

School of Basic and Applied Sciences

Course Code : BCHY2008

Course Name: Analytical Chemistry 1

Scanning Electron Microscopy

Instrumentation

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Introduction

- A Scanning Electron Microscope (SEM) is a type of electron microscope that images a sample by scanning it with a high energy beam of electrons in a raster scan pattern.
- The electrons interact with the atoms that make up the sample producing signals that contain information about the sample's surface topography, composition, and other properties such as electrical conductivity.
- Scanning electron microscopy is used for inspecting topographies of specimens at very high magnifications using a piece of equipment called the scanning electron microscope.
- SEM magnifications can go to more than 300,000 X but most semiconductor manufacturing applications require magnifications of less than 3,000 X only.

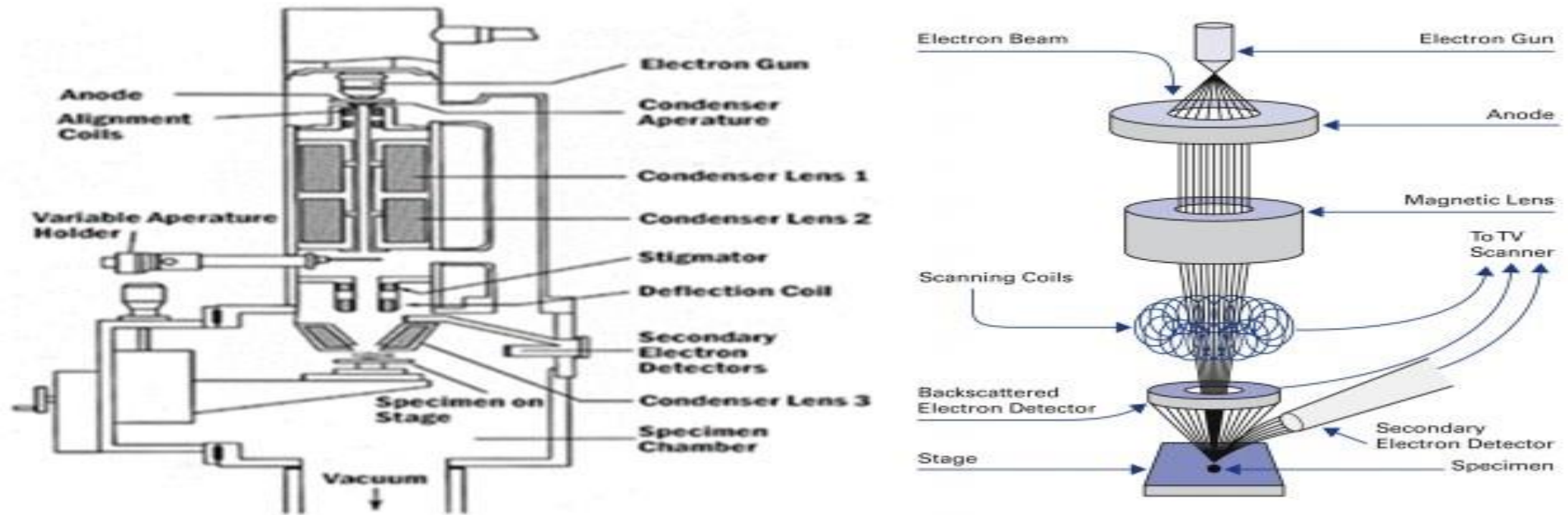
Components

- Electron gun consisting of cathode and anode
- The condenser lens controls the amount of electrons travelling down the column.
- The objective lens focuses the beam into a spot on the sample.
- Deflection coil helps to deflect the electron beam.
- SED attracts the secondary electrons.
- Additional sensors detect backscattered electrons and x-rays.

Principle

- The basic principle is that a beam of electrons is generated by a suitable source, typically a tungsten filament or a field emission gun.
- The electron beam is accelerated through a high voltage and pass through a system of apertures and electromagnetic lenses to produce a thin beam of electrons.
- Then the beam scans the surface of the specimen, electrons are emitted from the specimen by the action of the scanning beam and collected by a suitably positioned detector.

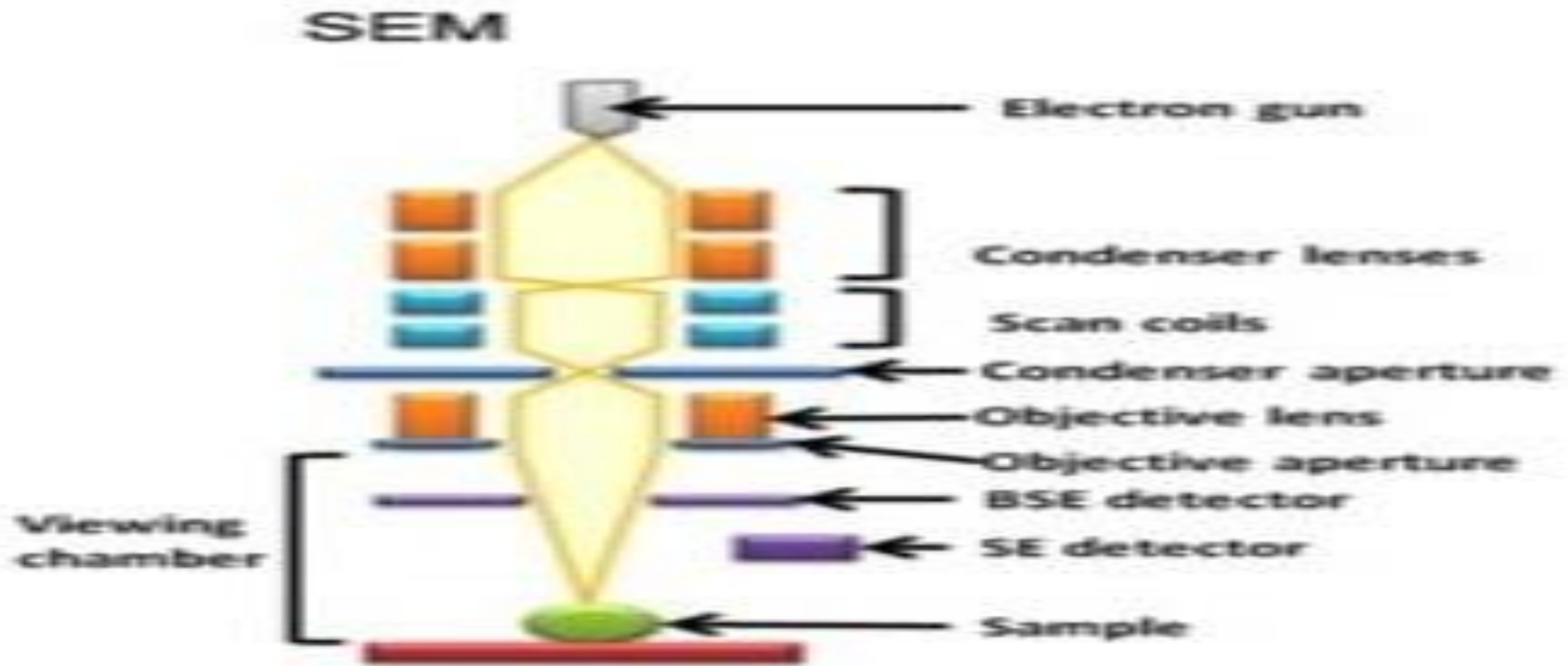
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Disadvantages

- SEMs are expensive and large.
- Special training is required to operate an SEM.
- SEMs are limited to solid samples.
- SEMs carry a small risk of radiation exposure associated with the electrons that scatter from beneath the sample surface.

Ray diagram



References

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