Electron microscopy/function

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Checked version of the article can be found here (https://www.wikilectures.eu/index.php?title=Electron_microscopy/function&oldid=18565).

See also comparation of actual and checked version (https://www.wikilectures.eu/index.php?title=Electron_microscopy/function&diff=-&oldid=18565).

Function

- In contrast with the light microscope, the electron microscope uses an electron beam that interfere with the specimen (biological or inorganic) placed in the tube.
- They are frequently used to examine cells, microorganisms, metals, crystals and biopsy samples.
- This type of microscope can reveal a wide variety of information about a specimen including:

  — morphology
  — crystallographic information
  — compositional information
  — topography

Uses

- Electron microscopes are valuable tools in medical and biological fields, as well as in the industry for materials research. Almost all scientific fields can use electron microscopes.
- The most common fields of study include:

  — biology
  — medicine
  — chemistry
  — forensics

EM Application

Biology and Medicine	Industry
Diagnostic electron microscopy	Particle detection and characterization
Cryobiology	Direct beam-writing fabrication
Protein localization	Dynamic materials experiments
Electron tomography	Sample preparation
Cryo-electron microscopy	Forensics
Toxicology	Mining (mineral liberation analysis)
Biological production and viral load monitoring	------
Particle analysis	------

Types

A. Transmission Electron Microscope

The transmission electron microscope (TEM) uses a high voltage beam of electrons to create an image of a specimen. The electrons emitted by an electron gun are accelerated, focused and transmitted through a partially transparent specimen. The beam then emerges from the specimen and carries information to the objective lens where magnification occurs. Photographic recording of the image can also occur by exposing film directly to the beam. TEMs can yield information about the morphology including size, shape and arrangement of particles. They

can also relay crystallographic information for example the arrangement of atoms and their degree of order, compositional information (relative ratios of the elements and compounds or defects in areas as small as a few nanometers).

B. Scanning Electron Microscope

Unlike the TEM, the scanning electron microscope (SEM) makes an image by using the electron beam that scans the specimen across a rectangular area. Known as raster scanning, the electron beam loses energy as it scans each point on the specimen. This lost energy is converted into heat, light and secondary electron emission. The display maps these varying intensities into an image relying on surface properties rather than transmission. While an SEM produces an image with a slightly lower resolution, it can analyze larger specimens and can produce great representations of 3D shapes. Like the TEM, a SEM can present information about morphology, composition and crystallography. However, they are limited to looking at composition in areas of one micrometer and degrees of order on single-crystal particles of greater than 20 micrometers. In addition, a SEM can also yield information about topography,the surface features and texture, down to a few nanometers.

Links

References

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