



Electron Microscope

Deepankar rath,
Assistant Professor,
CUTM, Rayagada

Electron microscope

- An **electron microscope** is a microscope that uses a beam of **accelerated electrons** as a source of illumination.
- The wavelength of an electron can be up to **100,000** times shorter than that of visible light photons.
- Electron microscopes have a higher resolving power than light microscopes and can reveal the structure of smaller objects



- It offers unique possibilities to gain insight into
 1. Structure
 2. Topology
 3. Morphology
 4. Composition of materials.

Advantages Of Electron Microscopy

- To study objects of >0.2 micrometer.
- For analysis of subcellular structure.
- For study of intracellular pathogens & viruses.
- For cell metabolism
- For study of minute structure in nature.

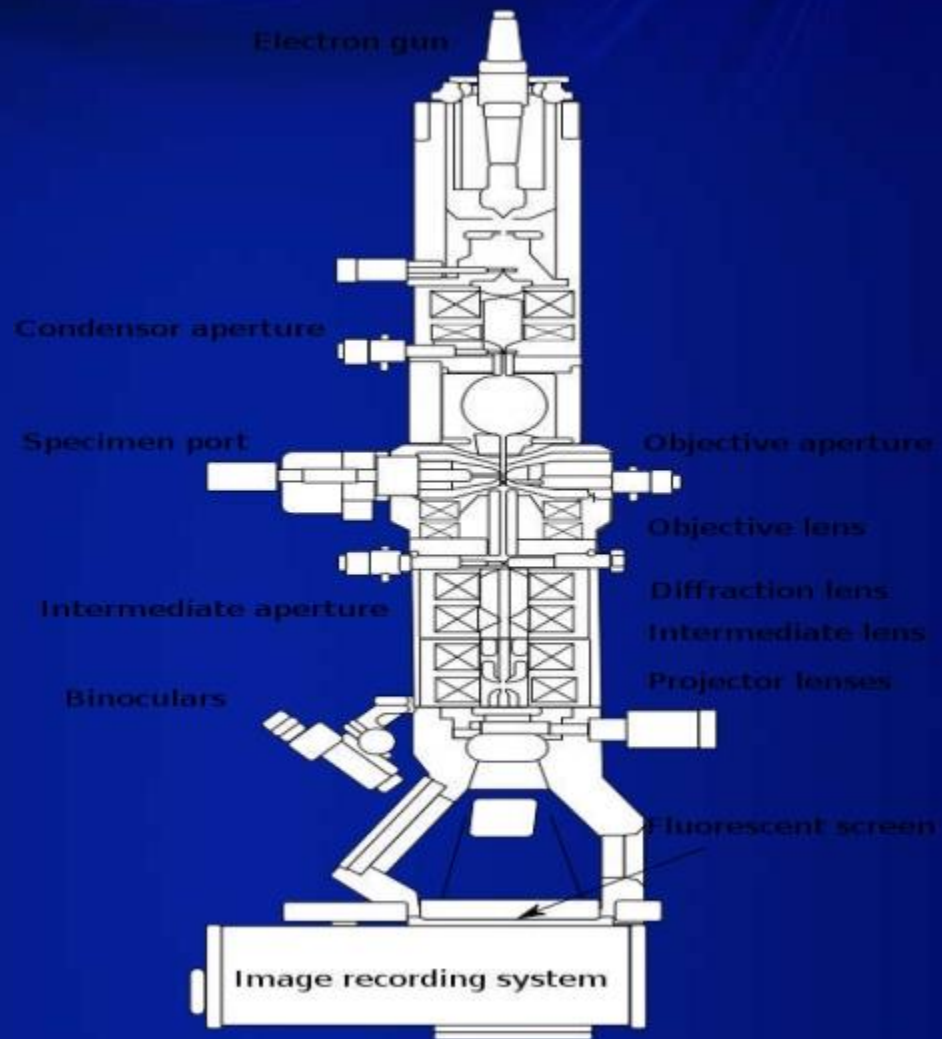
Types of Electron Microscope:

- There are basic 4 types of Electron Microscope:
 1. Analytical Electron Microscopy (AEM)
 2. Scanning Transmission Electron Microscope (STEM)
 3. Scanning Electron Microscope (SEM)
 4. Transmission Electron Microscope (TEM)

Transmission Electron microscope

- Is a microscopy technique in which a beam of electrons is transmitted through an ultra-thin specimen, interacting with the specimen as it passes through it.
- A transmission electron microscope can achieve better than 50 pm resolution and magnifications of up to about 10,000,000x





Types of TEM:

- Bright Field (BF) – BFTEM
 - Dark field (DF) – DFTEM
 - High Resolution TEM – HRTEM
 - Energy Filtered TEM – EFTEM •
- Electron Diffraction – ED

Techniques Of TEM: •

There are 4 techniques of TEM:

- Negative staining
- Shadow casting
- Freeze fracture replication
- Freeze etching.

Applications Of TEM

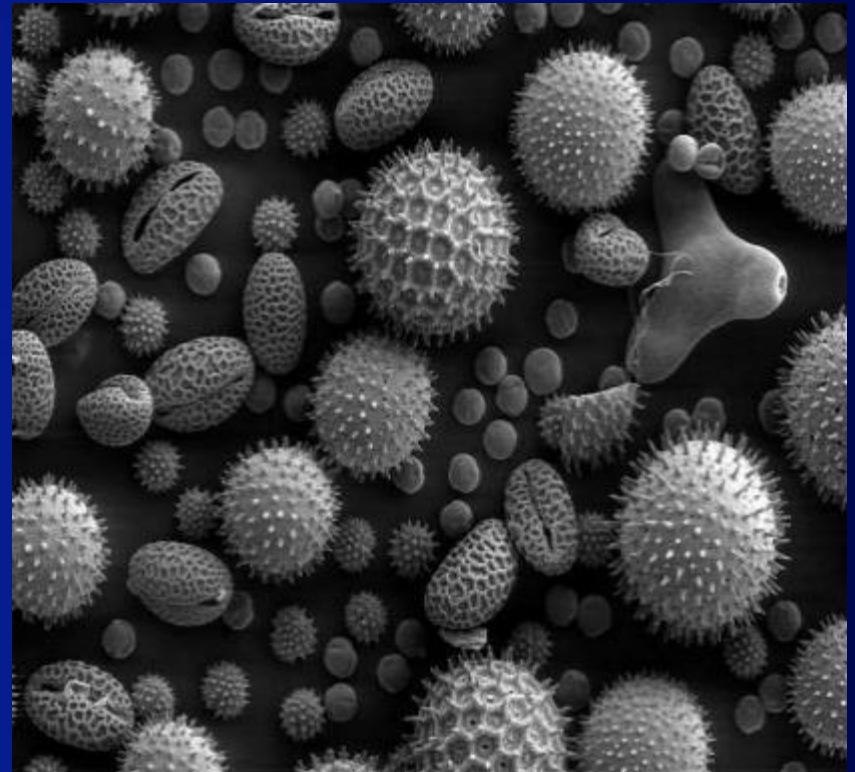
- It can be used for the study of:
 - To examine a small column of atoms.
 - Cancer research
 - Virology
 - Pollution Nanotechnology
 - Semiconductor research
 - Chemical Identity
 - Crystal orientation
 - Electronic structure

Limitations of TEM:

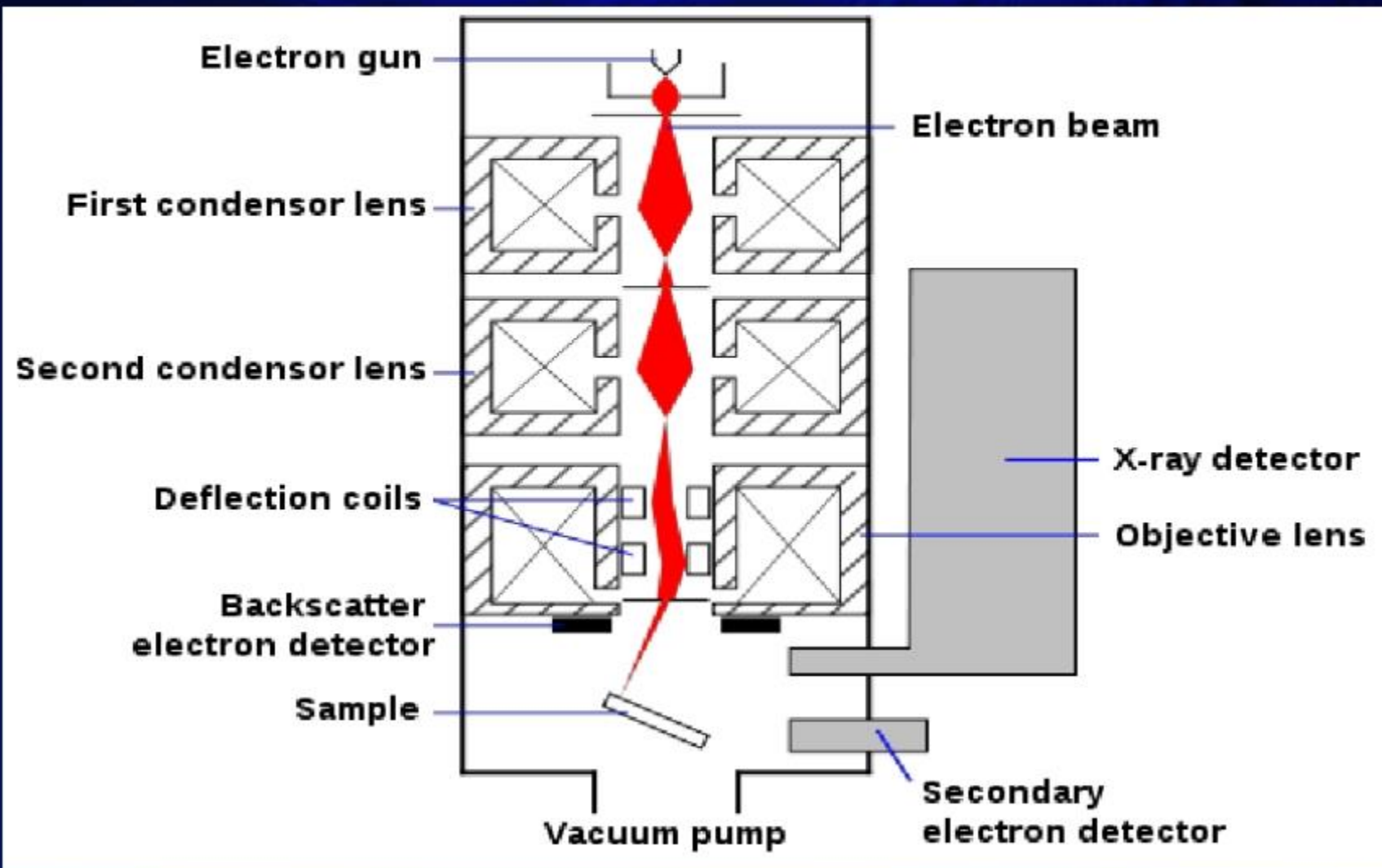
- It is difficult to produce thin sample.
- Relatively time consuming process with a low throughput of samples.
- The structure of the sample may be change during the preparation process.
- Small field of view may not give conclusion result of the whole sample.

Scanning Electron Microscope (SEM)

- A scanning electron microscope (SEM) is a type of electron microscope that produces images of a sample by scanning it with a focused beam of electrons.
- The electrons interact with atoms in the sample, producing various signals that contain information about the sample's surface topography and composition.



- Types of signals produced by a SEM include:
 - Secondary electrons
 - Back scattered electrons (BSE)
 - X-rays
 - Light rays
- A standard SEM uses secondary electrons & back scattered electrons.



Advantages of SEM:

- Better resolution.
- Work with low voltages.
- High brightness source.
- Fast imaging.
- High count rates in X-ray analysis.
- Easy to operate.

Applications of SEM:

- Use in ultra high vacuum, air, water & various liquid environment.
- Use for the live specimen examination.
- Use for the visualization of intra cellular changes.

Limitation of SEM:

- It cannot detect very light element (H, He & Li).
- It cannot detect elements with atomic numbers less than 11.



THANK YOU