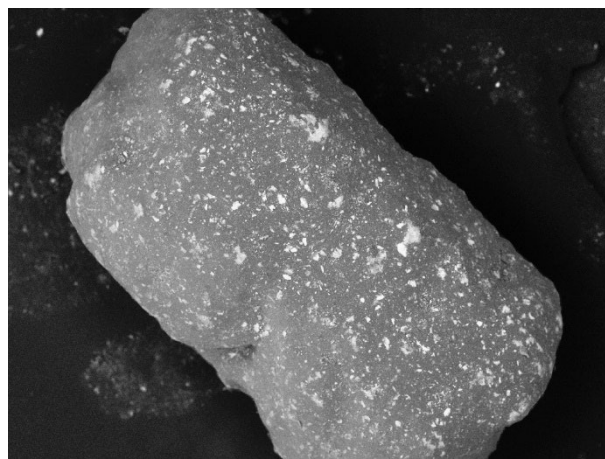
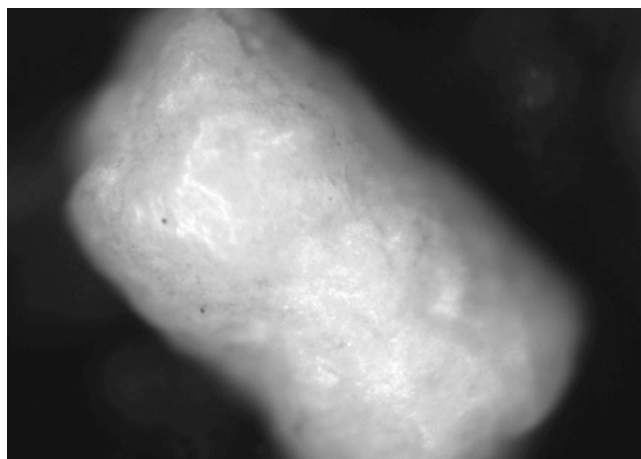


## Advantages of Benchtop Scanning Electron Microscopy vs. Optical Microscopy for Pharmaceutical Applications

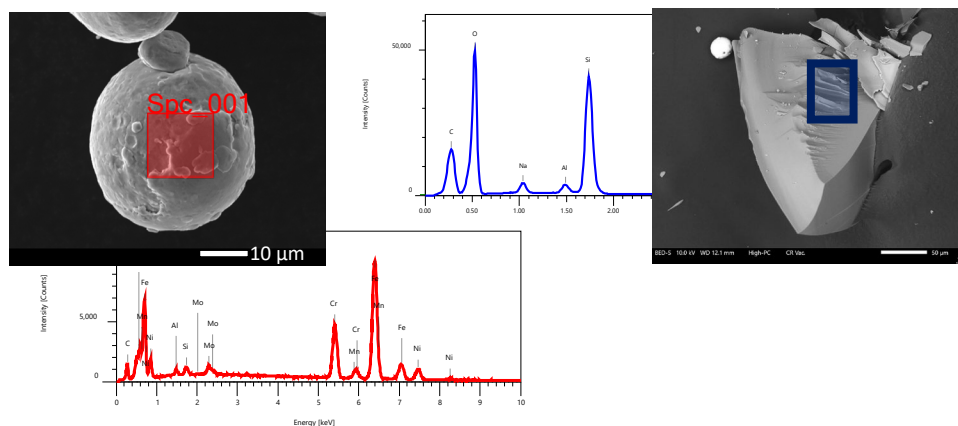


*Optical microscope image (left) vs. Scanning Electron Microscope (SEM) image (right) of pharmaceutical tablet.*

Throughout the discovery and manufacturing phases of bringing pharmaceuticals to market, scanning electron microscopy (SEM) plays a pivotal role in design and quality control. For visual inspection, the benchtop SEM far surpasses the capabilities of traditional optical or light microscopy with its large depth of field and functionality.

### Quality Imaging and Resolution

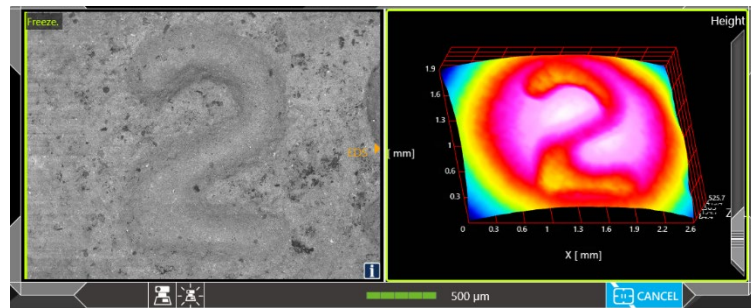
With SEM it is possible to observe the compositional contrast that cannot be seen on an optical image. Examination of a pharmaceutical tablet or powder sample in the benchtop SEM reveals greater detail and compositional contrast than can be achieved with optical microscopes, even at the same magnification. With magnification up to 100,000X and versatile, automated settings, the SEM makes it possible to easily inspect the microstructure of tablets and powders, textures and coatings, foreign particles, and their chemical composition. Using the benchtop SEM, it is possible to identify the source of contamination from manufacturing processes.



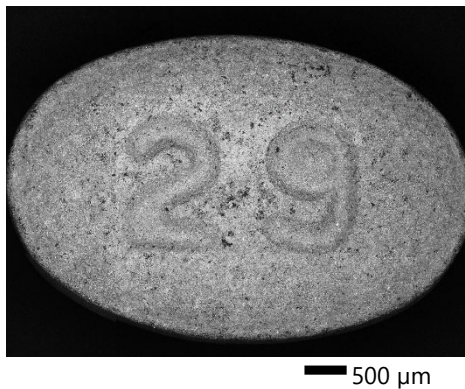
*SEM Image and EDS Analysis of Foreign Particle Contaminants (Metal and Glass)*

The JEOL benchtop SEM offers 100,000X magnification and selectable settings for imaging: backscattered electrons to reveal morphology and topography and give insight as to composition, or secondary electrons to reveal surface topography.

Adding to these characterization capabilities, the JEOL NeoScope SEM has a 3D imaging feature for surface reconstruction using the multi-segmented BSE detector and automated montage for high resolution view of a larger area.

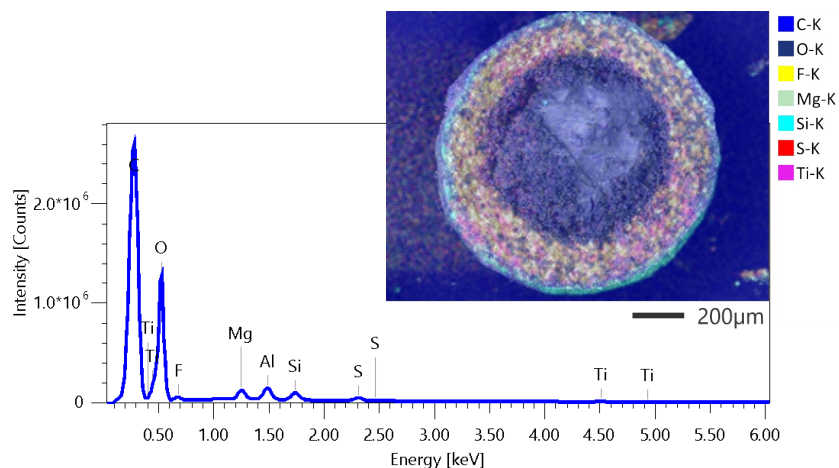


*Live 3D Surface Reconstruction – Pharmaceutical Tablet*



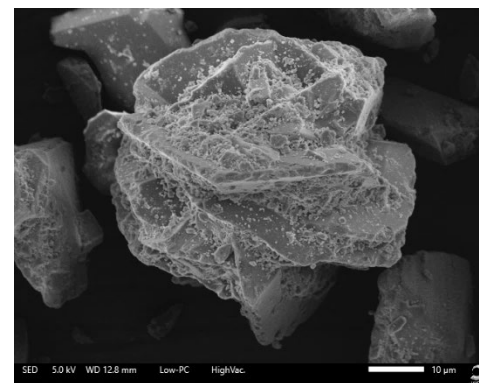
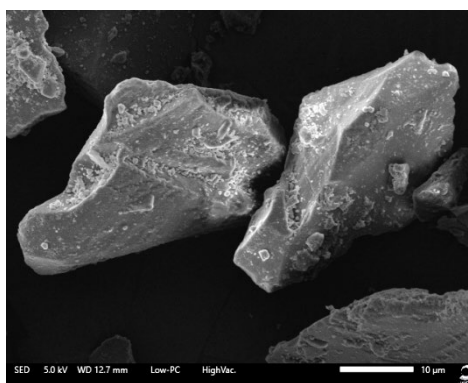
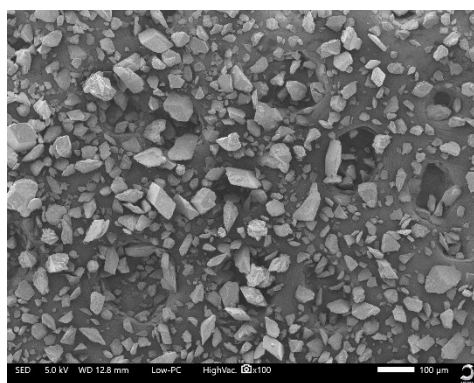
*Specimen: Pharmaceutical Tablet  
Montage – Composite Image  
Signal BED-C  
Landing Voltage 10.0 kV  
FOV 5.803 x 4.352 mm  
Number of Fields 4 x 4  
Field Magnification x75*

When configured with analytical capabilities, the SEM conducts real-time chemical analysis using Energy Dispersive Spectroscopy (EDS). The operator can view EDS spectra in real time, set the analysis points, areas of interest, and map position.



*EDS composite map of elements in Lantoprazole, a heartburn medication.*

In most pharmaceutical products, drug molecules are present in a particulate, crystalline form. The Benchtop SEM can analyze the size, shape, purity, and other characteristics of a drug crystal to help predict its behavior in large-scale production. The characterization of these crystals can be used to guide the optimization of process parameters, minimizing manufacturing costs.



*Insulin particles Au coated and imaged with the JEOL NeoScope Benchtop SEM.*

JEOL's NeoScope Benchtop SEM features simple navigation software, auto functions, selectable High and Low Vacuum modes, and integrated management of data collected through imaging and elemental analysis.



*JEOL 4<sup>th</sup> generation NeoScope Benchtop SEM.*

With the JEOL NeoScope Benchtop SEM, pharmaceutical companies gain a robust and versatile tool for analyzing substance morphology, topography and composition right from within their own laboratory environment. The small footprint and intuitive operation make it easy for any lab personnel to conduct the high resolution imaging and analysis that only an SEM can deliver.