

SEM-EDS Facility

Scanning Electron Microscopy / Energy Dispersive X-Ray Spectroscopy

Scanning Electron Microscopy (SEM) allows for visual observation of an area of interest in a completely different way from that of the naked eye or even normal optical microscopy. SEM images show simple contrasts between organic-based and metallic-based materials and thus instantly provide a great deal of information about the area being inspected. At the same time, Energy Dispersive X-Ray Spectroscopy (EDS), sometimes referred to as EDAX or EDX, can be used to obtain semi-quantitative elemental results about very specific locations within the area of interest. EDS technique can detect elements from carbon (C) to uranium (U) in quantities as low as 0.1 wt%.

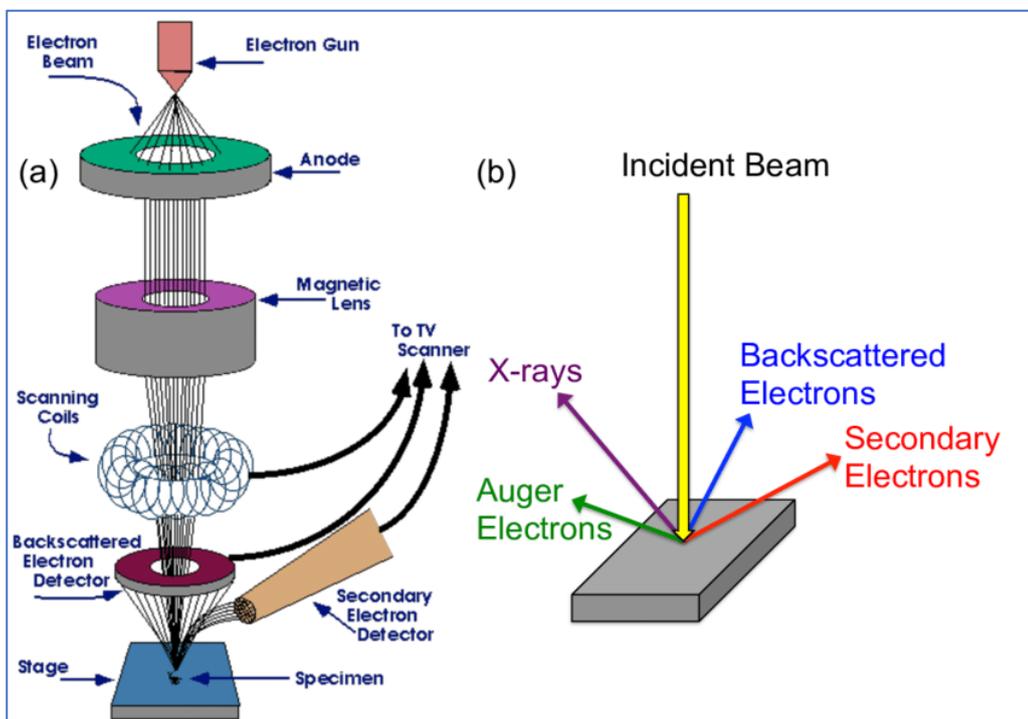


Fig: schematic of SEM

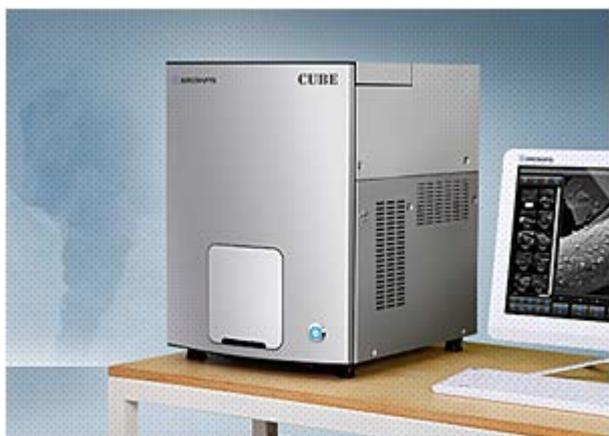


Fig: Emcraft CUBE II SEM-EDS



Fig: Gold Sputter coate

Technical Specification:

Model/Make: Emcraft CUBE II- With SED, BSED, EDS (Oxford Instruments)

Stage	5-axis Stage - X : 42mm (Motorized) Y : 42mm (Motorized) - Z : 5 ~ 53mm (Motorized) - T : -90° ~ 90° (Manual) - R : 360° (Beam Rotation)
Vacuum Mode	High Vacuum Mode ($<9 \times 10^{-3}$ Pa) Charge Reduction Mode
Vacuum System	Fully Automated Evacuation System - Turbo molecular pump (Vacuum ready within 90 sec) - Rotary vane pump - Electrical valve system
Electron Gun	Pre-centered Tungsten Filament
Detector	SE Detector 4CH BSE Detector
Resolution	5.0nm (SE Image at 30kV)
Magnification	x10 ~ x200,000
Acceleration Voltage	1kV ~ 30kV
Image Shift	100 μ m
Maximum Sample Size	Horizontal : 140mm Vertical : 80mm
Working Distance	5 ~ 53mm
Sample loading Time	90 sec (Vacuum) 10 sec (Vent)
Automatic Function	Auto Brightness & Contrast Auto Focus Auto Gun Alignment Auto Saturation Auto Filament Bias
Image Format	JPG TIFF BMP PNG
Display Mode	Focus Mode : 320 x 240 pixel, Resizable Preview Mode : 800 x 600 Slow Mode : Applicable to both preview and focus mode Photo Mode : Up to 3200 x 2400
Dimension(mm)	W x D x H = 410mm x 440mm x 520mm 65kg
Operation Device(PC)	Windows 10-based All-in-One 21.5" Workstation 100% controlled by keyboard and mouse
Optional Devices	EDS (All-in-one Model of SEM-EDS) Auto Rotation Auto Tilt Chamber Camera Navigation *Oxford, Bruker, EDAX, Thermo compatible
Power Supply	Single Phase : 100 ~ 240VAC, 50 / 60Hz, 1kVA

Applications:

SEM-EDS has been used to study microscopic properties of environmental samples such as fly ash, aerosols particles, microplastics, soil, and ore samples for their morphological and size investigations. Apart from regular environmental samples analysis existing SEM has been used in the study of the structure of micro-capillary for water filtration, nano-composites, and other applied sciences application. Few specific applications are:

- **Morphological study and elemental profiling of fly ash samples generated from Thermal power plants was carried out. Major elements Si, Al and Ca were identified using EDS.**
- **Surface morphology of microplastics in beach sand samples collected from Indian coastal area. Strong chlorine (Cl) peaks in EDS spectra are characteristics used for PVC microplastics. Other plastics items have no specific peak in X-ray spectra other than strong peak of carbon viz. polyethylene and polyethylene terephthalate.**
- **Surface characteristics of natural adsorbents for decontamination of water pollutants, ultrafiltration tubes, atmospheric particulates etc.**