

## MATERIALS CHARACTERIZATION USING THE NEW LEO 1530VP-FESEM

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In order to examine nonconductive samples in their natural state (i.e. without significant sample preparation) at high resolution in the SEM, the technique of low voltage field emission scanning electron microscopy (LVFESEM) is used. Due to the limitation in accelerating voltage ( $U < 1$  kV) this technique is limited in respect of chemical analysis. Furthermore it is not possible to examine humid and out gassing samples in high vacuum. In recent years the application of variable pressure scanning electron microscopes (VPSEM) became an important technique in materials science as well as in life science. Due to the capability of maintaining a high chamber pressure humid, out gassing and non-conductive samples can be examined in their natural state without significant sample modification or preparation. The new LEO 1530VP FESEM is a high-resolution field emission electron microscope combining low voltage and variable pressure capabilities.

The variable pressure capabilities can be achieved by setting up a differentially pumped column. The ultra-high vacuum of the gun is maintained by using two ion getter pumps (IGP). The lower part of the column is pumped by a turbo molecular pump (TMP). Under high vacuum conditions the chamber is also pumped by the TMP. Under variable pressure conditions the chamber is isolated from the TMP by a separation valve. The chamber is directly pumped using an oil free rotary pump. The chamber pressure can be fine tuned by a mass flow controller. This results in a pressure gradient ranging from 0.01 mbar in the chamber up to  $10^{-9}$  mbar in the gun region. A graphical 32-bit software based on a Windows TM 98 or Windows TM NT 4.0 operation system controls the fully automated vacuum system. The microscope can be used without any restrictions in high vacuum or variable pressure mode just by mouse clicking a software switch.

Multiple detectors are available in high vacuum and variable pressure mode in order to obtain high-resolution images:

In high vacuum mode an in lens-detector, an Everhart-Thornley-detector and a choice of backscattered detectors can be used. The in lens-detector operates best for low voltage imaging resulting in highly resolved surface images of even insulating materials. In addition the Everhart-Thornley-detector detects the topography of the sample. Chemical composition can be imaged by backscattered detectors.

In variable pressure mode a LEO patented VPSE detector and a choice of backscattered detectors can be used. The VPSE detector detects secondary electrons, which results in a high-resolution image of the sample topography under variable pressure conditions. The backscattered detector operates like in the high vacuum mode. In addition all detector signals can be electronically mixed in both vacuum modes.

Due to the geometry of the LEO 1530VP chamber it is possible to run analytical instruments like EDS, WDS and EBSP parallel without restrictions in high vacuum and variable pressure mode.

