YY5.05

A New Method for Enhancing the Resolution of Low Voltage Scanning Electron Microscope Images

Eric Lifshin
College of Nanoscale Science and Engineering, University of Albany, Albany, NY, USA

The creation of high spatial resolution scanning electron microscope (SEM) images has been a major goal of instrument developers since the first commericial SEM's were introduced in the mid-1960's. The major strategy to achieve this goal has been the production of electron beams of smaller and smaller size that would have sufficient probe current to generate a statistically significant signal above the inherent noise in a reasonable time. Over time, it was recognized that conventional tungsten and lanthanum hexaboride sources were limited by both source brightness concerns and chromatic aberrations and the field moved to cold field emission and Shottky sources since they have high brightness and low chromatic aberrations. As the gun potentials used to extract the electrons are high, methods were developed to de-accelerate the electrons prior to striking the sample to acheive low voltage operation and a small spot size. In the research described here it will be shown that conventional sources can be used to obtain high resolution low voltage images by using relatively large probes typical of conventional sources at low voltage . This is accomplished by using a series of images combined with a knowledge of the point spread function of the electron beam. The combination of these factors with a new image processing algorithm makes it possible, in principle, to determine intensity data from regions considerably smaller than the electron beam size. This is particularly interesting when used with conventional sources since they are capable of producing much larger probe currents at the sample than field emission sources. Thus, a lot of data can be collected quickly and processed. Examples of this new method as well as the underlying theory will be presented.