



Ebatco Nano

A Bimonthly Newsletter

Nano

Brief

Ebatco president, Dr. Dehua Yang, and vice president, Ms. Ming Li, exhibited with an Ebatco booth at RAPID + TCT in Boston, MA, April 14-16, 2026. They met many current and potential customers at North America's largest additive manufacturing (AM) and industrial 3D printing event and discussed how Ebatco could assist them and their clients through our ISO/IEC 17025:2017 accredited contract lab services.

To keep pace with market needs, and to meet and greet our existing and potential customers in the rest of 2026, Ebatco will participate in several additional regional and national conferences and exhibitions as listed below:

- April 28-29 – SVC TechCon 2026, Booth 226, Long Beach Convention Center, Long Beach, CA
- May 1 – MMS Annual Spring Symposium & Poster Session, Theme: Microscopy & Nature, Minnesota Landscape Arboretum, Chaska, MN
- May 5-7 – American Coatings Show 2026, Booth 242, representing Kyowa Interface Science Co., Ltd., Indiana Convention Center, Indianapolis, IN
- June 2-4 – Space Tech Expo USA 2026, Booth 238, Anaheim Convention Center, Anaheim, CA
- September 28 - October 1 – IMAT 2026, Québec City Convention Centre, Quebec City, Canada
- October 13-15 – SEMICON West 2026, Booth 6808, representing Kyowa Interface Science Co., Ltd., Moscone Center, San Francisco, CA
- October 28-29 – MD&M Midwest 2026, Booth 3636, Minneapolis Convention Center, Minneapolis, MN

Please stop by our booth to discuss the incredible world of nanomaterials, nanodevices, nanoinstruments, and nano/micro scale surface characterization and your unmet material analytical and testing needs with our staff scientists. We hope to see you soon!

Ebatco

- Ebatco announces the successful completion of its 2026 Annual Audit on its ISO/IEC 17025:2017 accreditation conducted by Perry Johnson Laboratory Accreditation, Inc. and continues its technical competence and quality excellence. Ebatco had achieved its first ISO/IEC 17025:2005 accreditation in 2017 and ISO/IEC 17025:2017 in 2020 for a defined scope in Chemical, Mechanical, Metallurgical, and Thermodynamic fields.

ISO/IEC 17025:2017 is one of the highest standards that a testing laboratory can meet. ISO/IEC 17025:2017 covers management systems for quality, administrative and technical operations. ISO/IEC 17025:2017 accreditation indicates the accredited lab meets the general requirements for the competence to carry out tests and/or calibrations including sampling, using standard methods, non-standard methods, and laboratory-developed methods in the specified and listed test scope.

- To support the additive manufacturing industry, Ebatco has released a whitepaper titled: *Additive Manufacturing: Characterization, Testing, and Analysis from Raw Materials to Finished Goods*. Click [HERE](#) to read!
- To view Ebatco's latest news release click [HERE](#).
- We are happy and grateful to receive the most recent feedback from one of our customers, Mr. Steven Maurer, Director of Product Development, a Medical Device Company "Our team has reviewed and find the reported analysis very meaningful. We will likely reach out in the next month for a larger set of samples to be tested on production parts. Always appreciative of the great work we get from your team."
- While attending SVC TechCon 2026, Dr. Dehua Yang will also be co-chairing the session on Characterization, Testing and Failure Analysis of Thin Films, Coatings and

Engineered Surfaces and Dr. Lawrence Anderson will be presenting on *X-ray Diffraction and X-ray Reflectivity for Thin Film Phase Identification, Residual Stress, and Film Thickness Determination*.

Case

Study

Porosity Measurement of Additive Manufactured Products using SEM

Additive manufacturing (AM) is a process by which parts and products are made layer-by-layer. There are a variety of types of AM, such as extrusion, powder bed fusion, material jetting, binder jetting, VAT photopolymerization, sheet lamination, and directed energy deposition that can be used for polymers, metals, ceramics, and composites. Additive manufacturing is a rapidly growing field that impacts numerous commercial areas, such as aerospace, automotive, medical, energy, and other industries. One of the common challenges in the AM process is unintended porosity within the printed piece. This porosity may come from poor layer adhesion, filament quality, powder packing, or unoptimized fabrication parameters. When the total porosity of a part increases, its mechanical properties such as stiffness, tensile, compressive, and fracture strength tend to decrease. As known from fracture mechanics, the stress that causes fracture in a brittle material, σ , is closely linked to the maximum flaw/pore size, a , by

$$\sigma \propto \frac{1}{\sqrt{a}}$$

Porosity and pore distribution impact product density, thermal conductivity, electrical conductivity, permeability, and many more other properties that may be relevant and important for a given application.

One technique to measure the porosity of a part is to image its cross-section using scanning electron microscopy (SEM). A scanning electron microscope functions by having a focused, high energy electron beam raster scan a sample surface area to gain topographical and compositional information. The SEM at Ebatco's NAT Lab is equipped with a large specimen chamber that allows for analysis of a wide variety of samples with sizes and shapes up to 70 mm in height and 178 mm in diameter. Our SEM is utilized for high resolution imaging at magnifications of 30x – 300,000x and can be operated in low vacuum mode to examine non-conductive samples without needing an electrically conductive coating for the sample surface.

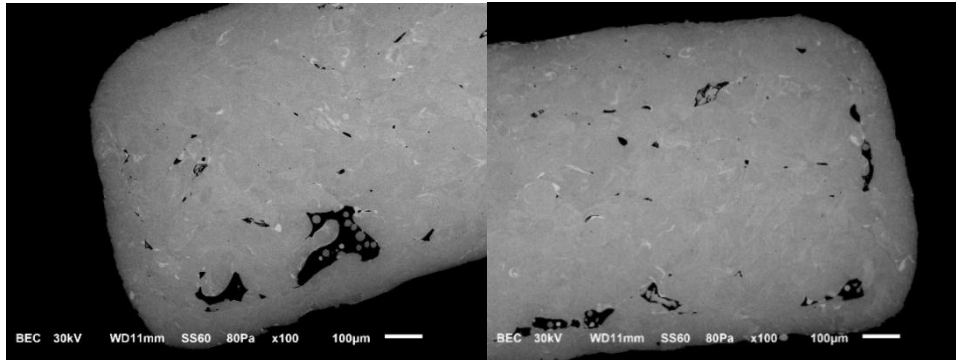


Figure 1. Low vacuum SEM images of two sides of a metal AM product cross section at 100x.

Two regions of a cross section from an AM product made with laser powder bed fusion are shown in Figure 1. The high resolution and brightness contrast make it possible to clearly identify the pores in the sample as the darker regions. The readily visible large pores may be caused by a low powder packing density or improper fusion during the manufacturing process. Inside the larger porous regions, spherical metal particles can be seen, which may be due to incomplete fusion. In the images, smaller features like cracks and small pores are also visible. With these high-quality SEM images, an image processing software, ImageJ, was used to quickly identify the pores within the cross-section and to determine key aspects of the sample porosity.

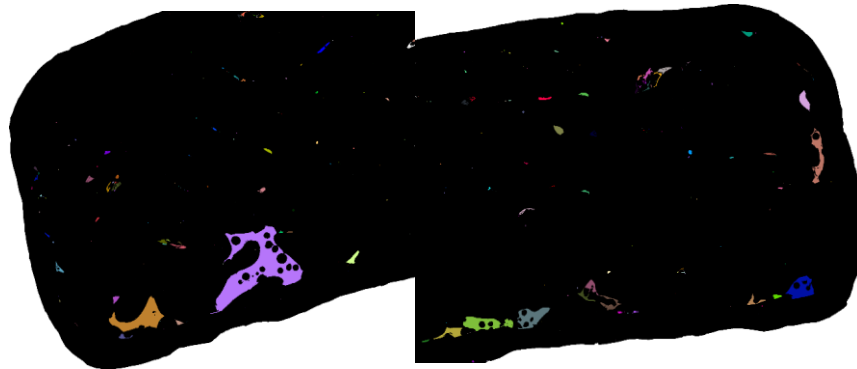


Figure 2. ImageJ analysis of porosity on two sides of a metal AM product.

Table 1 Quantitative Porosity Characteristics of Two Sides of a Metal AM Product

Total Porosity (%)	Average Max Feret Diameter (µm)	Average Min Feret Diameter (µm)	Average Pore Area (µm ²)	Largest Pore Area (µm ²)
2.66	13.25	5.98	171.21	17,155.14

Figure 2 shows the ImageJ processed SEM images with colored overlays on porous regions and a black background for the non-porous fused metal. ImageJ was also used to analyze the images and to determine the porosity characteristics. As displayed in Table 1, the total porosity determined from all pores found on the two sides is 2.66%. In addition, every pore is individually analyzed and statistics for the porosity of the AM product are determined. From Table 1, the average maximum pore Feret diameter is 13.25 μm , the average minimum pore Feret diameter is 5.98 μm , and the average pore area is 171.21 μm^2 . Further, the largest pore, as shown in light purple overlay of Figure 2, has an area of 17,155.14 μm^2 .

As mentioned previously, microstructural flaws such as cracks, pores, voids and other defects within a part can have significant influences on the fracture and failure of the part. The microstructural flaws can act as stress risers and might induce failure during its service. SEM analysis of a part cross-section can be used to identify the size, location, and shape of individual pores at micro and nano scales in additive manufactured parts. With the assistance of an image analysis tool, pore size distribution and porosity can also be obtained easily. A better understanding of porosity in additive manufactured parts will help to achieve desirable mechanical strength and other material properties for additive manufactured products.

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