Large-Chamber Scanning Electron Microscope Services

The large-chamber scanning electron microscope (LC-SEM) offers extensive materials characterization and failure analysis investigations for commercial industries, government agencies and universities.

UNIQUE CAPABILITIES

The LC-SEM is a unique resource for two reasons: it is one of the largest chamber SEMs in the world, and it has the largest array of analytical capabilities of any SEM. These features make it possible to conduct detailed *nondestructive* surface analysis of large components. The advantage over a conventional SEM is that large samples don't have to be cut to fit into the chamber, which is very important for expensive or irreplaceable samples. If sections must be cut, the cuts can be made far away from the region of interest to avoid introducing anomalies or contaminants. These capabilities are potentially useful in the aerospace, automotive and military industries, among others.

The LC-SEM easily accommodates this V-6 engine block.

A 15-in. diameter copper casting and a 50-lb steel pipe are a sampling of the specimens examined by the LC-SEM.

SERVICES OFFERED

The LC-SEM can examine an object 40 inches in diameter and 40 inches high, weighing up to 660 pounds and at magnifications up to 50,000x.

High-resolution imaging

- Secondary electron (SE) for topographic imaging
- Backscatter electron detection (BSE) for elemental contrast imaging

Surface characterization

- Energy dispersive X-ray spectrometry (EDS) for chemical analysis
- Fourier transform infrared spectrometry (FT-IR) to analyze non-metallic materials such as paints, polymers, and corrosion products

Metal microstructure

- Electron backscatter diffraction (EBSD) for crystallography of polished samples

Expanded material range

- Variable pressure (VP) for nonconductive surfaces

APPLICATIONS

Quality assurance

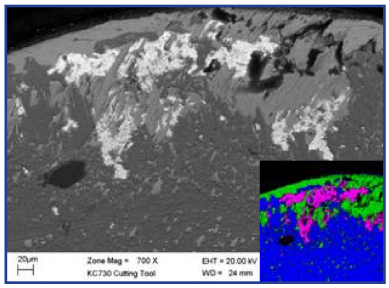
- The LC-SEM establishes the quality of a casting, welding or machining operation *without destroying the sample*. The LC-SEM identifies surface blemishes with high magnification to determine if a sample meets specifications. Intermediate nondestructive investigations of in-service components can potentially extend their service life.

Research and development

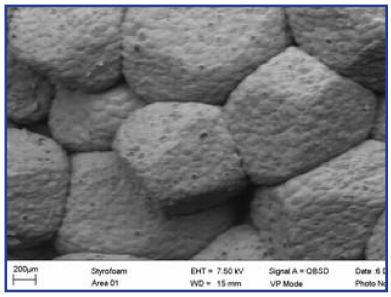
- The LC-SEM nondestructively evaluates how parts react over time through analysis between cycles of wear, corrosion, or stress studies. Special fixtures can be adapted to the LC-SEM to allow for evaluation of samples through dynamic testing.

Failure analysis

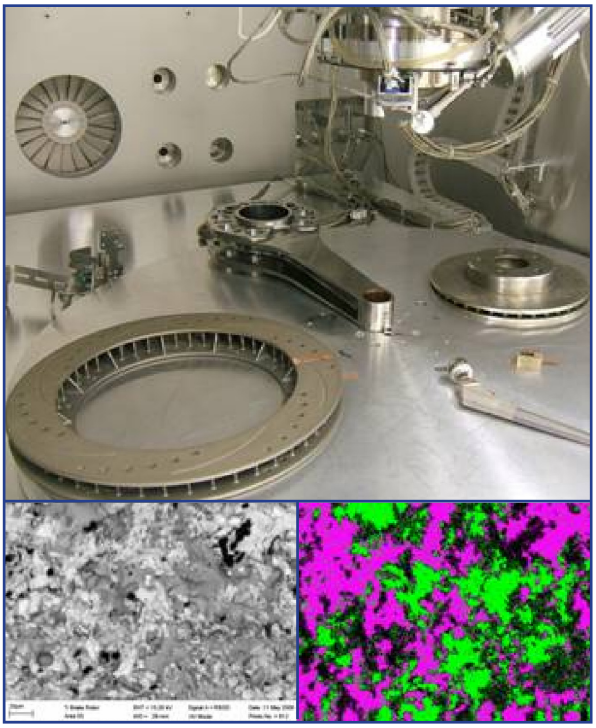
- How and why did this part break, fall apart or blow up? We can help you uncover the root cause of a part's failure to prevent similar failures in the future.



BSE image of different materials smeared across the surface of a cutting tool. The subset image is an EDS elemental map identifying the materials.



Low-magnification image evaluating the bonding of expanded polystyrene beads using the variable pressure system.



A large brake rotor and other parts are shown in the LC-SEM. The subset images show a BSE image and EDS elemental map of the ceramic coating on the titanium brake rotor.

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NNSA National Nuclear Security Administration