# Electron Microscopy: A versatile Technique for Material Characterization

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Electron microscopy, which overcomes the inherent resolution limit of the light microscope by using the wavelength of electrons, is a versatile technique for examining the extremely fine detail or ultrastructure of material. Electron microscopes are used in a variety of fields, including biology, materials science, and nanotechnology, to study the structure and properties of materials at a very small scale. There are several types of electron microscopes, including transmission electron microscopes, scanning electron microscopes, and scanning transmission electron microscopes, each of which has its own unique set of capabilities and applications. The scanning electron microscope is so named because a fine probe of electrons is scanned across the surface of a specimen to generate an image with a three-dimensional appearance. In the transmission electron microscope, the electrons are transmitted through the specimen to reveal a two-dimensional image of the interior of cells. Although these instruments operate in completely different ways, both use the accelerated electrons and electromagnetic lenses to generate images. The high spatial resolution of SEM and TEM, from nano- to microscale in both imaging and chemical characterization modes, is highly complementary to other non-destructive materials characterization techniques . The talk will cover the basic principles underpinning the use of electron microscopy and give an overview of the core methodologies available in SEM and TEM. The range of useful signals generated by electron–matter interactions will be discussed. The application SEM and TEM to the evaluation of key microstructural features of materials including surface topography, grain size, and local chemistry and an overview of the applications will be given.