ELECTRON AND ION BEAM MICROSCOPY

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The ability to image, characterize, analyze and manipulate objects at the nanoscale requires precision instruments. Nanoscale analysis typically requires the use of Electron or Ion beam microscopy. Today, nanoscale analysis is becoming commonplace and electron and ion beam microscopes are the precision instruments which enable company's to search for lighter, stronger, safer materials, more efficient fuels and fuel cell technologies, faster more efficient chip technologies and more efficient products that are used by consumer's everyday.

Several variations of electron microscopes exist. These include scanning electron, transmission scanning electron, and transmission electron microscopes. We will examine each of these briefly. In addition, we will discuss focused ion beam microscopes and there uses. In addition there is the entire field of detector technology for the creation of images. This includes the detection of secondary electrons, back scattered electrons, Auger electrons and secondary ions. What usually determine the final vacuum level inside the chamber is a combination of the detector, the charged particle beam used and the application e.g. in surface analysis higher vacuum is required.

Advanced vacuum technology is required to move samples in and out of vacuum in a rapid and efficient manner. Load locks and both in-air and in-vacuum robots are being used.
Several pump technologies are used to create good vacuum fast, such as mechanical pumps, turbo pumps and ion pumps.

The area of "low vacuum" technology to view "wet" samples is receiving more attention as more biology samples are being viewed in today's electron microscopes.

Dual beam systems composed of high end scanning electron and focused ion beams provide more advanced analysis flexibility, characterization, and manipulation capability. The ion beam allows the machining of samples to cut cross sections of samples to facilitate manufacture of nano and micro scale parts. These dual beam microscopes require high vacuum, clean vacuum chambers, precision multiple axis stages, extremely low vibration and low acoustic performance, as well as sample automation. We will discuss these challenges and present commonly used solutions to each. Finally, we will close with open issues for the future which are in need of solutions.