Scanning Electron Microscope (SEM): A Powerful Tool for Unveiling the Microscopic World

The scanning electron microscope (SEM) allows us to observe the world in a level of detail that was previously unattainable. SEMs scan a sample's surface with a concentrated electron beam to create high-resolution images. SEM images can be used to examine a variety of materials, including biological tissues, metals, ceramics, and polymers.

**How does a scanning electron microscope work?**

A beam of electrons is focused onto the surface of a sample by a scanning electron microscope (SEM). Secondary electrons are created as a result of interactions between the electrons and the sample's atoms. Secondary electrons are those that the primary electron beam has thrown out of their initial orbits.

A detector gathers the secondary electrons and uses them to build an image of the sample. Each pixel's brightness in the image is related to the quantity of secondary electrons that were gathered there.

**[What is the scanning electron microscope used for](https://www.creative-biostructure.com/scanning-electron-microscope-service.htm)?**

* Metals: study the microstructure of metals, such as grain size, grain boundaries, and precipitates, developing new metal alloys with improved properties.
* Ceramics: research into the microstructure of ceramics, including the size and distribution of pores and grains, can aid in the creation of new ceramics with enhanced strength, durability, and other qualities.
* Polymers: study the morphology of polymers, such as the size and distribution of crystallites and amorphous regions. Develop new polymers with improved properties, such as strength, toughness, and flexibility.
* Biological tissues: study the morphology of biological tissues, such as the structure of cells, tissues, and organs. Diagnose diseases and to develop new treatments.

**[Sample preparation for scanning electron microscopy](https://www.creative-biostructure.com/scanning-electron-microscope-service.htm)**

SEM samples must be electrically conductive in order to produce images of high quality. There are numerous ways to prepare samples for SEM, depending on the type of sample and the desired outcome.

**Common sample preparation steps include:**

1. Cleaning: To get rid of any dirt, dust, or other contaminants, samples should be cleaned. Numerous techniques, including ultrasonic cleaning, solvent cleaning, and plasma cleaning, can be used to accomplish this.
2. Coating: In order to conduct electricity, samples must be coated with a thin layer of conductive metal, such as gold, platinum, or palladium. Numerous techniques, including sputter coating, thermal evaporation, and electroless plating, can be used to accomplish this.
3. Mounting: Samples must be mounted on a support, such as a stub. Typically, conductive epoxy or double-sided carbon tape are used for this.

**Specific sample preparation steps may vary depending on the type of sample:**

* Biological samples: Before using a SEM to image biological samples, they must be fixed and dehydrated. A number of techniques, including critical point drying, freeze-drying, and chemical fixation, can be used to accomplish this.
* Non-conductive materials: Before SEM imaging, non-conductive materials such as polymers and ceramics must be coated with a conductive material. This can be accomplished through a variety of techniques, including sputter coating, thermal evaporation, and electroless plating.
* Metallic samples: Before SEM imaging, metallic samples may need to be polished to remove any surface flaws. Many polishing methods, including mechanical polishing and electrochemical polishing, can be used to accomplish this.

Once the sample is prepared, it is placed in the [SEM](https://www.creative-biostructure.com/scanning-electron-microscope-service.htm) chamber and imaged. The SEM beam scans the surface of the sample and produces an image based on the secondary electrons that are emitted.

**Conclusion**

The scanning electron microscope is a very potent tool that gives us access to a level of world detail that was previously unattainable. SEMs are used to study a wide variety of materials in a variety of industries and research fields. SEM technology is always evolving, and SEMs are becoming more powerful tools.