دانشگاه شیراز
Department of Materials Science and Engineering

SCANNING ELECTRON MICROSCOPY LABORATORY

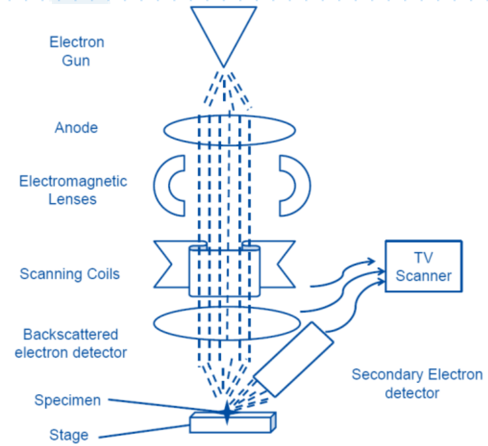
Shiraz University, Department of Materials Science and Engineering

ANALYTICAL INSTRUMENTS

Scanning electron microscopy

Introduction

Scanning electron microscope (SEM) is one of the common methods for imaging the microstructure and morphology of the materials. In SEM, an electron beam with low energy is radiated to the material and scans the surface of the sample. Several different interactions occur as the beam reaches and enters the material, which lead to the emission of photons and electrons from or near the sample surface. In order to form an image the receiving signals produced from the electron–sample interactions are detected with different types of detectors depending on the mode of SEM being used. Different modes of SEM exist for characterization of materials (including biomaterials) such as the X-ray mapping, secondary electrons imaging, backscattered electrons imaging, electron channeling, and Auger electron microscopy. This method has many advantages over traditional microscopes. The SEM has a large depth of field, which allows more of a specimen to be in focus at one time. The SEM also has much higher resolution, so closely spaced specimens can be magnified at much higher levels.



Schematic of SEM operation

Shiraz University, Department of Materials Science and Engineering

Scanning electron microscopy

Introduction

Because the SEM uses electromagnets rather than lenses, the researcher has much more control in the degree of magnification All of these advantages, as well as the actual strikingly clear images, make the scanning electron microscope one of the most useful instruments in research today

Device: Scanning electron microscopy

Manufacturer: *LEICA CAMBRIDGE INSTRUMENTS / S360*

This lab is equipped with a SEM with the following technical specifications.

Technical specifications

Magnification	**5-50,000**
Accelerating voltage	**High: 4-30 kV**
	Low: 0.3-3 kV
Resolution capability	**5 nm**

***Detecting both backscattered and secondary electrons**

*** Stage movement along X, Y, and Z directions**

*** Tilt -10° to 90°**

*** Rotation by 360°**

Non-Analytical Instruments

Device: Plasma sputtering

Manufacturer: *NANO-STRUCTURED COATINGS CO./DSR1*

SEMs can image all kinds of samples: ceramics, metals and alloys, semiconductors, polymers, biological samples, and much more. However, certain types of samples are more challenging and require an extra step as the sample is prepared to gather high-quality information. This extra step involves coating the sample with an additional thin layer of about 10 nanometers (nm) of a conductive material such as gold, silver, platinum, or chromium. Due to their high conductivity, coating materials can increase the signal-to-noise ratio during SEM imaging and therefore produce better quality images. This lab is equipped with a **plasma sputtering** device with the following characteristics.

Technical specifications

Possible target material	**Au, Pd, Pt, Pd**

*** Control coating rate to achieve finer grain structures**

*** Control coating rate to achieve finer grain structures**

*** Manual or automatic Timed and Thickness sputtering**

Shiraz University, Department of Materials Science and Engineering