

## SCANNING ELECTRON MICROSCOPY

Scanning Electron Microscopy is a well-established technique for the examination of solids at magnifications from 10x to 300,000x with spatial resolution as high as 4 nm and with excellent depth of field. When equipped with an X-ray Energy Dispersive Spectrometer, a Scanning Electron Microscope becomes an excellent micro-chemical analysis tool.

In a Scanning Electron Microscope an electron beam is focused onto a fine spot and scanned across the specimen in a TV-like raster by the action of scanning coils. A number of interactions occur when the primary electron beam strikes the specimen surface. The interactions of most common interest are:

1. Generation of secondary electrons
2. Back scattered primary electrons
3. X-ray emission

The first two interactions produce images of the specimen. Secondary electrons yield contrast based on morphology and backscatter electrons yield contrast based on atomic number. X-rays are used for micro-chemical analysis (MCA). The MCA equipment used permits simultaneous detection of all elements present with atomic numbers between Z=4 (B) and Z=99 (Es) with a minimum detectable limit of about 1 %. The combination of scanning and MCA can be used to produce x-ray maps that show the physical location/distribution of elements in the sample with a spatial resolution of 1.0  $\mu\text{m}$ .

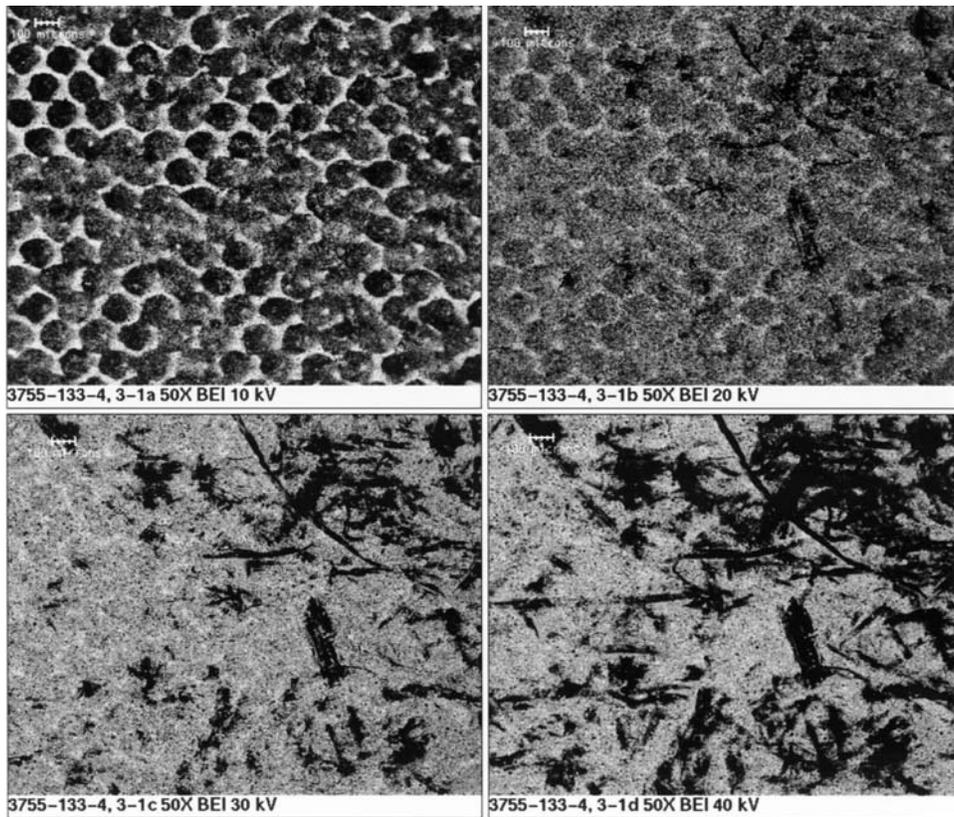
The uses of the SEM/MCA are many and varied.

1. Steel inclusion chemistry
2. Particle morphology, size, and, agglomeration and morphology
3. Failure analysis
4. Filler distribution in paper and polymers
5. Fiber Coverage
6. Surface structure and morphology
7. Stereo Imaging
8. Image Analysis

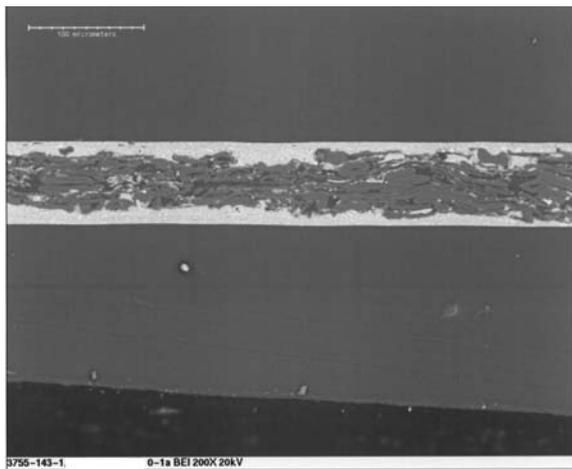
Sample size: 1mg fine powders; 1/2 sheet of paper; small bulk samples approximately 25 mm x 25 mm x 1 mm thick

Turnaround: Typically 2 weeks but can vary with the number of samples submitted and other priority samples in the queue.

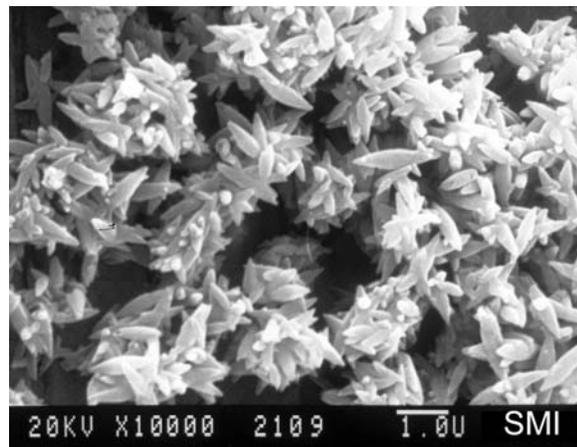
Some example micrographs:



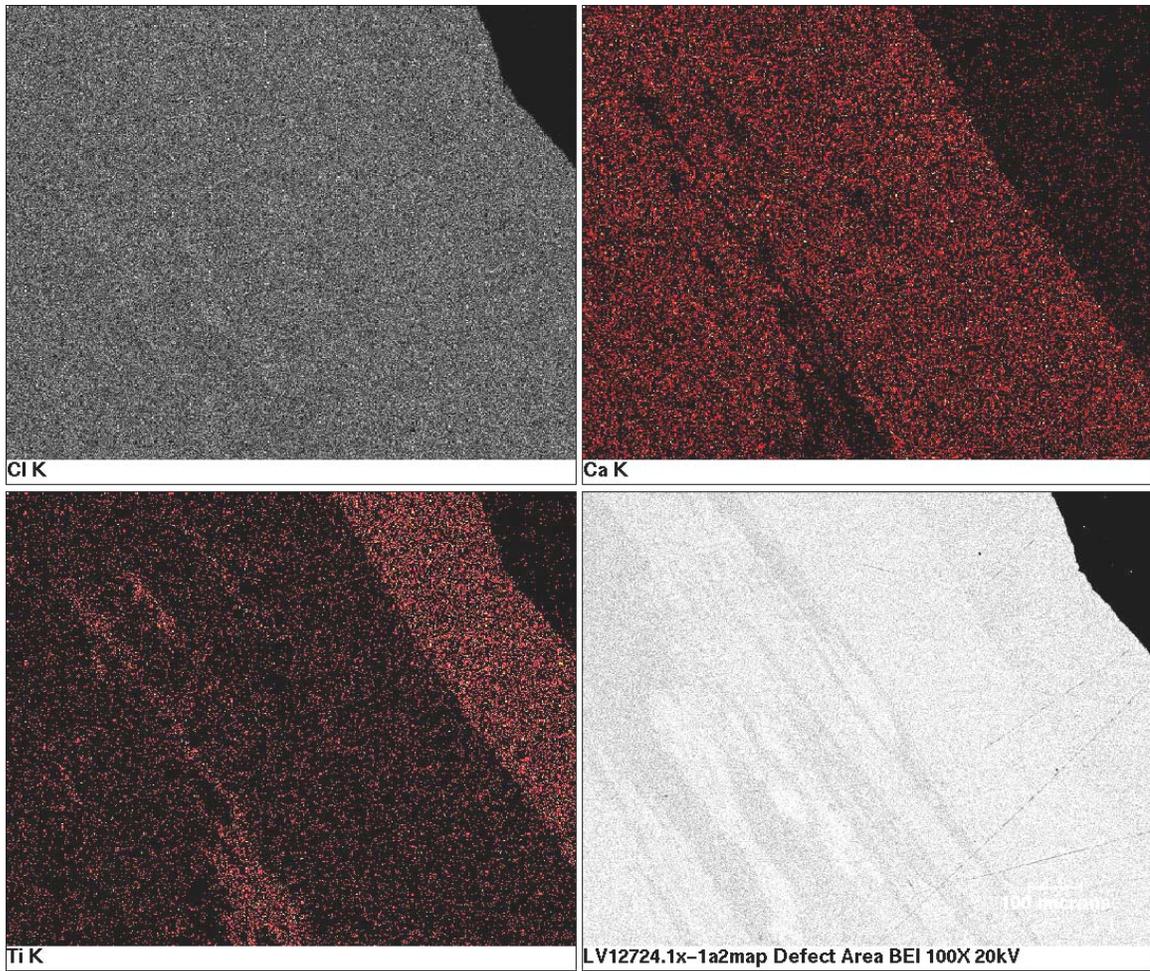
SEM surface BEI of printed paper at different kV. All images are from the same area.



SEM Cross-sectional BEI of coated paper



ALBACAR® HO PCC



X-ray Elemental Map for Chlorine (Cl), Calcium (Ca) and Titanium (Ti)  
in PVC

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