

## **FIELD EMISSION SCANNING ELECTRON MICROSCOPY**

Field Emission Scanning Electron Microscopy (FESEM) is similar to SEM (see **Scanning Electron Microscopy**) except a field emission gun (FEG) generates an electron beam current greater than a conventional (thermionic) SEM that permits high-resolution (1 nm) imaging and X-ray analysis at high magnification. X-ray spatial resolution depends on primary beam energy (operating voltage) and sample chemistry. Similar to a conventional SEM, X-ray analysis has a minimal detectable level of about 1 weight %.

### **Instrumentation:**

#### Zeiss Supra 40 VP:

- In-Lens secondary electron detector (InLens) for high resolution imaging;
- Conventional E-T secondary electron detector (SE2) for “3D” morphology contrast;
- Backscatter electron detector (BSE) for atomic number contrast;
- Variable pressure secondary electron detector (VPSE) for imaging un-coated, non-conductive samples;
- Scanning transmission electron microscope detector (STEM) for imaging TEM type materials;
- Computer controlled for automated operation.

#### EDAX Pegasus Integrated System:

- Genesis X-ray Energy Dispersive Spectrometry;
- TSL Electron Backscatter Diffraction (EBSD);
- Column control of FESEM for automated operation.

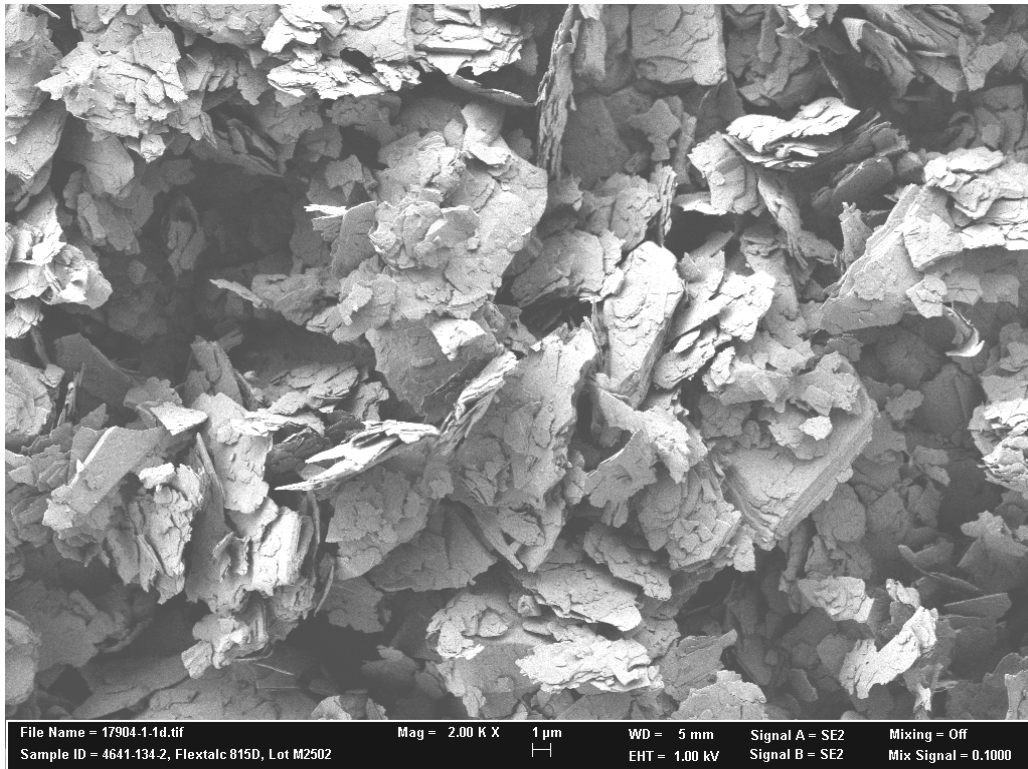
### **Capabilities of FESEM and XEDS/EBSD:**

- High resolution (1 nm) imaging of particles and structures;
- Enhanced surface structure imaging with low, < 1 kV, beam energy;
- Identification of coating surface pores and binder;
- Compositional imaging;
- Simultaneous high resolution FESEM and STEM imaging;
- Automated particle analysis;
- Crystalline structure phase identification;
- Grain size, orientation and texture;
- Automated image and X-ray map collection with image stitching;
- Microstructure quantification with image analysis.

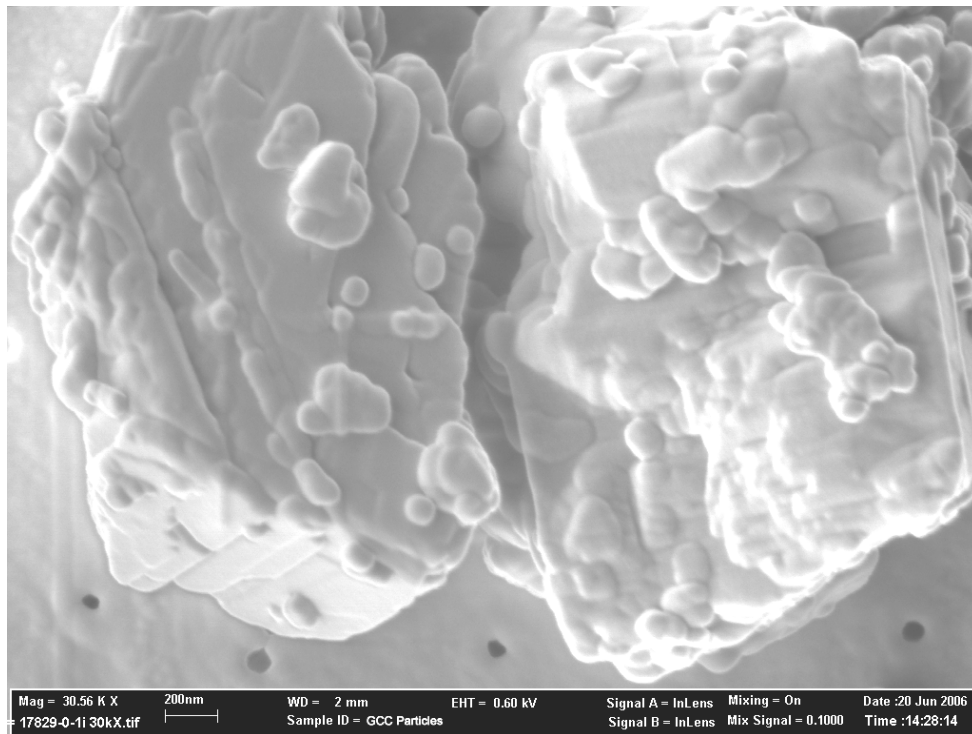
**Sample size** – 100 mg powders or small bulk samples approximately up to a 20 mm cube. Samples preparation, sectioned, microtomed or mechanically polished, may be required.

**Turnaround** - 2 weeks depending on the number of samples submitted, sample preparation requirement, other samples in the queue and complexity of the request.

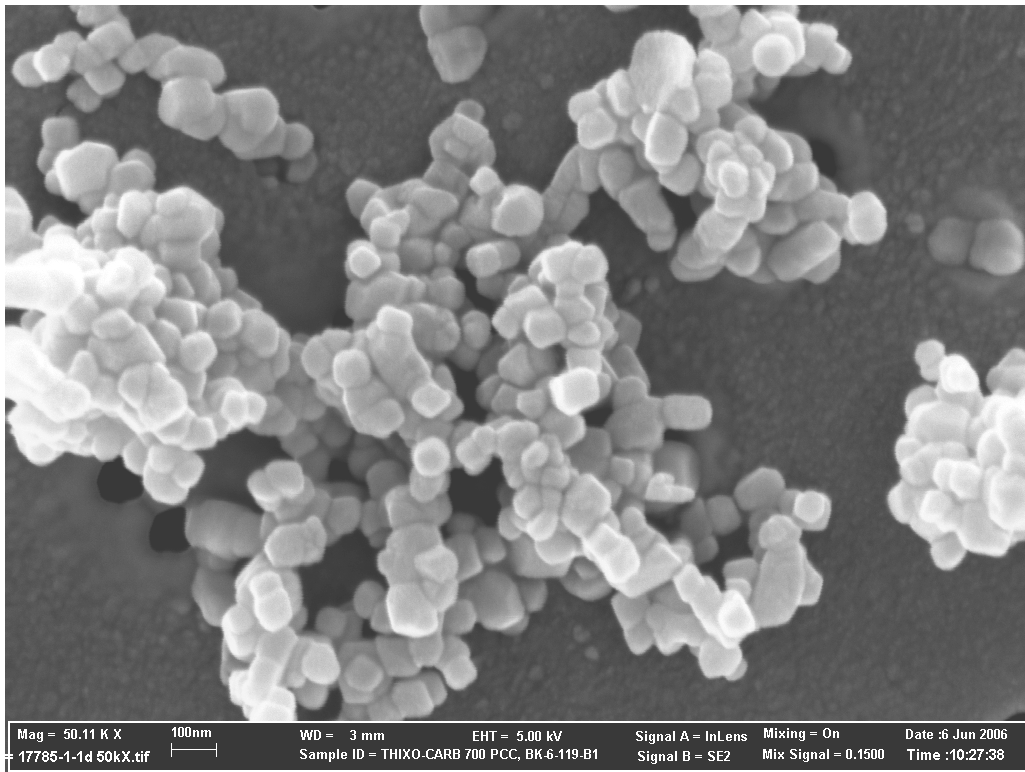
**Examples:**



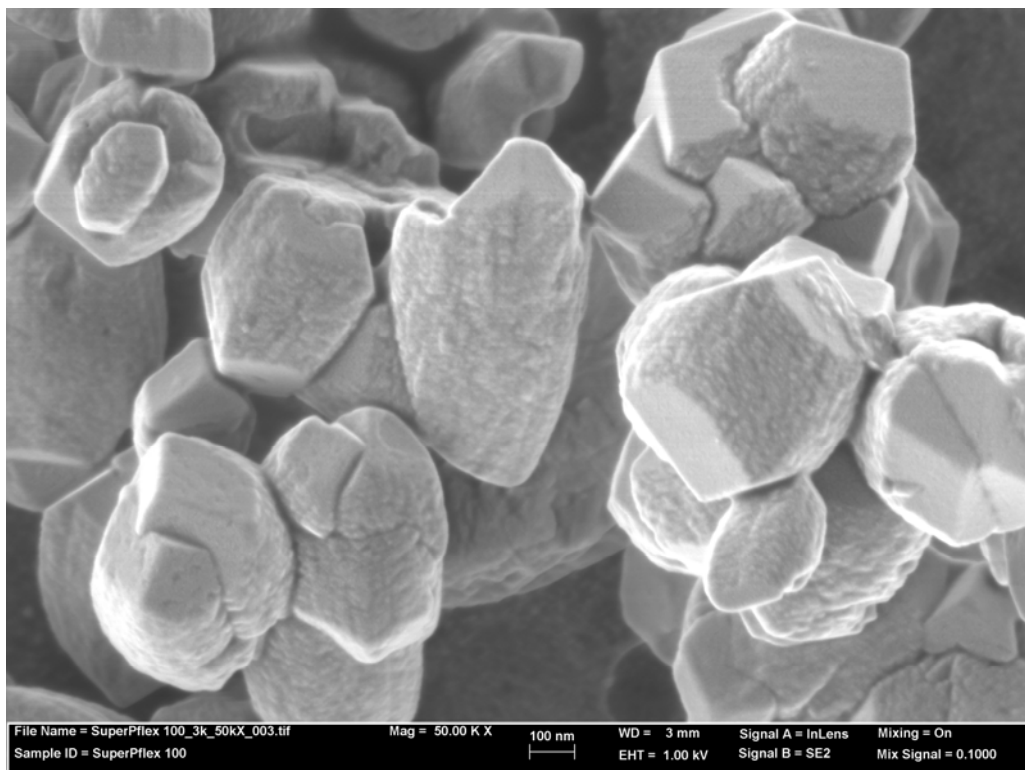
**FESEM Figure 1. FlexTalc 815D “InLens” image collected at 1 kV (2 KX)**



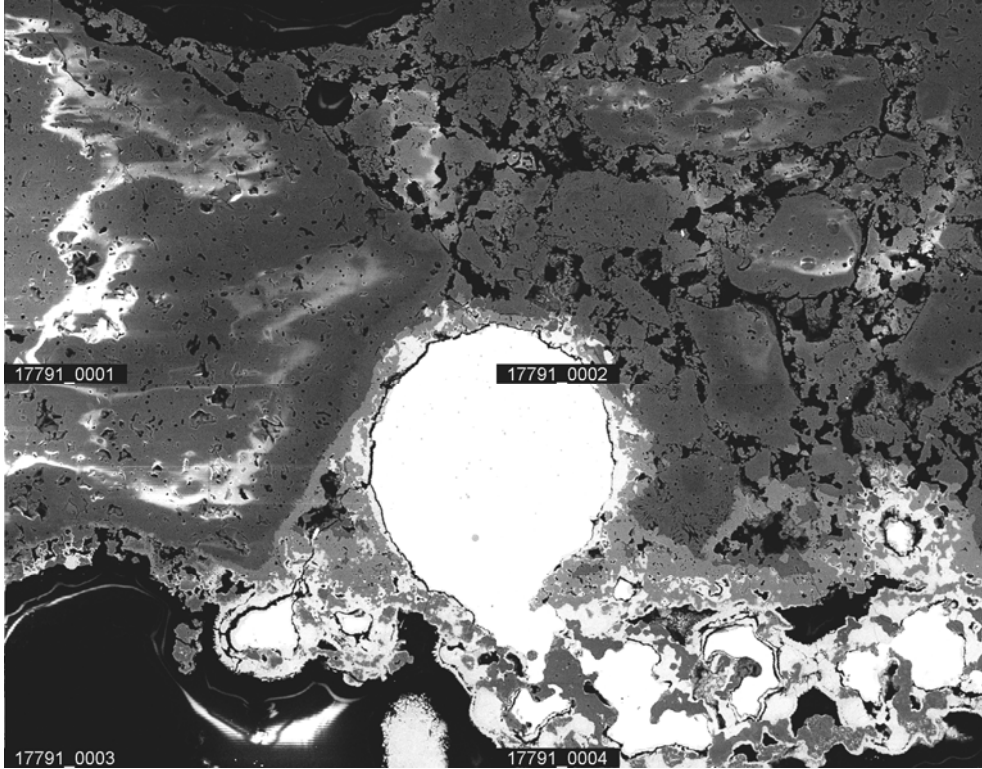
**FESEM Figure 2. GCC “InLens” image collected at 600 V (30 KX).**



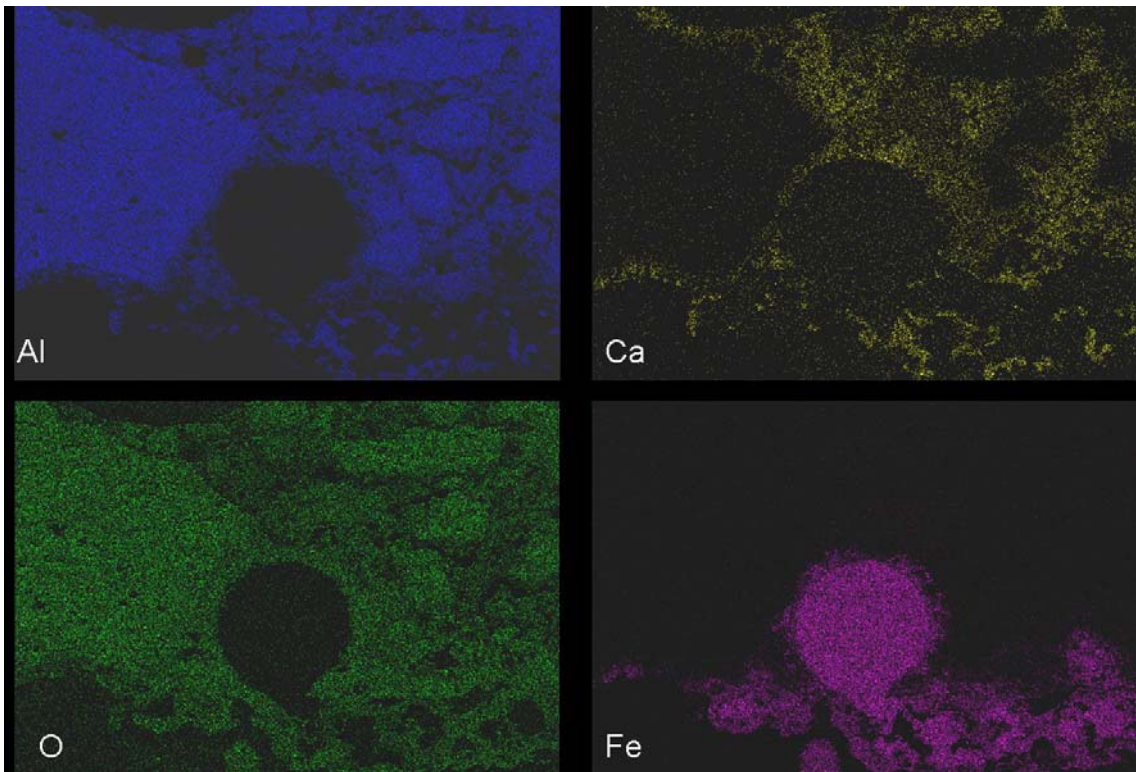
**FESEM Figure 3. THIXO-CARB @ 700 PCC mixed SE image collected at 5 kV (50 X).**



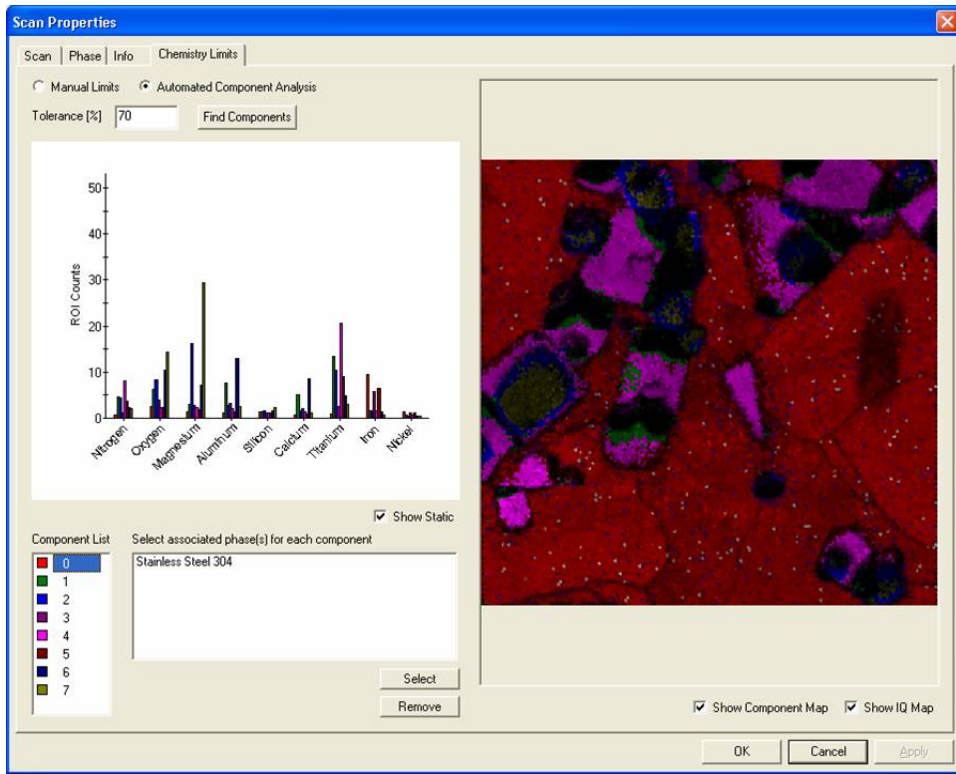
**FESEM Figure 4. SUPER-PFLEX @ PCC mixed SE image collected at 1 kV (50 kX)**



**FESEM Figure 5. BSE images (2x2) stitched to create single image.**



**FESEM Figure 6. XEDS elemental maps (2x2) stitched to create single elemental maps. Individual maps can be combined to form a single map.**



**FESEM Figure 7. Combined XEDS and EBSD Chemical Index phase map (Chi-Scan) of Stainless Steel with MgO and TiN inclusions.**

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