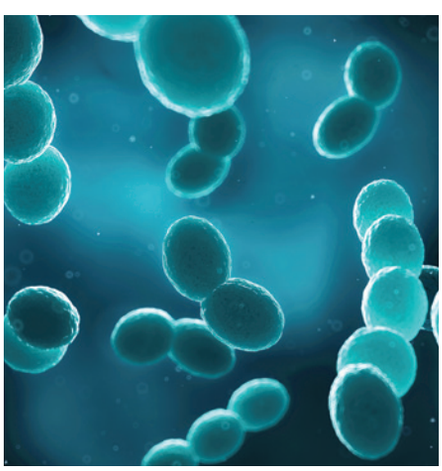
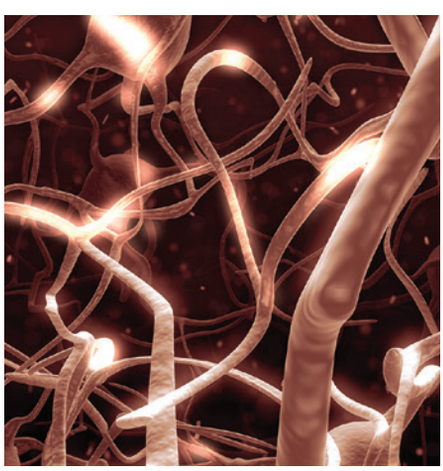
APPLICATION NOTE I

with *COXEM*

Scanning Electron Microscope (SEM) is used to analyze the shapes and constituents of microstructure materials in both quantitative and qualitative ways. It is essential for wide range of applications in numerous fields such as chemistry, biology, material science, nano-materials, and nano-biology.

Since 2008, COXEM has commercialized the popular SEM and entered into both domestic and global marketing. For our product description, please visit www.coxem.com.





COXEM

Highest Performance Table Top SEM with Integrated EDS

EM-30AX

COXEM
www.coxem.com

Features

- High Performance EDS System Integrated
- High Quality Images(5nm resolution)
- Magnification Up To 150,000x
- Easy Navigation with the "Navigation Mode"
- Precise Control with a Joystick and the "Driving Mode"
- Low Energy Consumption
- Intuitive User Interface

Specifications

- **Magnification :** x15 ~ x150,000
- **Acc Voltage :** 1 ~ 30kV (1kV increments)
- **Electron Gun :** Tungsten Filament (W)
- **Detector :** SE Detector
- **EDS :** Oxford : 129eV at Mnk. B(5) ~ Cf(98)
  Bruker : 129eV at Mnk. B(5) ~ Cf(98)
- **Stage :** Auto Stage (X: 35mm, Y: 35mm, T: 0 to 45°)
  Manual Stage (Z: 5 to 50mm)
- **Image Shift :** X, Y, R(Rotation)
- **Operating System :** Microsoft Windows 10
- **Dimension :** 400(W) X 600(L) X 550(H) mm
- **Weight :** 95kg

Life Science

To understand cells, proteins, and DNA, scientists are now actively using scanning electron microscopy to directly visualize surface structures of cells and macromolecules at nanometer resolution.

COXEM provides multiple useful techniques with its leading scanning electron microscope, such as SE, BSE, and cool stage, to investigate morphological structures of these biological specimens.

The data acquired can provide valuable insights into scientists in leading research labs and hospitals, as well as professors and students in universities.

- Microbiology
- Food / Environmental Science
- Plants and Animals
- Medicine / Pharmaceuticals
- Human Body

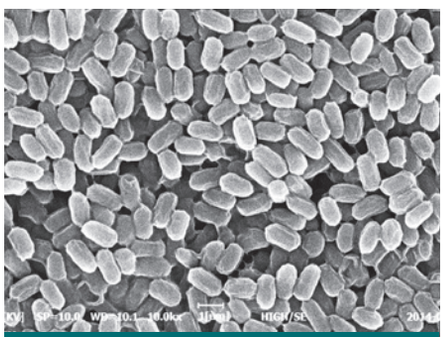
Microbiology

Overview

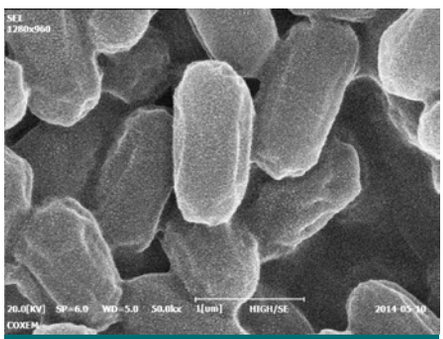
With scanning electron microscope's greater depth of focus compared to the optical microscope, features of various microorganisms ranging from bacteria to virus can be identified, such as their structure, morphology, and composition.

Lactic Acid Bacteria Isolated from Soy sauce

Proper sample preparation is important when viewing lactic acid bacteria isolated from soy sauce. If soy sauce is naturally dried, lactic acid bacteria cannot be seen due to salt particles. By incubating them in a culture medium, bacteria can be imaged more clearly.



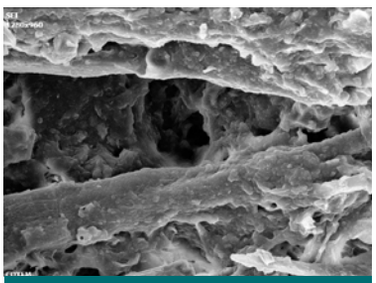
x10,000, 20kV



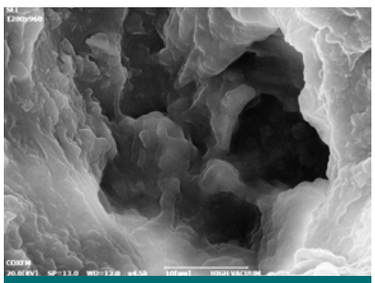
x50,000, 20kV

Wood Bio-chips

Wood bio-chips, which act as home for thermopile microorganisms, are used to turn food wastes into a fertilizer. Microorganisms reproduce in the chips by decomposing food wastes in highly saline and acid environments. This so-called fermentation-extinction technology is patented to Land & Housing Institute, Korea Land & Housing Corporation.



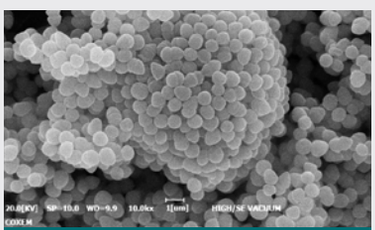
x1,000, 20kV



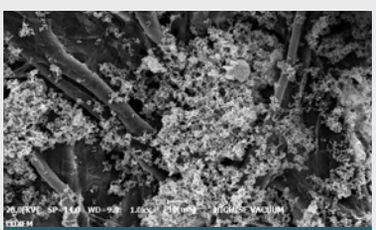
x4,500, 20kV

Other Images

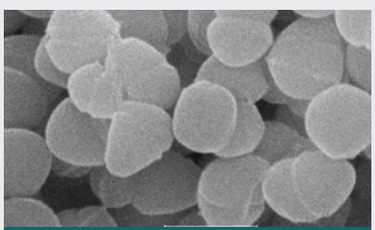
Bacteria 1 (x20,000)



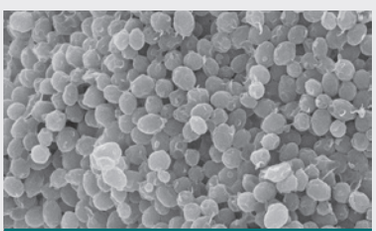
Bacteria 2 (x20,000)



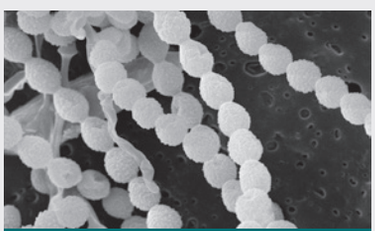
Bacteria 3 (x20,000)



Virus (x50,000)



Fungus (x30,000)



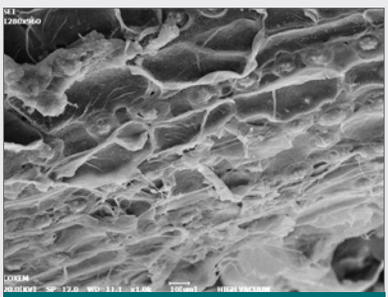
Mold (x6,300)

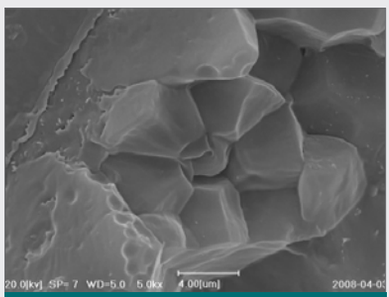
Food I Environmental Science

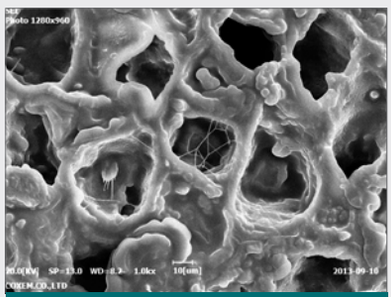
Overview

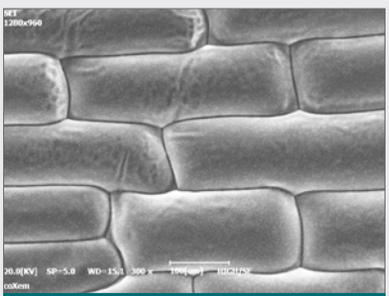
SEM provides valuable insights when visualizing food structures. With high resolution images, scientists can examine any internal structures or cross sections and make other pertinent observations.

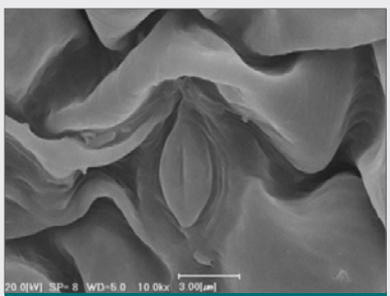
Images

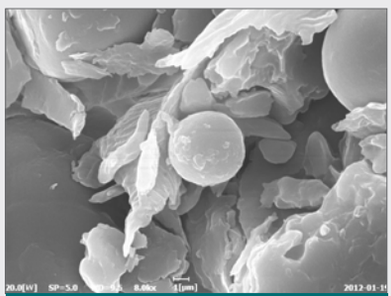

Rice (x5,000)

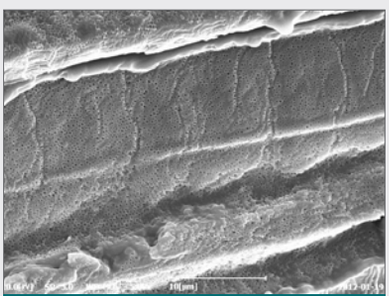

Rice (x5,000)

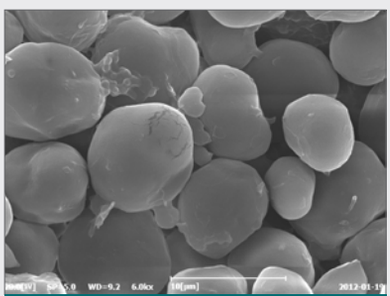

Coffee bean (x1,000)

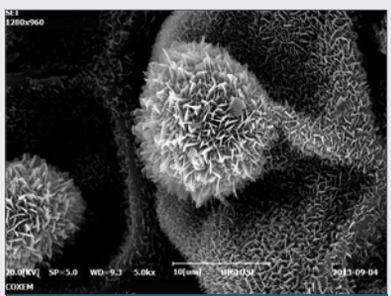

Onion cell (x300)

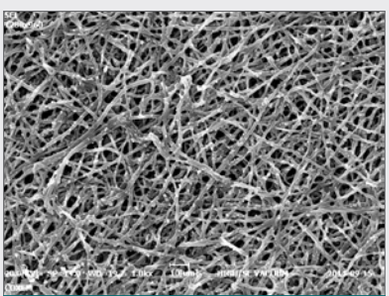

Cabbage (x10,000)

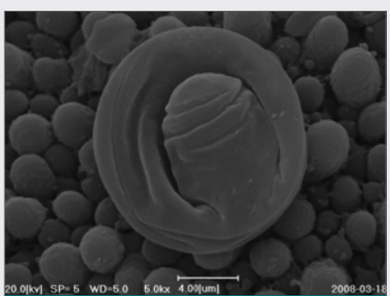

Mung bean (x8,000)

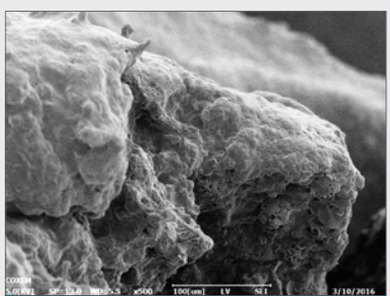

Black bean (x5,000)


Sorghum bicolor (x6,000)


Taro leaf (x5,000)


Egg membrane (x1,000)


Mushroom (x5,000)


Cheese crust (x500)

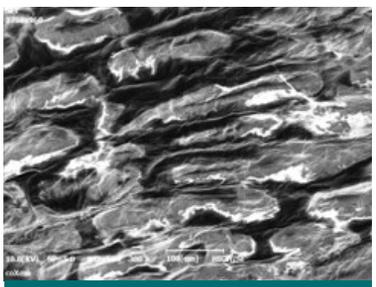
Plants and Animals

Overview

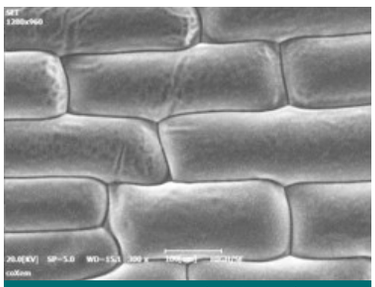
With a greater depth of focus of a scanning electron microscope over the optical microscope over the optical microscope, features of various microorganisms ranging from bacteria to virus can be identified, such as their structure, morphology, and composition.

Onion Skin

Biological samples, largely composed of water, must undergo complex additional preparatory steps to ensure that their native structures are retained. Such steps include sample collecting, fixing, washing and dehydrating. Freezing the sample with COXEM's Coolstage allows it to be preserved better and observed faster. Images are onion skin cells viewed without (left) and with (right) Coolstage.



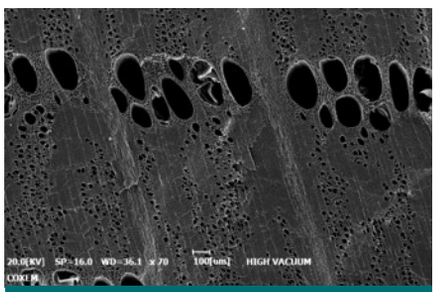
Without coolstage (x300, 20kV)



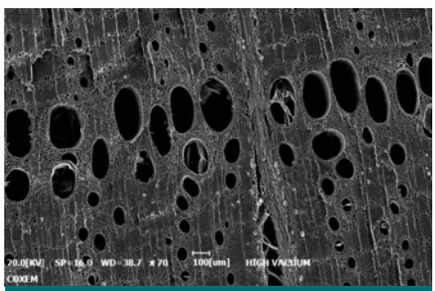
With coolstage (x300,20kV)

Charcoal

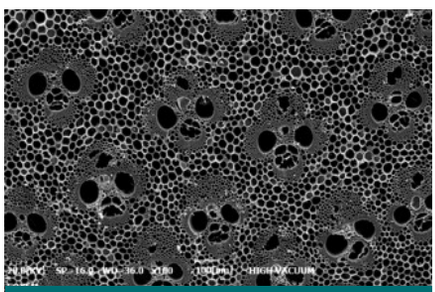
Different types of charcoals.



Fine (x70, 20kV)



Black (x70, 20kV)



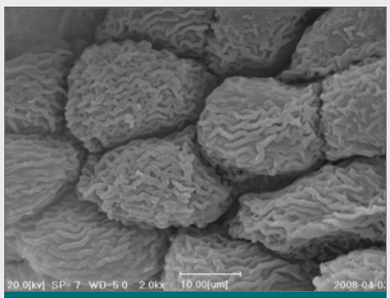
Bamboo (x100, 20kV)

Coolstage

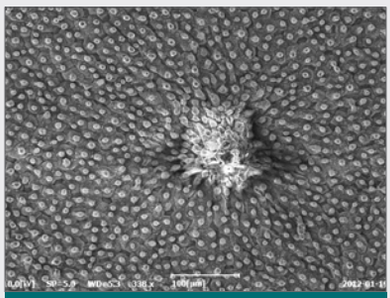
With COXEM's coolstage, biological samples remain frozen while examined. Life-like appearance of the samples are preserved as they are fully hydrated. Coolstage is a quick method to view samples without destroying them.

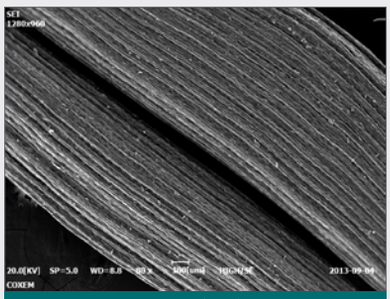
Plants and Animals

Other Images

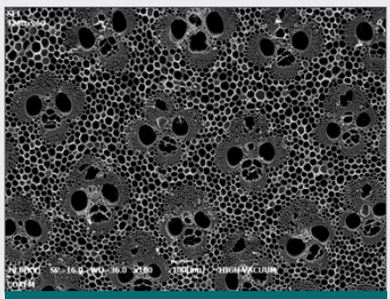

Stamen (x2,000)

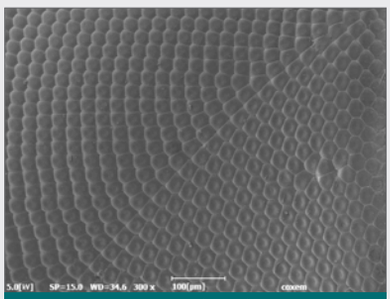

Aquilegia (x3,800)


Lotus leaf (x338)


Grass (x80)

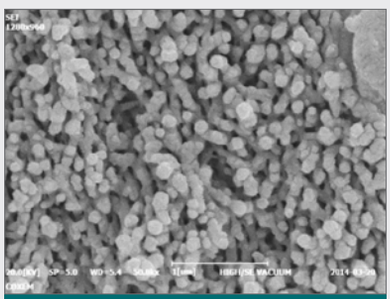

Belamcanda chinensis (x1400)

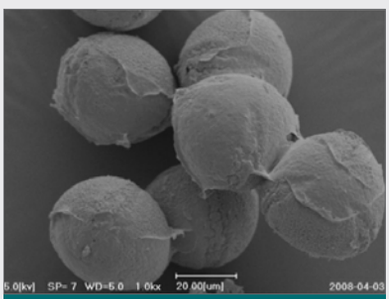

Bamboo charcoal (x100)

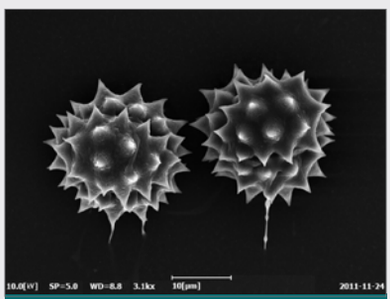

Fly eye (x300)


Mosquito mouth (x100)


Pulsatilla koreana (x4,200)


Feather cross section (x50,000)


Pollen (x1,000)


Chrysanthemum zawadskii (x3,100)

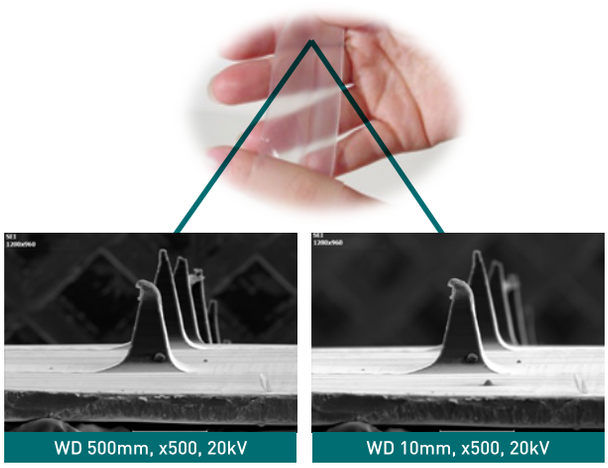
Medicine I Pharmaceuticals

Overview

COXEM's SEM and EDS offer useful information about microstructures of pharmaceutical powders, such as particle size and composition. SEM can also identify any extraneous matters contained within the particle.

Cosmetic Patches

Fabricated microneedle-array patches enhance collagen permeation through the skin and supply other nutrients by penetrating the skin with their sharp tips. These patches are imaged better by increasing the working distance (WD). Higher working distance leads to a better depth of field, which is the effective focus range. Compared to the image to the right, the image to the left has more sample features that remain in focus.

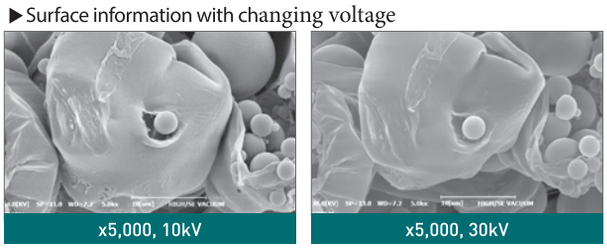


WD 500mm, x500, 20kV | WD 10mm, x500, 20kV

Drug Powder with Changing Accelerating Voltage

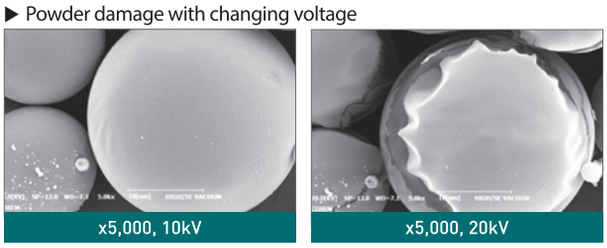
Accelerating voltage can be easily manipulated based on the sample condition and magnification.
When viewing images at higher magnification, resolution is better when the voltage is high, but samples may be damaged. Depending on the sample type, it is sometimes better to observe samples at low accelerating voltage.

▶ Surface information with changing voltage



x5,000, 10kV | x5,000, 30kV

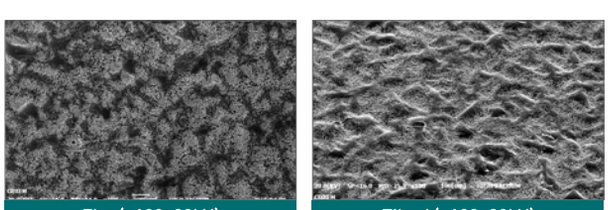
▶ Powder damage with changing voltage



x5,000, 10kV | x5,000, 20kV

Sunscreen

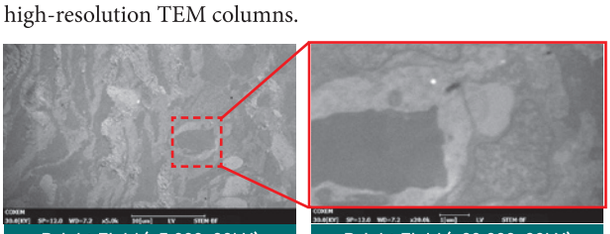
In the images, sunscreen was applied to a glass plate with indentations to look for its distribution. Sunscreens contain titanium oxide (TiO2) particles. The shape and size of these particles affect sun protection. As particle size gets smaller, SPF protection is better but UVA protection becomes worse. Also, small particles may penetrate the skin and cause side effects. By looking at SEM images, it is important to measure the size and find the balance, as small particles provide greater transparency and larger particles allow greater UVA protection.



Flat (x100, 20kV) | Tilted (x100, 20kV)

Colorectal Cancer Cell with Scanning Transmission ElectronMicroscope (STEM)

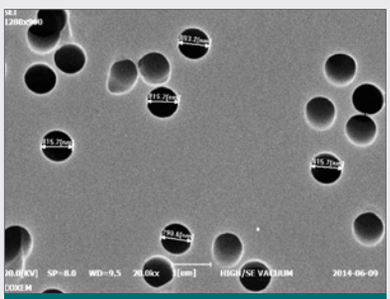
COXEM's SEM can be easily transformed into STEM by inserting a STEM detector. By detecting transmitted electrons with low voltage STEM, high-contrast images of biological specimen can be acquired with bright and dark field imaging modes. At the same time, radiation damage is reduced because voltage is low compared to the dedicated STEMs based on high-resolution TEM columns.

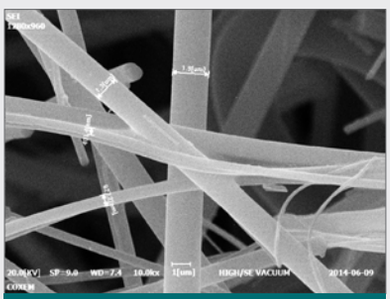


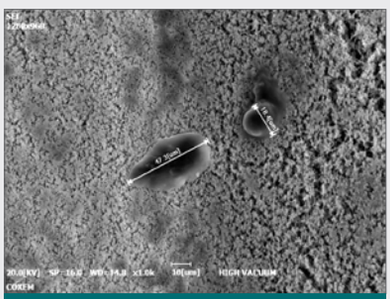
Bright Field (x5,000, 30kV) | Bright Field (x20,000, 30kV)

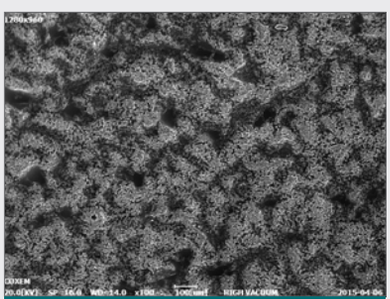
Medicine I Pharmaceuticals

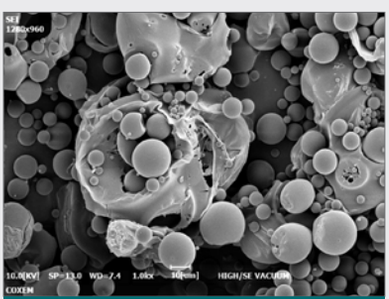
Other Images

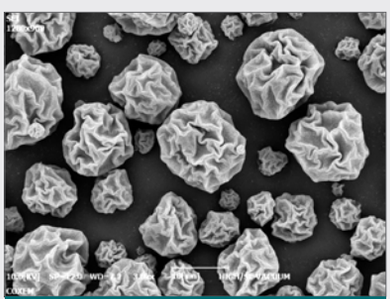

Filter 1 (x20,000)

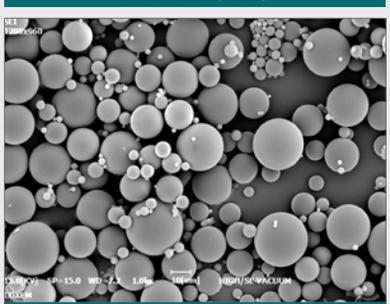

Filter 2 (x10,000)

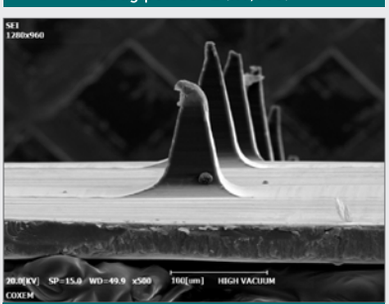

Filter 3 (x1,000)

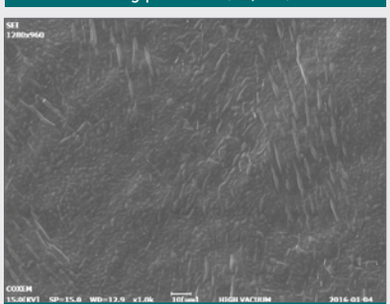

Sunscreen (x100)

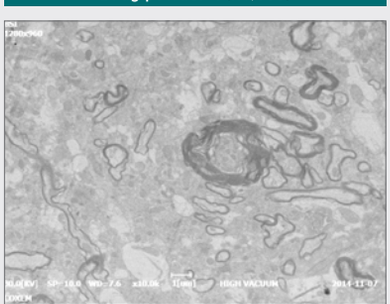

Drug powder 2 (x1,000)

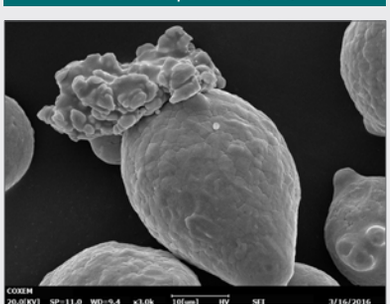

Drug powder 3 (x3,000)

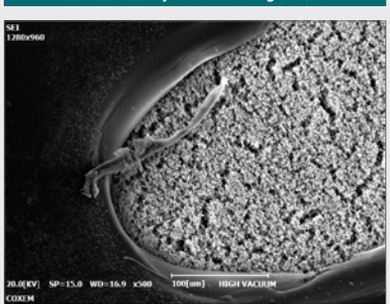

Drug powder 4 (x1,000)


Cosmetic patches (x500)


Intravenous injection tubing (x1,000)


Cell (x10,000)


Drug powder 5 (x3,000)


Contaminant inside powder (x500)

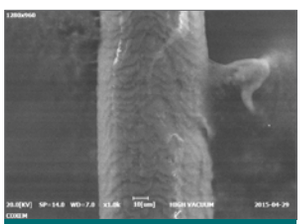
Human Body

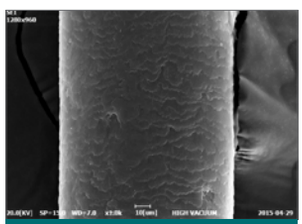
Overview

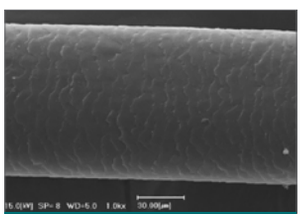
Electron microscope is used to investigate human body parts and hairs. Examples include surfaces of epidermis, hair follicles, fat cells, glands, and blood vessels.

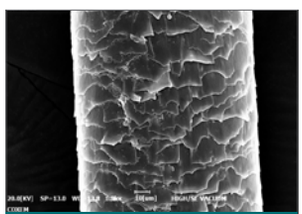
Hair Fibers

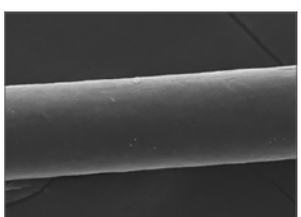
(Top) Human hair is not conductive so needs to be coated before taking SEM images. In BSE mode, however, sample may be observed without coating. But due to charging, quality images cannot be obtained.
(Bottom) SEM micrograph of a healthy hair shows overlapping intact cuticle and scales on its surface. In a damaged hair, cuticles are lifted and have cracks inside. In an artificial hair, the surface is very smooth and there are no cuticles.


Before coating (BSE, X1,000, 20kV)


After coating (SE, X1,000, 20kV)

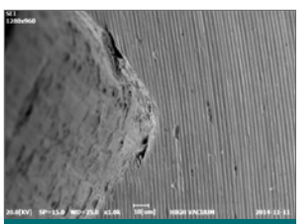

Healthy (X1,000, 15kV)

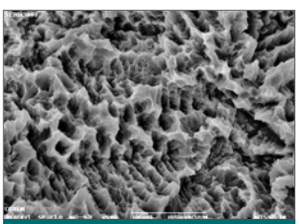

Damaged (X1,000, 20kV)

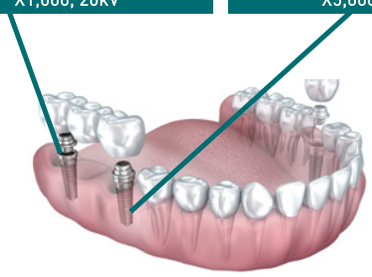

Artificial (X1,000, 15kV)

Dental Implants

Below is a surface morphology of titanium implants used in dentistry.
Proper surface morphology and chemistry are keys to a successful osseointegration. To improve clinical performance, various surface modification techniques are used. Implant shown below illustrates honeycomb structures with crystallographically oriented boundaries and blasting particles


X1,000, 20kV

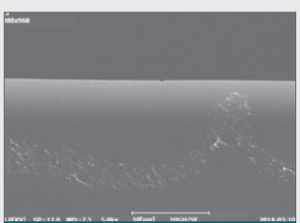

X5,000, 20kV

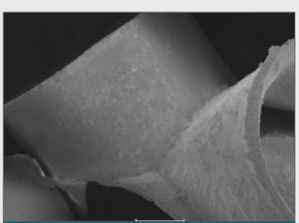


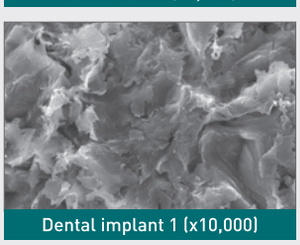
SPT-20 Ion Coater

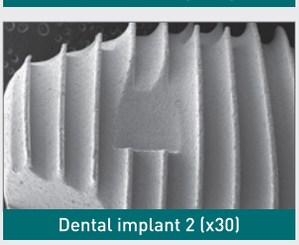
Samples that do not conduct electricity are coated with gold (Au), gold/palladium (Au/Pd), platinum (Pt), silver (Ag), chromium (Cr), or iridium (Ir) with the SPT-20 ion coater to prevent charging effect.
COXEM provides different types of targets for customer's needs.

Other Images


Contact lens (x5,000)


Artificial bone (x200)

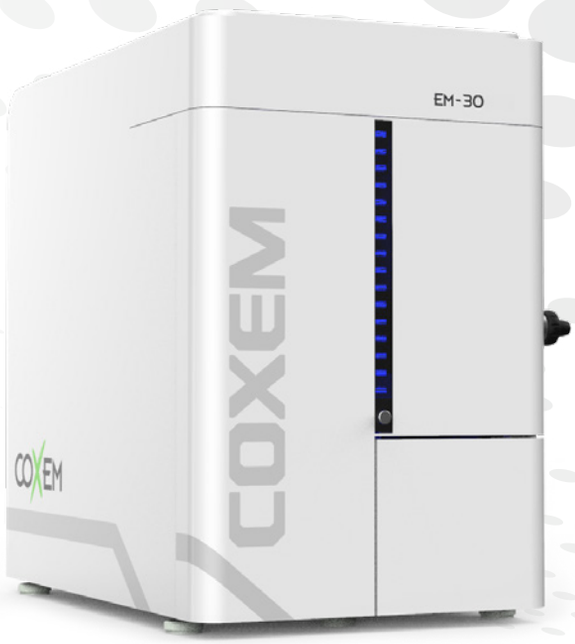

Dental implant 1 (x10,000)


Dental implant 2 (x30)

Perfect Table Top SEM for General Purpose

EM-30

COXEM
www.coxem.com



Features

- High Quality Images (5nm resolution)
- Magnification Up To 150,000x
- Easy Navigation with the "Navigation Mode"
- Precise Control with a Joystick and the "Driving Mode"
- Easy operation (Auto focus, Contrast, Brightness)
- Low Energy Consumption
- Intuitive User Interface

Specifications

- **Magnification :** x15 ~ x150,000
- **Acc Voltage :** 1-30 kV (1kV increments)
- **Electron Gun :** Tungsten Filament (W)
- **Detector :** SE Detector
- **Image Shift :** X, Y, R(Rotation)
- **Stage :** Auto Stage (X: 35mm,Y: 35mm,T: 0-45°)
  Manual Stage (Z: 5-50mm)
- **Operating System :** Microsoft Windows 10
- **Dimensions :** 400(W) x 600(L) x 550(H) mm
- **Weight :** 85Kg

Materials Science

Materials science, which involves discovering and designing new materials, incorporates elements of physics, chemistry, and engineering. With the help of scanning electron microscope, material scientists are now able to analyze microsctructure, crystal structure, chemistry, and surface structure of solid samples with great depth of focus and resolution down to the nanoscale.

Using COXEM's SEM with energy-dispersive X-ray spectroscopy (EDS), scientists are also able to perform qualitative chemical analysis, such as obtaining elemental maps that show which elements are in which part of a sample. With the BSE detector, multiple phases in a sample can be easily discriminated and documented based on the atomic number.

- Chemistry
- Automotive
- Construction
- Smartphones
- Energy
- Semiconductors & Electronics
- Metals

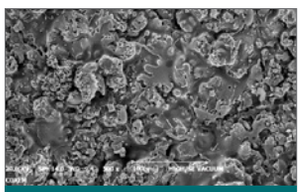
Chemistry

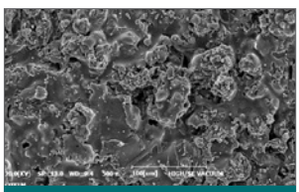
Overview

Due to SEM's high resolution and large depth of focus, various chemicals can be analyzed in great detail.

Microstructures of Plasma Sprayed Ytrria Coatings

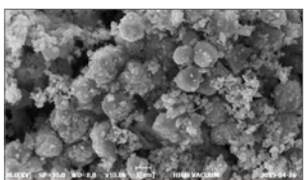
Yttria coatings (Y2O3) on alumina (Al2O3) and titania (TiO2), manufactured by suspension plasma spraying, have been employed in a wide variety of applications. For example, they are used for anti-oxidation or anti-wear applications in semiconductors, where the sample of interest must resist contact with abrasive surfaces. Yttria is known for its low etch rate, but due to its high cost, the demand for high-purity ceramics as a substitute is increasing. Two micrographs below show ytrria coatings on alumina, with low plasma power density.


X500, 20kV


X500, 20kV

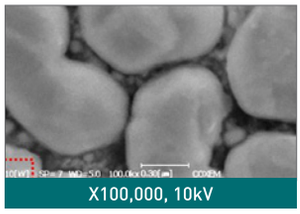
Silver Powder

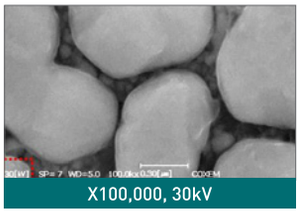
Silver is actively used in electrical applications because it is the best thermal and electrical conductor of all the metals. Scientists are actively finding ways to develop silver nanowires because small-sized silver particles can be used to make better touchscreens for smartphones.


X10,000, 20kV

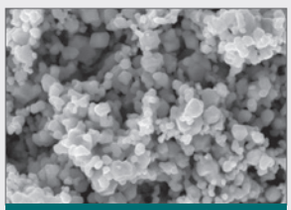
Gold Particle

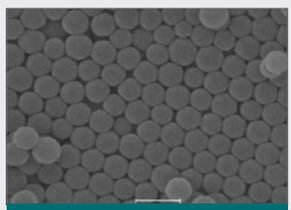
Accelerating voltage is an important factor in determining resolution. For highest resolution, samples are imaged at high voltage. However, samples may be damaged when imaged at high voltage. Image below is a gold particle imaged at low voltage (left) and high voltage (right).

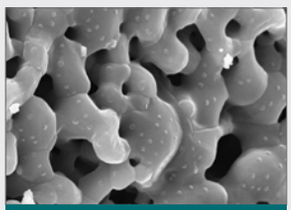

X100,000, 10kV

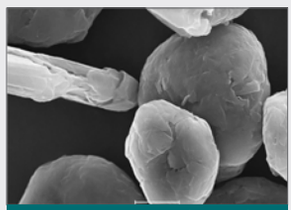

X100,000, 30kV

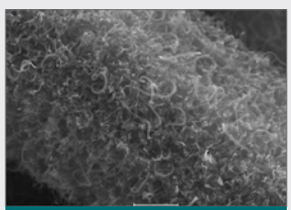
Other Images

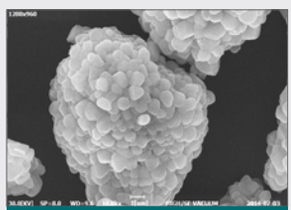

Silver (x20,000)

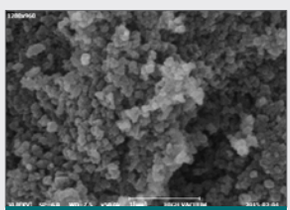

Silica (x20,000)


Zirconium oxide (x10,000)

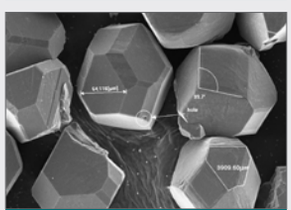

Graphite powder (x5,000)


Carbon nanotube (x10,000)

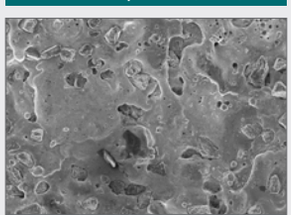

Lithium (x10,000)

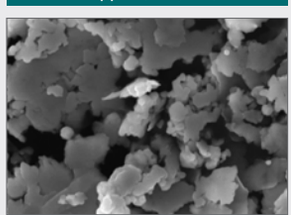

Titania (x50,000)


Fiber (x10,000)


Diamond powder (x500)


Copper (x10,000)


Diamond bulk (x500)


Silver powder electrode (x20,000)

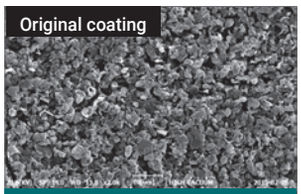
Automotive

Overview

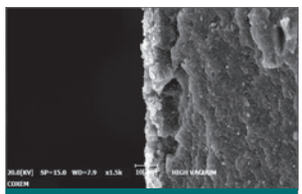
SEM offers strategies to examine the microstructure, chemistry, and crystal structure of various materials and compounds in the automotive industry. Images are used to gain in-depth information on processing conditions, vehicle aging, automotive performance, automotive failure, and many more.

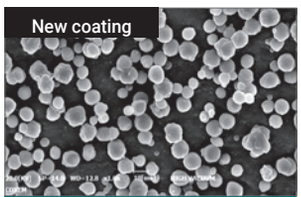
Car Wiper

Most windshield wiper blades are coated with graphite for streak free wiping and high durability. Special coating materials other than graphite are being developed for even better durability.

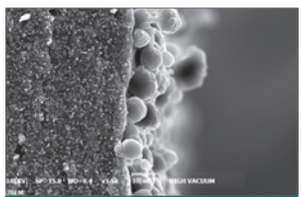


X2,000, 20kV


X1,500, 20kV

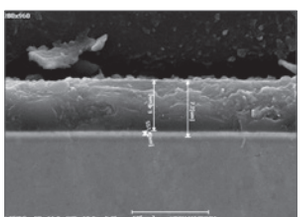


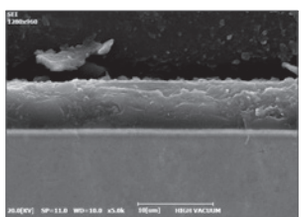
X1,000, 20kV


X1,500, 20kV

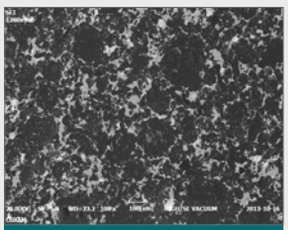
Car Windshield Piston Rings

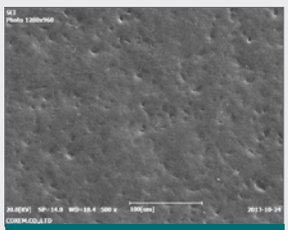
Piston rings for car engines are specially coated to decrease wear by reducing gasoline engine friction. It is important to measure the layer thickness as thickness is directly related to the conformability of the ring. Since the coatings are destroyed when physically cutting the rings, the rings are molded and polished instead. Following images show the thickness of the ring after the correct sample preparation.

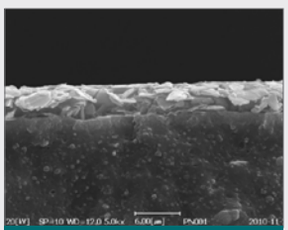

X5,000, 20kV

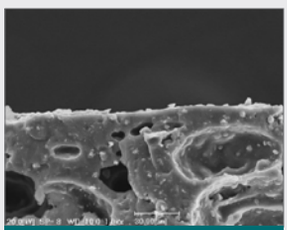

X5,000, 20kV

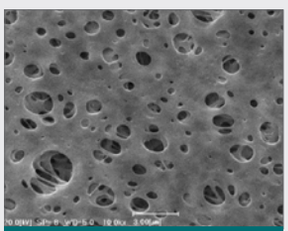
Other Images

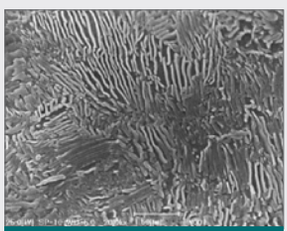

Car engine (x100)

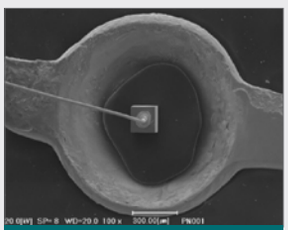

Windshield (x500)

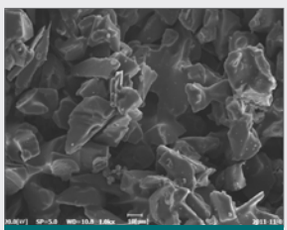

Windshield wiper (x5,000)

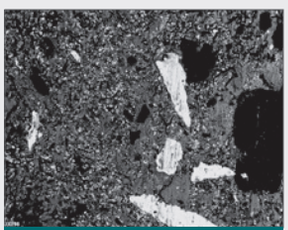

Tire (x1,000)

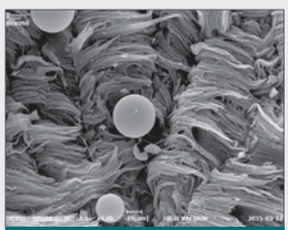

Air filter (x10,000)


Iron plate (x20,000)


LED car lighting (x100)


Engine filter (x1,000)


Brake (x91)


Car interior plastic (x1,000)

Construction

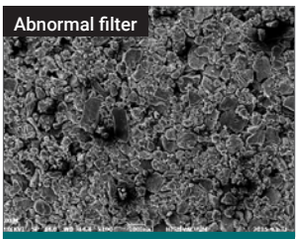
Overview

SEM may be used to characterize the size, morphology and chemistry of paint, soil, and any other particles associated with construction materials.

Domestic Filters for Water Purifier

Water purifier filters are made by mixing ion exchange resin with activated carbons. They can filter biological impurities (bacteria, viruses, microscopic parasites), dissolved organic compounds (PCBs, synthetic detergents), heavy metal salts, (lead, mercury), dissolved gases (radon), and suspended solid particles (asbestos fibers). SEM micrographs of microstructures such as pore cavities can be analyzed to sort out defective filters. Like the image on the right, filters with defective structures may prevent water flow.

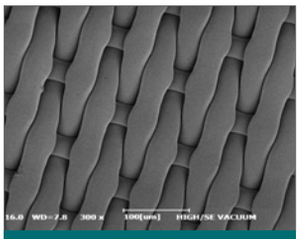
X100, 20kV

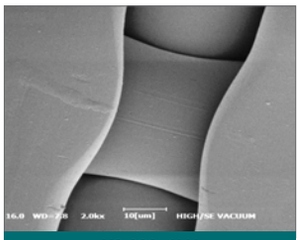


X100, 20kV

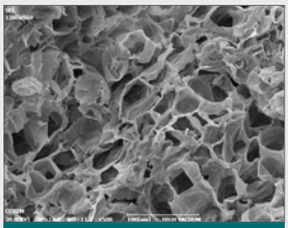
Filter

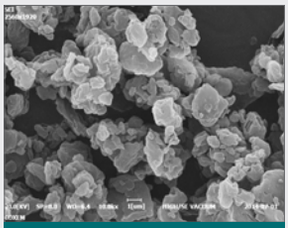
Low voltage imaging is important in investigating surfaces of nanomaterials. This is because lowering the voltage leads to greater surface sensitivity and less charging effect. To see the surface information of the filter, it is better to observe images at low voltage. Below are SEM micrographs of a filter observed at 1kV.


X300, 1kV

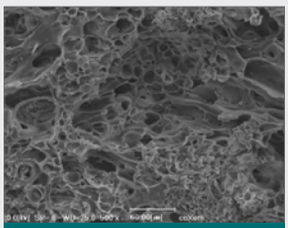

X2,000, 1kV

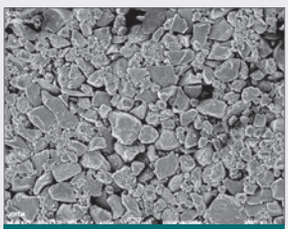
Other Images

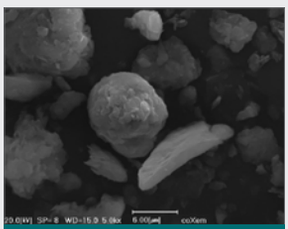

Cocopeat (x500)

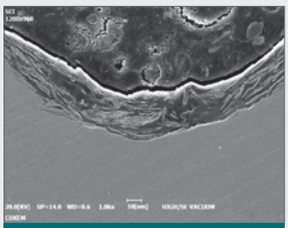

Paint (x10,000)

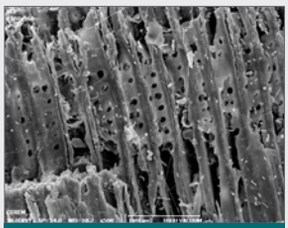

Gypsum powder (x3,000)

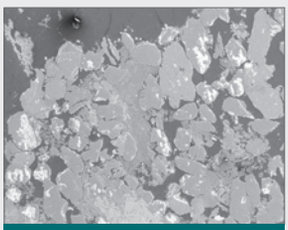

Stone (x500)

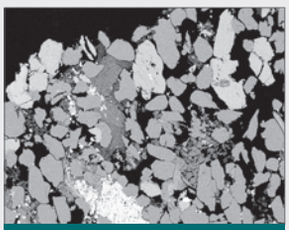

Water filter (x100)


Sand (x5,000)


Coated screw (x1,000)


Wood (x500)


Mineral (BSE, x2,000)


Mineral (SE, x2,000)

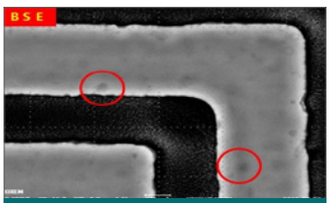
Smartphones

Overview

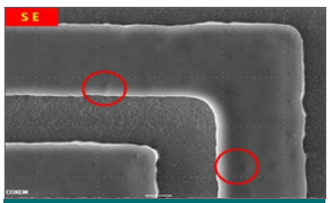
Not only physicists or microscopists, but also electronic engineers can use SEM to gain better understandings of smartphones.

Electronic Display Board

The following sample is an electronic board used for display. The board entails a specific pattern. BSE mode gives supplementary sample information by providing a different kind of image that the SE mode cannot, such as information on the surface morphology.

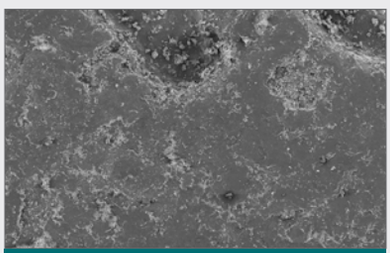


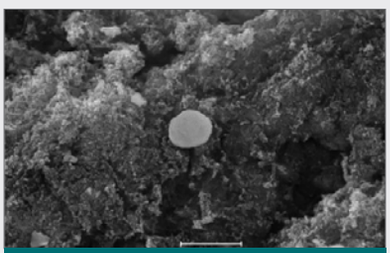
X1,500, 20kV

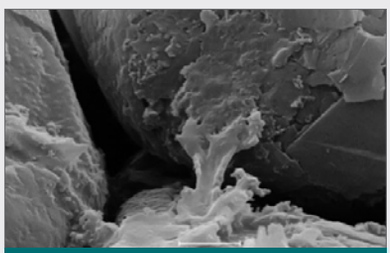


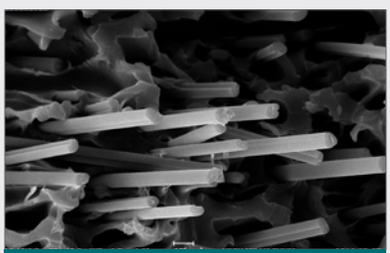
X1,500, 20kV

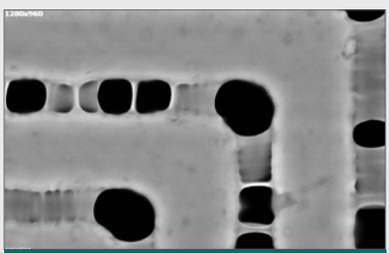
Other Images

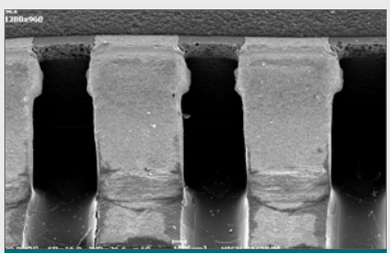

Tablet (x100)

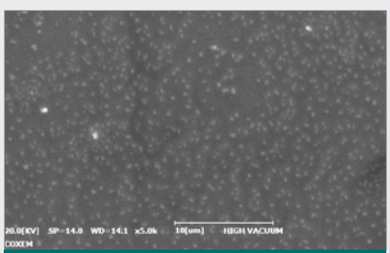

Battery (x2,000)

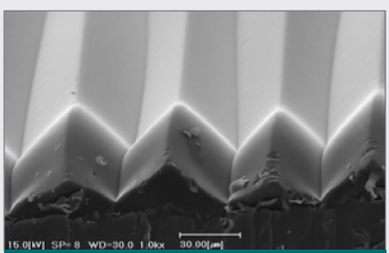

Electrode (x20,000)

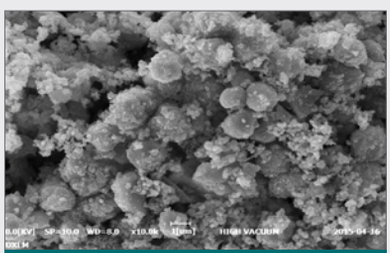

Phone case (x1,000)

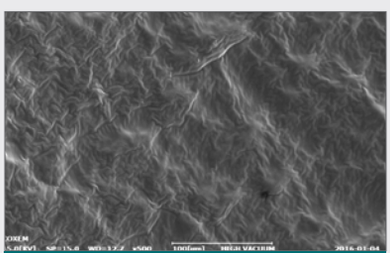

Electron board (x1,500)


Semiconductor (x60)


Display (x5,000)


Film (x1,000)


Coating (x10,000)


Lens surface (x5,000)

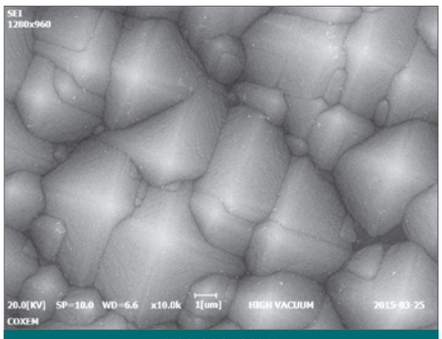
Energy

Overview

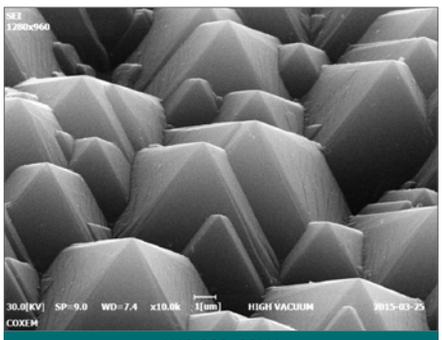
SEM may be used to characterize the size, morphology and chemistry of paint, soil, and any other particles associated with construction materials.

Solar Cell

SEM can provide insights into the fine structure of solar cells, such as layer thickness and surface topographies. These are usually on the micron scale so observing with optical microscope is impossible. On identical positions, tilting the sample to 45 degrees can give different information on the surface as shown below.

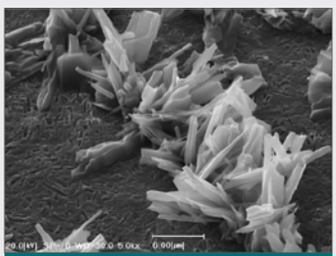


X10,000, 20kV

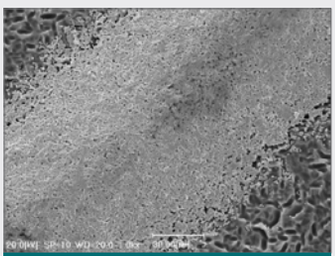


X10,000, 30kV

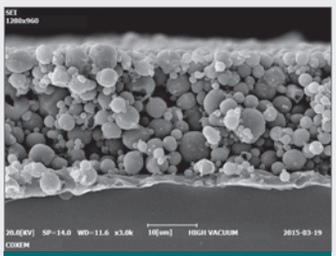
Other Images



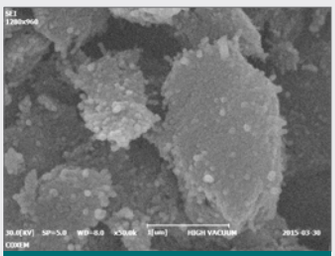
Solar cell (defect) (x5,000)



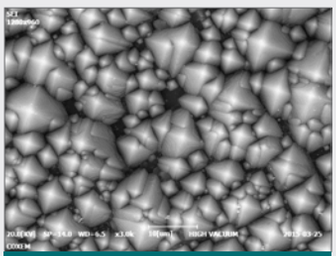
Solar cell (electrode) (x1,000)



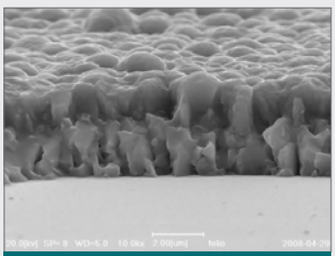
Solar cell (x3,000)



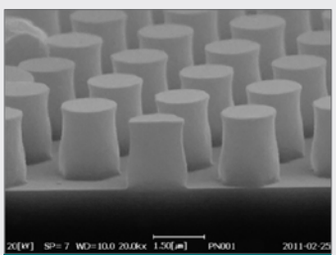
Carbon electrode (x50,000)



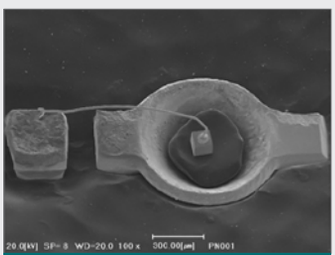
Solar cell (x3,000)



Solar cell (wafer) (x10,000)



Sapphire wafer (x20,000)



LED (x100)

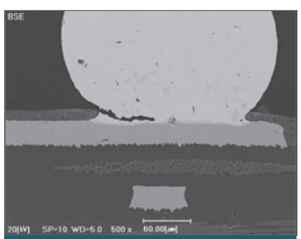
Semiconductors & Electronics

Overview

Flexibility in selecting and using operating parameters (accelerating voltage, specimen tilt, scan line time, etc) as well as correct analytical procedures are needed to obtain the maximum information when examining semiconductors and microelectronic devices.

Cracks in Solder ball

Cracks in solder balls are causes of product defects. Since it is hard to cut the cross section, the sample is prepared by molding and polishing. Below are cross section SEM images with cracks along the interface of solder bump and the metallzied pad.

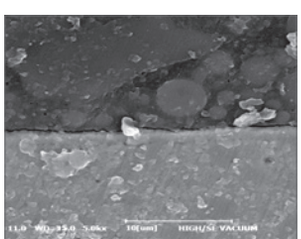


X500, 20kV

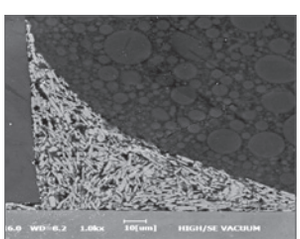
X500, 20kV

Interface Cracks in QFN Device

Interface cracks in QFN devices, caused by hydgro-thermal environment such as moisture absorption, are common and result in failure of the devices. SEM can be used to look for any cracks. Users can see which junction of the interface these cracks lay on as well as their expansion direction. Since they are related to the interface intensity, information on cracks can be used to evaluate the practical significance to the study of QFN devices.



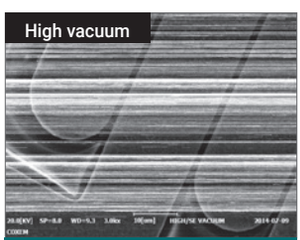
X5000, 20kV



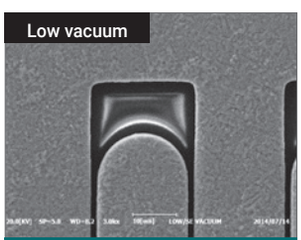
X1,000, 20kV

Flexible Printed Circuit Board (FPCB)

SEM normally operates in high vacuum state. In low vacuum, however, specimen not coated with conductive materials may be viewed. In the figure below, uncoated FPCB was taken in both high vacuum (left) and low vacuum (right) mode. In high vacuum, charging effect is unavoidable. By imaging the sample in low vacuum, charging effect is reduced and image is more clear.



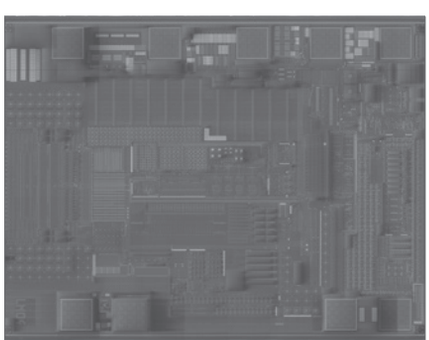
X3,000, 20kV



X3,000, 20kV

MxN (M by N) Function

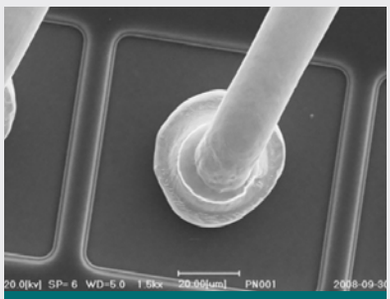
Originally, to see the entire sample, users had to take images separately and compose them manually. With COXEM's M by N function (so-called the panorama shot), however, multiple images of a selected area are captured and combined automatically. This function is optimized for analyzing large areas such as semiconductor surface (right), biological samples, and other metals.

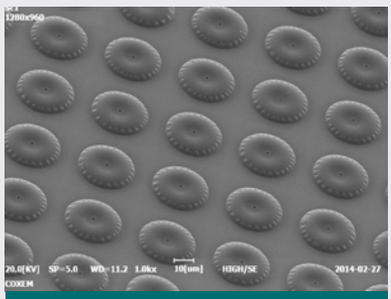


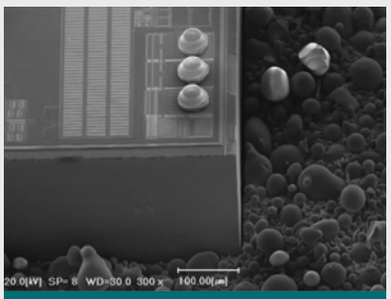
Chip (MxN mode)

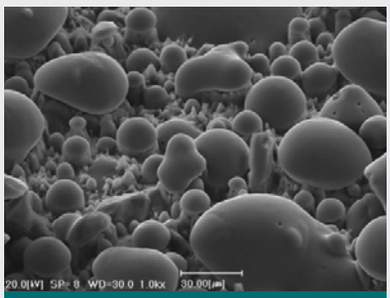
Semiconductors & Electronics

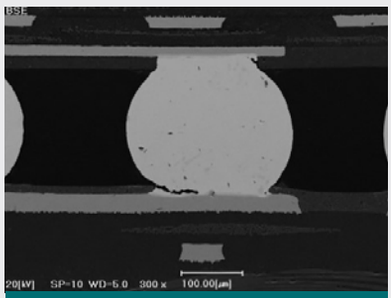
Other Images

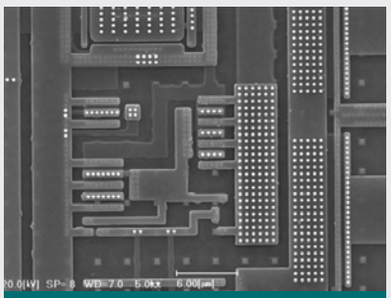

Wire bonding (x1,500)

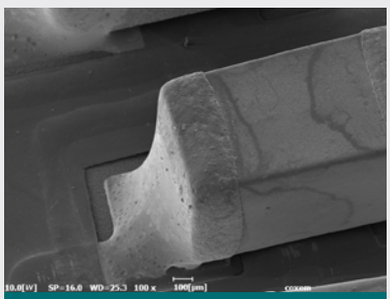

Si wafer (x1,000)

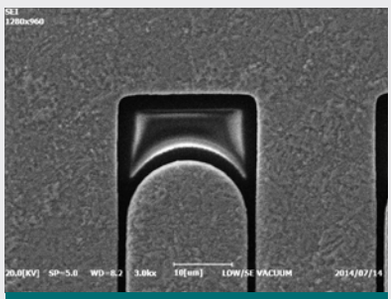

IC Chip tilted 45° (x300)

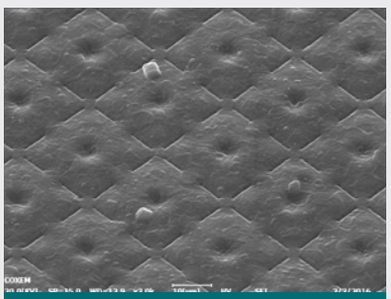

PKG epoxy (x1,000)

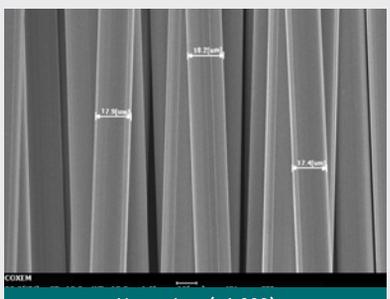

Solder ball (x300)

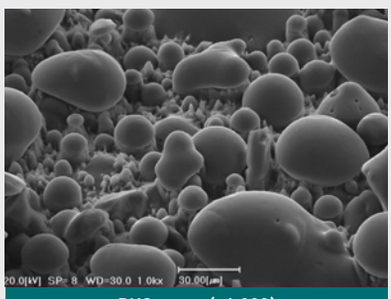

Chip layer (x5,000)

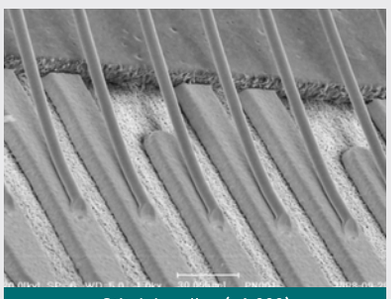

PCB mount (x100)


PCB (x3,000)


Semiconductor surface (x2,000)


Nanowires (x1,000)


PKG epoxy (x1,000)


Stitch bonding (x1,000)

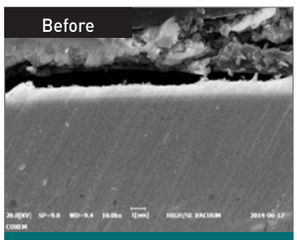
Metals

Overview

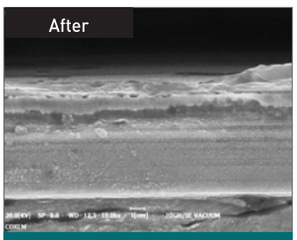
SEM can be used to assess topography of metals and related coatings. BSE mode is extremely useful in this case.

Metal with Chemical Etching

Above image is a copper sample coated with nickel and gold. Since nickel and copper have similar atomic number, it is hard to differentiate the boundary between the two. Through chemical etching, as shown in the right image, two layers can be easily distinguished. If etching is impossible, layers can be distinguished in the BSE mode.



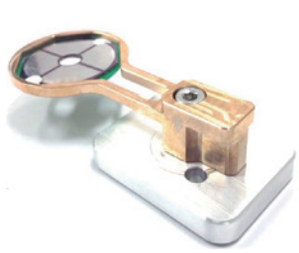
X10,000, 20kV

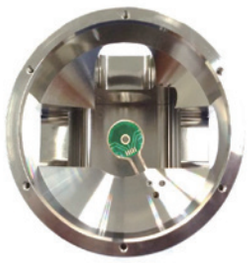


X10,000, 20kV

Back Scattered Electrons (BSE)

BSE detector can be easily integrated into COXEM's SEM. BSE imaging is as generally useful as SE imaging, especially when gathering composition and topography features of images with high atomic number contrast. For example, when viewing biological samples stained or coated with heavy metals, the BSE mode can be used to detect metals more pronouncedly than the SE mode. BSE image can be acquired at both high and low vacuum.





Metal Surface

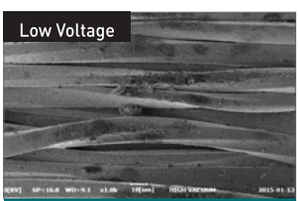
Metal objects require little special sample preparation for SEM imaging. Coating is not necessary since they are highly conductive. If the surface level is similar, particles may not be distinguished clearly. To account for this, the BSE mode can be utilized. The BSE mode detects atomic number differences on and below the surface, so high atomic number particles can be easily differentiated.

X5,000, 20kV

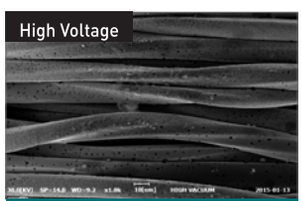
X5,000, 20kV

Poly Wire

The sample is a poly wire partially coated with copper and carbon. When the image is taken at high voltage, carbon coating cannot be viewed due to carbon's low atomic number. To account for this, accelerating voltage is lowered to see additional information on the surface. At low voltage, carbon is easily viewed, as illustrated in the left image.



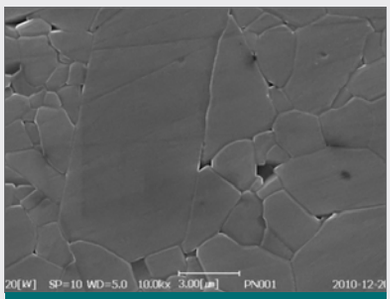
X1,000, 5kV

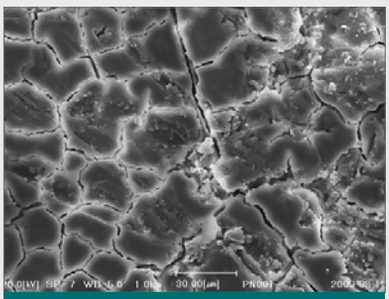


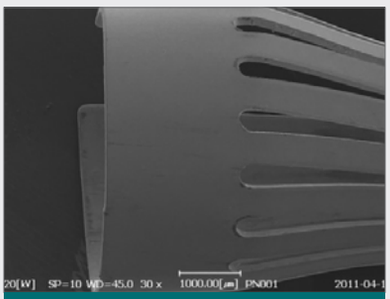
X1,000, 30kV

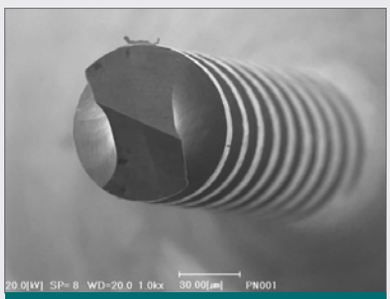
Metals

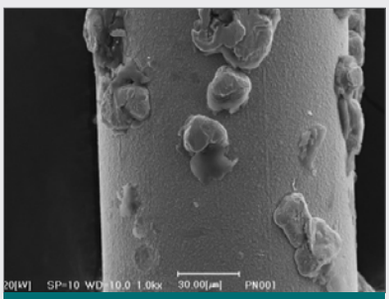
Other Images

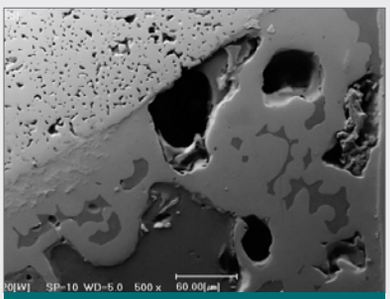

Grain boundary (x10,000)

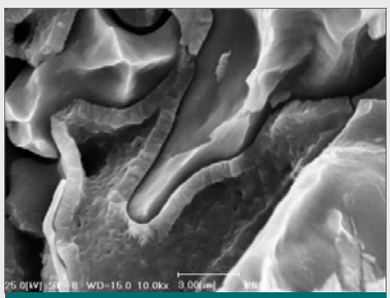

Aluminum surface (x1,000)

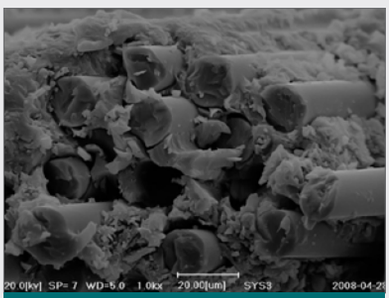

Heater (x30)

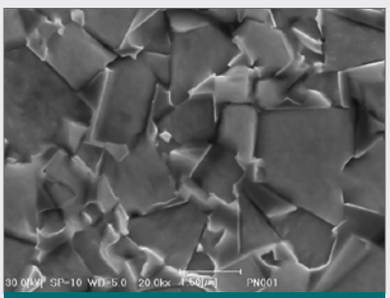

Drill (x1,000)

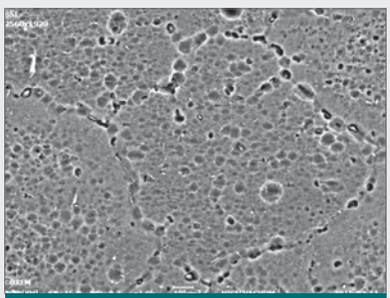

Sawing wire (x1,000)

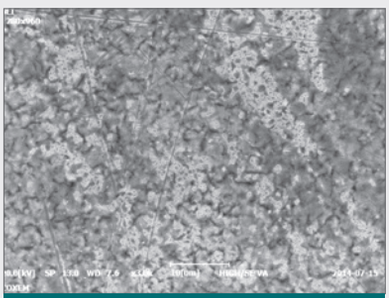

Alloy metal (x60)

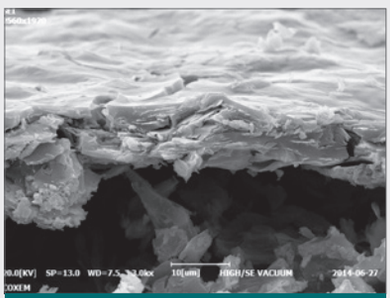

Crack (x10,000)


Metal fiber (x1,000)


Grain boundary (x20,000)


Metal grain boundary surface (x1,000)


Metal coating surface (x3,000)


Metal coating (Al, cross section) (x3,000)

Cost-Effective Normal SEM Solution

CX-200Plus

COXEM
www.coxem.com

Features

- Magnification Up To 300,000x
- Full Auto Stage (X, Y, R, T, Z Axis)
- Panorama Shot
- Click & Move Stage Control
- Auto Functions : Filament, Focus, Contrast, Brightness
- Higher Image Pixel : 5120 X3840 Pixel

Specifications

- **Magnification :** x15 ~ x300,000
- **Acc Voltage :** 1 ~ 30 kV (1kV increments)
- **Electron Gun** : Tungsten Filament (W)
- **Detector :** SE, BSE, EDS Detector (Optional)
- **Image Shift :** X, Y, R(Rotation)
- **Stage :** Auto Stage
  (X: 40mm,Y: 40mm,T: -20° to 90°, R: 360°, Z: 5 to 60mm)
- **Operating System :** Microsoft Windows 10
- **Dimensions :** 800(W) x 900(L) x 1500(H) mm
- **Weight :** 400Kg

Specifications

Items / Model	EM-30	EM-30AX	CX-200Plus
Resolution SE	5.0 nm at 30 kV		3.0 nm at 30 kV
Magnification	x15 ~ x150,000		x15 ~ x300,000
Accelerating Voltage	1 ~ 30 kV		
Vacuum Mode	High Vacuum		
	-		Low Vacuum (Optional)
EDS	Integrated (Optional)	Integrated (Standard)	External (Optional)
Maximum Specimen Size	60 mm in diameter		160 mm in diameter
Stage	3-Axes Motorized		5-Axes (Motorized)
X	0~35 mm		0~40 mm
Y	0~35 mm		0~60 mm
T	0~45°		-20~90°
Z	5~50 mm (Manual)		5~60 mm
R	360° (Raster)		360°
Observation Area	40 mm in diameter		110 mm in diameter
Maximum Height	45 mm		55 mm
Electron Gun	Pre-centered Cartridge		
Source	Tungsten		
Detector	SE		SE
	BSE(Optional)		BSE
Control	Mouse		Mouse
	Keyboard		Keyboard
	Joystick		Joystick
Auto Image Adjustment	Auto Focus		
	Auto Brightness & Contrast		
	Auto Filament		
	Auto Start		
Special Features	Multiple Sample Holder		
	Panorama Shot		
	Dual Display(SE/BSE)		
	Signal Mixing(SE+BSE)		
	Line Profile		
	Image Processing		
	Measuring tool		
	Remote Access		
	Navigation View		CCD Camera
Options	EDS	-	EDS
	BSED		Low Vacuum
	Cool Stage		Cool Stage

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