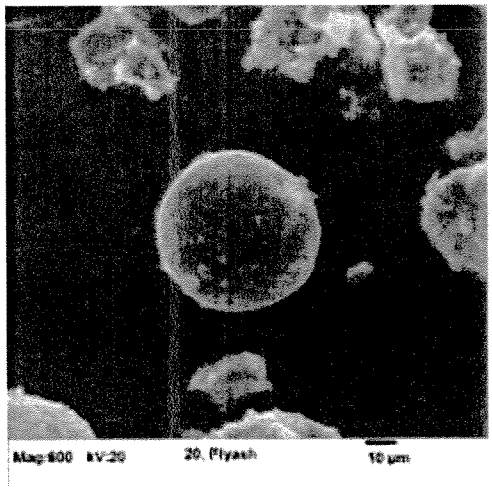


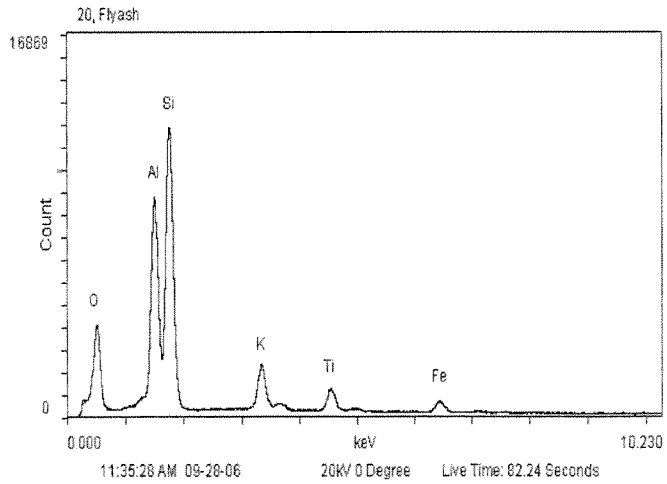
The coal ash specimen has numerous pits and craters. Some smooth fly ash spheroids are embedded in the coal ash particle. The coal ash particle demonstrates strong to moderately strong peak concentrations of oxygen, aluminum, silicon, potassium, calcium, titanium and iron.



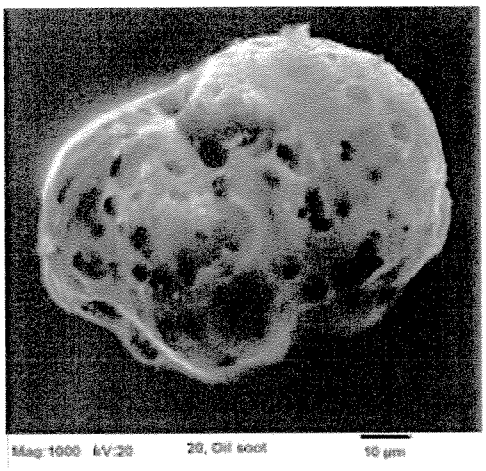


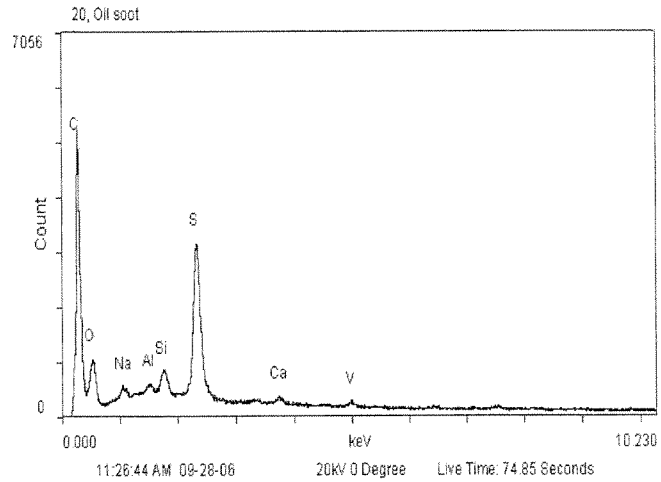
The smooth spherical fly ash contains strong peak concentrations of aluminum and silicon and moderate peaks of oxygen, potassium, titanium and iron.





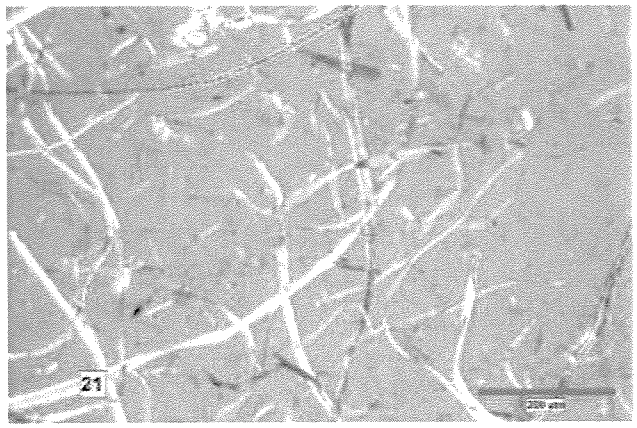
The porous oil soot spheroid demonstrated strong peak concentrations of carbon and sulfur with lower peak concentrations of oxygen, sodium, aluminum, silicon, calcium and vanadium.



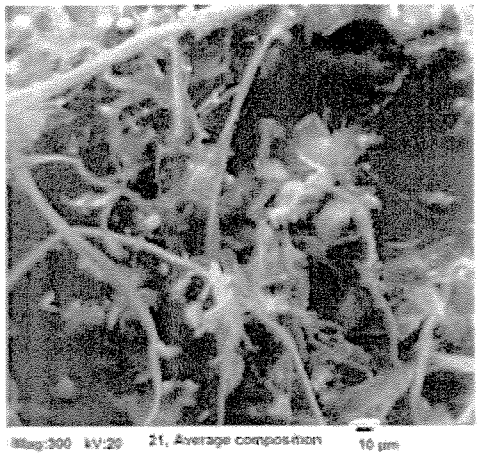


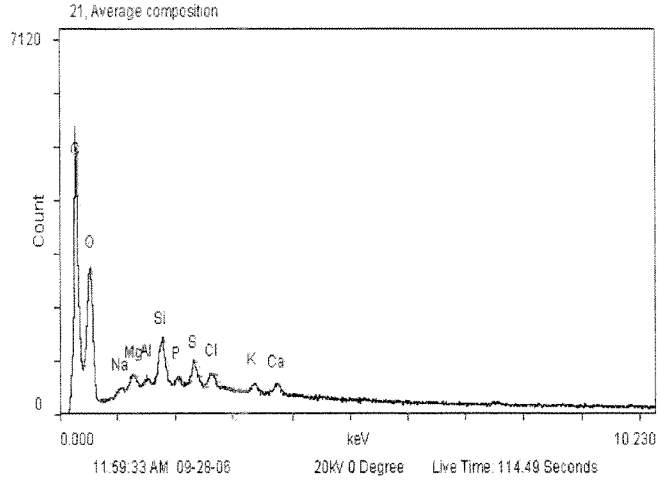
21:

60%	Cellulose (paper, cotton fibers)
30%	Biologicals (organic debris-skin scales, pollen, hair, starch grains, spore/spore related material)
6%	Synthetic fibers
3%	Mineral grains
1%	Opaques (non-soot organic/inorganic, vehicle dust, pigmented/paint residue)
*N/D	Coal/Industrial Soot



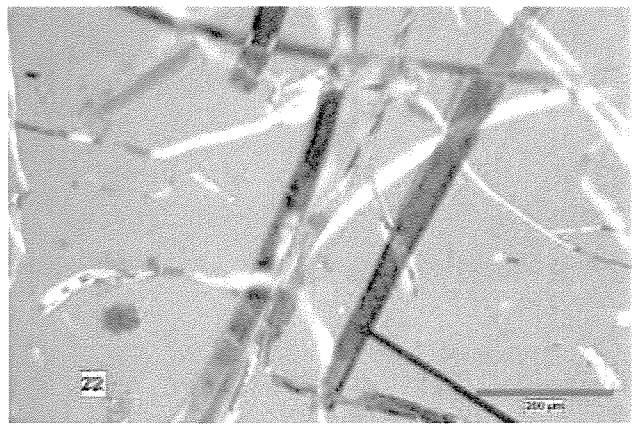
Sample consisted primarily of fibrous material, biological debris and some mineral matter. Industrial soot particles and coal were not detected in this sample. The average composition image and spectra demonstrates mainly the organic with some suggestion of inorganic content that characterizes this sample.





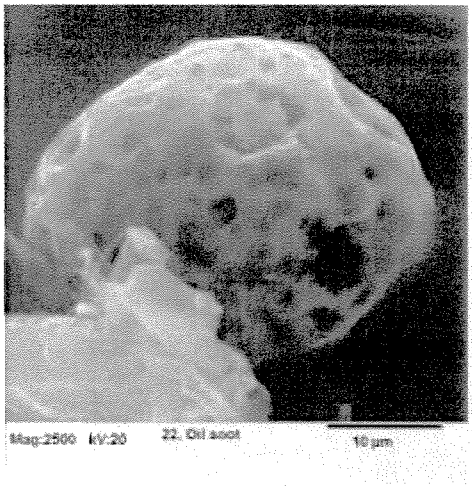
22:

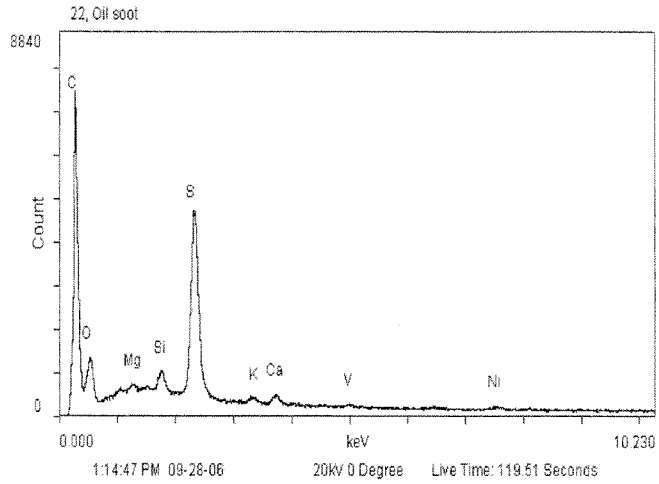
50%	Cellulose (paper, cotton fibers)
25%	Biologicals (dyed animal fibers, hair, organic debris, skin scales, spore/spore related material)
18%	Mineral grains
5%	Synthetic fibers
2%	Opaques (non-soot organic/inorganic, pigmented/paint residue)
Trace	Soot (oil)



Sample 22 contained fibrous material, biological debris and mineral. Particles demonstrating morphology suggestive of industrial soot material were not observed with the PLM.

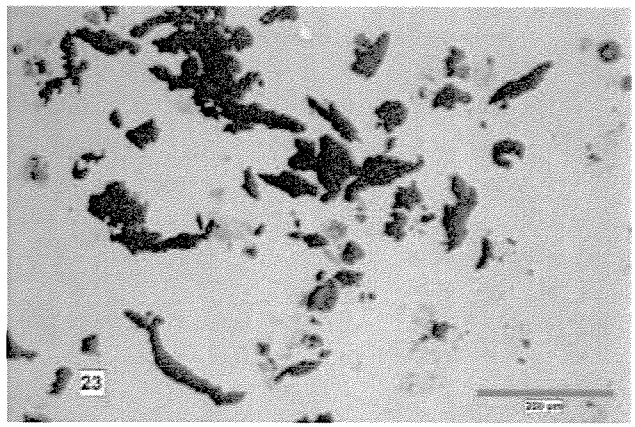
SEM analysis confirms the presence of oil soot. No coal particles were detected with the SEM in this sample. The porous oil soot spheroid demonstrates strong peak concentrations of carbon and sulfur with lesser peak concentrations of oxygen, magnesium, silicon, potassium, calcium, vanadium and nickel.





23:

75%	Opaques (vehicle dust, paint residue/spheres, non-soot organic/inorganic, welding spheres, metallic chip)
10%	Mineral grains
10%	Soot (coal ash, fly ash)
3%	Biologicals (organic debris, trichome, spore/spore related material, starch grains)
2%	Cellulose (paper fibers)

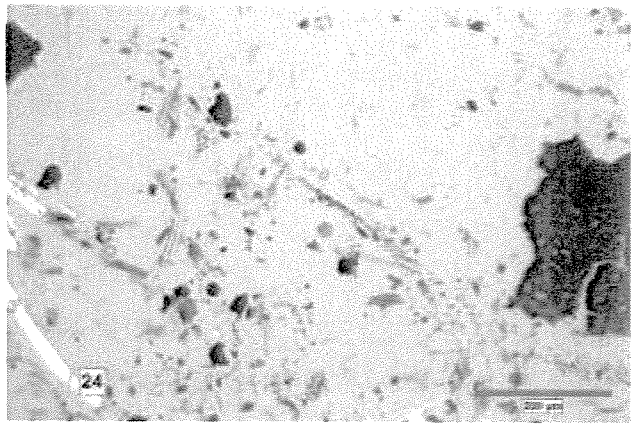


Sample 23 contained a noticeable concentration of non-soot opaques, most of which was classified as vehicle dust. Mineral grains and biological material also were noted in this sample. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM.

SEM analysis confirms the presence of coal ash and fly ash. No coal particles were detected with the SEM in this sample. The porous, irregularly shaped coal ash particle demonstrated strong peak concentrations of carbon, aluminum and silicon with oxygen, sulfur, potassium, calcium, titanium and iron. The smooth spherical fly ash showed strong peak concentrations of aluminum and silicon, moderately strong oxygen with carbon, potassium, calcium, titanium and iron.

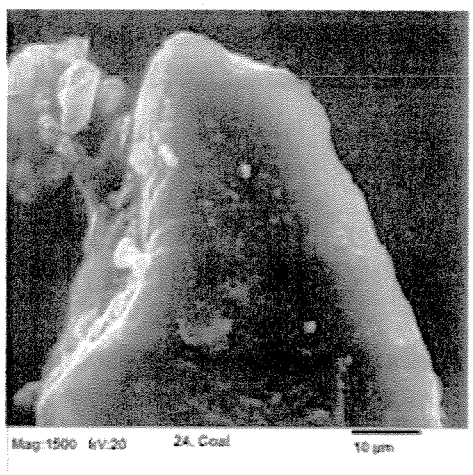
24:

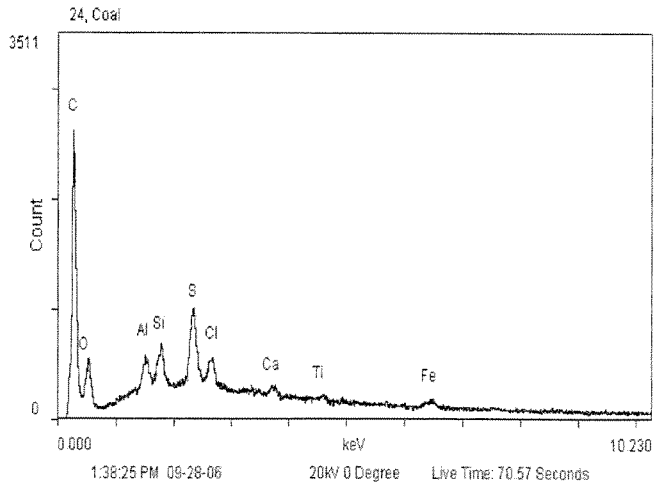
45%	Opaques (paint chips/residue, rust, vehicle dust, non-soot organic/inorganic)
25%	Cellulose (vegetative, paper fibers)
22%	Biologicals (hair, spore/spore related material, organic debris, insect parts, trichome)
3%	Synthetic fibers
3%	Soot (coal, fly ash)
2%	Mineral grains
Trace	Glass fiber



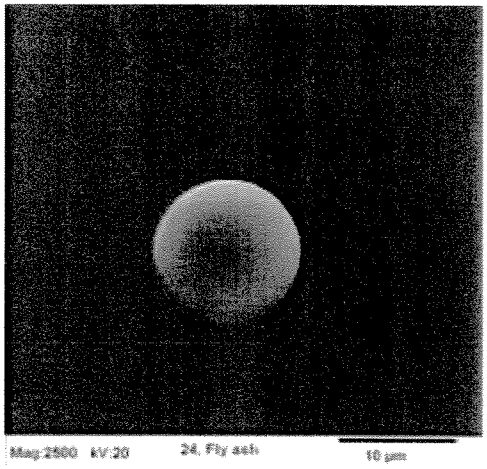
Sample 24 contained a mix of non-soot opaques, fibrous material and biological debris. Particles demonstrating morphology suggestive of coal were observed with the PLM

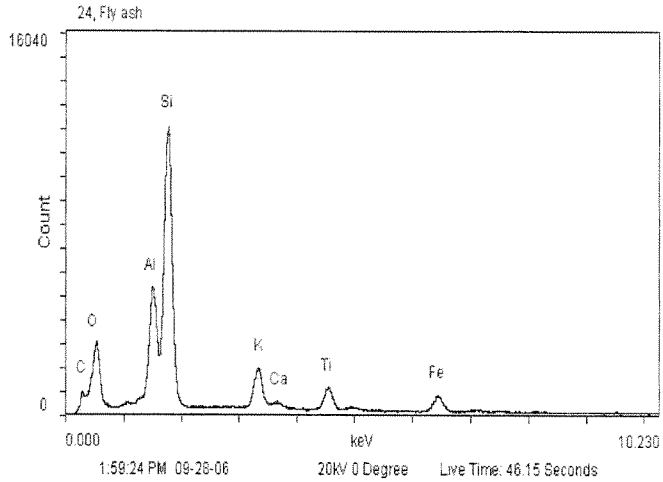
SEM analysis confirms the presence of coal and fly ash. The coal specimen a strong peak concentration of carbon and moderately strong peaks of oxygen, aluminum, silicon, sulfur and chlorine with calcium, titanium and iron over a moderately raised background.





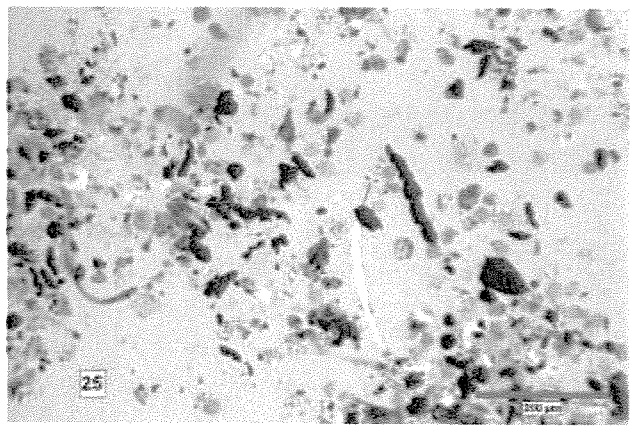
The smooth spherical flyash particle demonstrates a strong peak concentration of silicon, moderately strong oxygen, aluminum, potassium, titanium and iron with carbon and calcium.





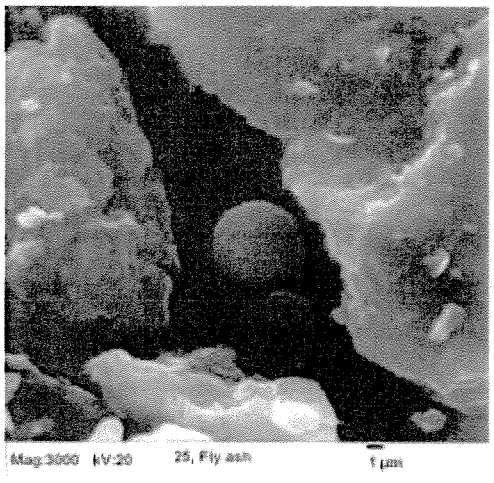
25:

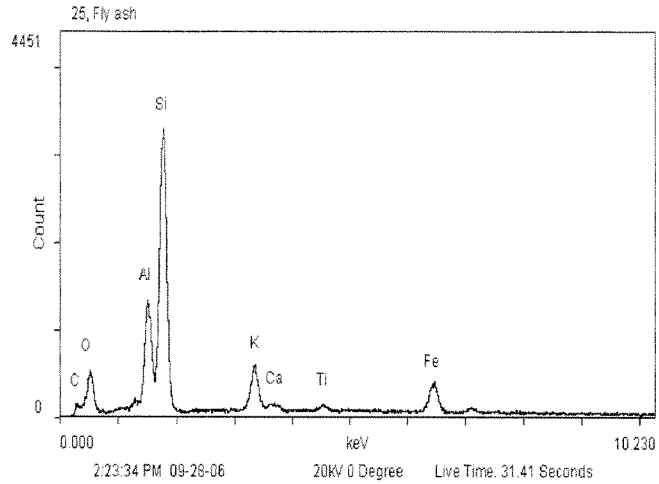
43% Mineral grains
43% Biologicals (pollen, trichome, organic debris, cob web)
10% Opaques (vehicle dust, non-soot organic/inorganic, rust, metallic chip)
2% Soot (fly ash)
2% Cellulose (paper fibers)



Sample 25 contained primarily mineral grains and biological debris with non-soot opaques. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM.

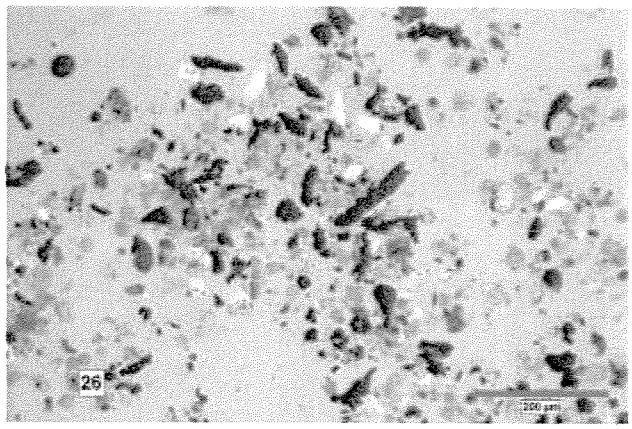
SEM analysis confirms the presence of fly ash. No coal particles were detected with the SEM in this sample. The smooth spherical flyash particle demonstrates a strong peak concentration of silicon, moderately strong oxygen, aluminum, potassium and iron with carbon, calcium and titanium.





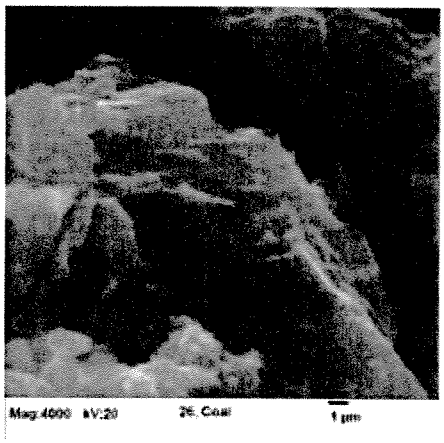
26:

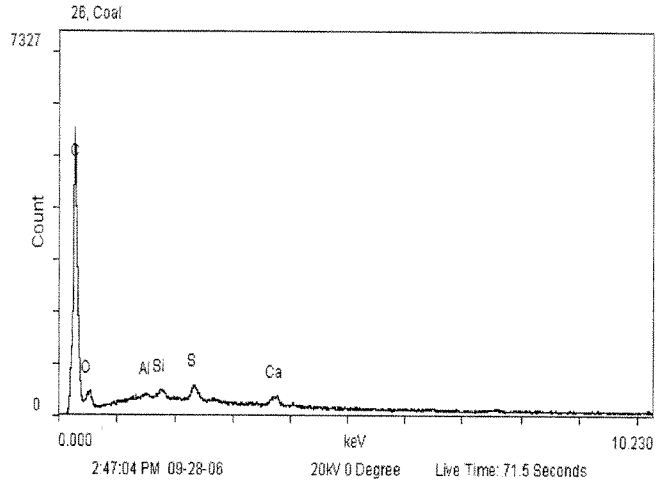
40%	Mineral grains
32%	Biologicals (pollen, trichome, organic debris, spore/spore related material)
15%	Opaques (vehicle dust, non-soot organic/inorganic, rust)
5%	Soot (coal, fly ash)
4%	Synthetic fibers
3%	Cellulose (paper fibers, wood fine)
1%	Glass fibers



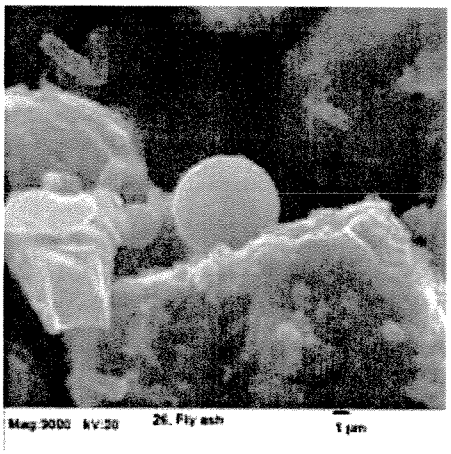
Sample 26 contained minerals grains, biological debris with non-soot opaques. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM.

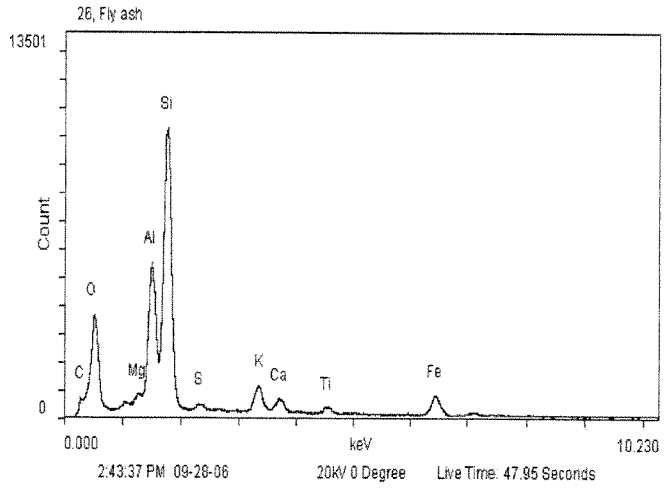
SEM analysis confirms the presence of coal and fly ash. The coal particle demonstrates a strong carbon peak with lower peaks of oxygen, aluminum, silicon, sulfur and calcium over a slightly raised background.





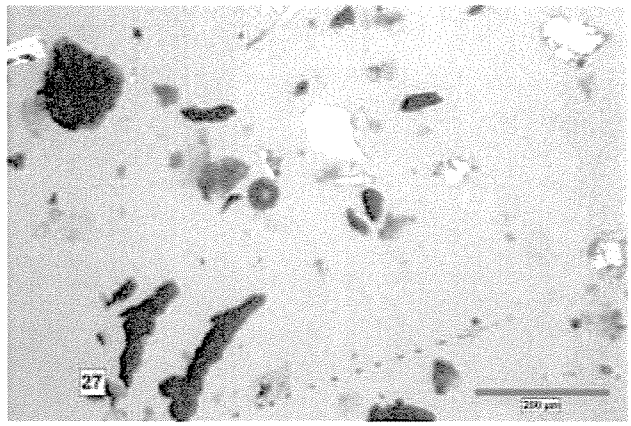
The smooth spherical fly ash demonstrates strong to moderately strong peak concentrations of oxygen, aluminum and silicon with lesser peak concentrations of carbon, magnesium, sulfur, potassium, calcium, titanium and iron.





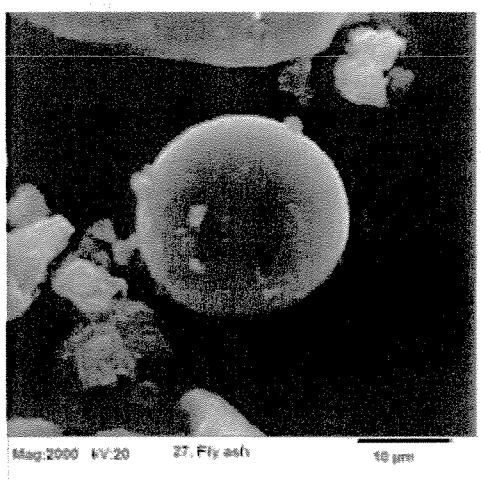
27:

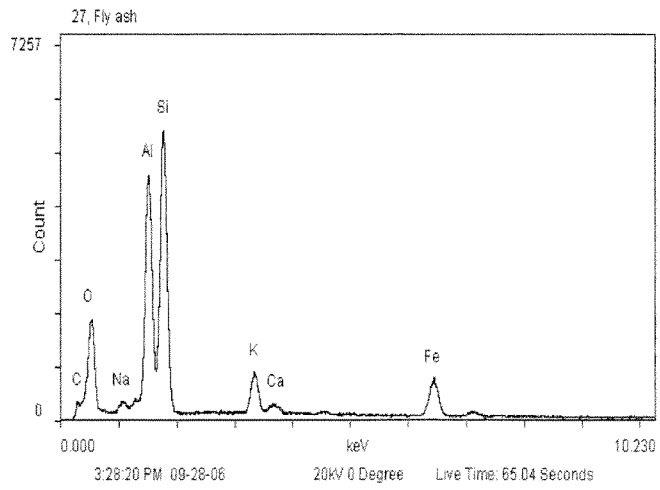
40%	Mineral grains
34%	Biologicals (pollen, organic debris, hair, trichome, spore/spore related material)
20%	Opaques (vehicle dust, non-soot organic/inorganic, pigmented/paint residue/sphere, rust, welding spheres)
3%	Cellulose (paper fibers)
2%	Soot (fly ash, coal ash)
1%	Synthetic fibers



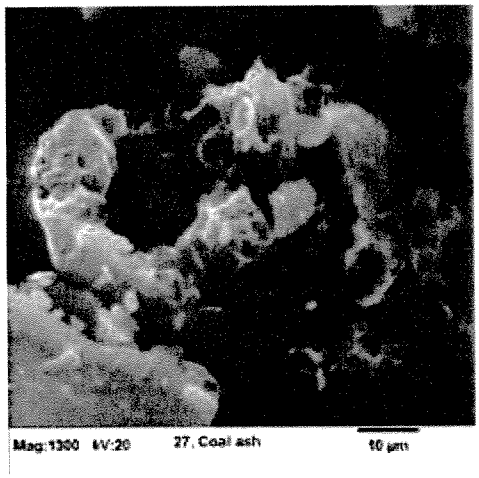
Sample 27 contained a mix of minerals grains, biological debris and non-soot opaques. Particles demonstrating morphology suggestive of combusted soot material and coal were observed with the PLM.

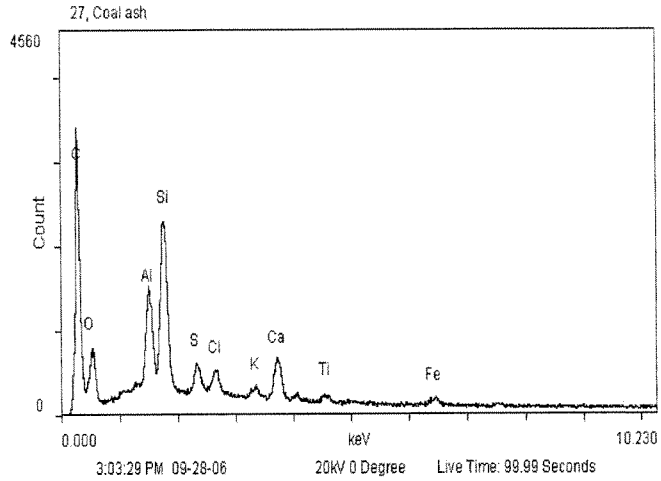
SEM analysis confirms the presence of fly ash and coal ash. No coal particles were detected with the SEM in this sample. The smooth spherical fly ash particle demonstrated strong peak concentrations of aluminum and silicon with moderately strong to lower peak concentrations of carbon, oxygen, sodium, potassium, calcium and iron.





The irregularly shaped, porous coal ash particle demonstrates strong to moderately strong peak concentrations of carbon, oxygen, aluminum, silicon, sulfur, chlorine and calcium with lower peaks of potassium, titanium and iron.





Should you have further questions, or need additional information, please contact us at any time.

Sincerely,

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