Charge Reduction Sample Holder

Extending imaging capability on non conductive samples

The Phenom™ can make high-magnification images from a wide variety of conductive and non-conductive samples using a standard sample holder.

However, compared to conductive samples, non-conductive samples are more difficult to image with an electron microscope. They often need additional sample preparation involving special equipment and more time.

The charge reduction sample holder is designed to eliminate extra sample preparation of non-conductive samples. It allows samples such as paper, polymers, organic materials, ceramics, glass, and coatings to be imaged in their original state.

Figure 1: Charge reduction sample holder (left); metallurgical charge reduction sample holder (right).

Key benefits

- Up to 8 times higher magnification without charging.
- The need for sputter coating is reduced dramatically, requiring no additional equipment and resulting in faster sample preparation.
- Any sample can be imaged in its natural state to provide valuable back-scatter material contrast information.

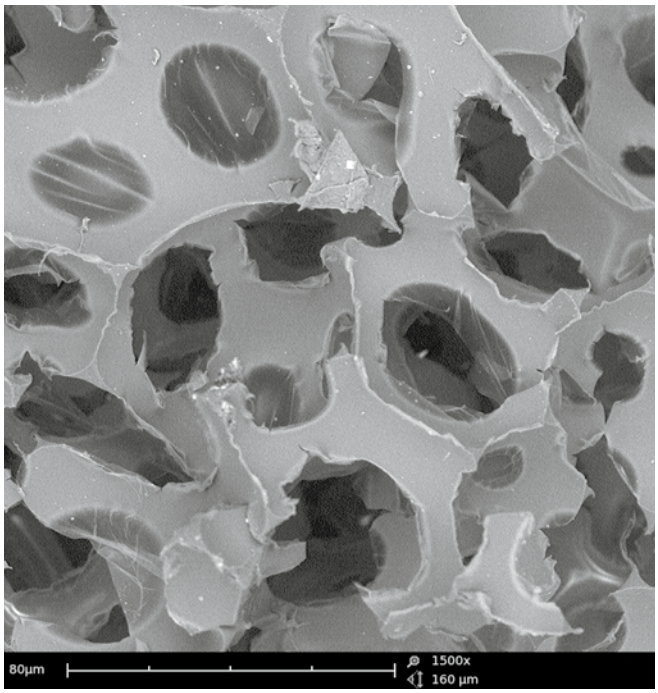

Figure 2: Polymer filter, 1500x magnification, imaged in its original state.

The Phenom is designed with a versatile combination of a low accelerating voltage (5 kV), low vacuum (0.1 mBar) and high brightness/long life electron source. This unique combination was chosen to allow the capture of high-quality images from conductive and non-conductive samples.

Despite these optimized settings, it is still possible for non-conductive samples to show charging effects. A traditional way of reducing these effects in a scanning electron microscope is to increase the sample vacuum. The charge reduction sample holder contains a pressure-limiting aperture which allows a controlled amount of air into the sample chamber to raise the pressure around the sample. The leakage rate is designed for optimal charge reduction while maintaining a high vacuum in the column for stable system operation.

Compared to standard holders, the charge reduction sample holder can be used to obtain significantly higher magnification images from non-conductive materials.

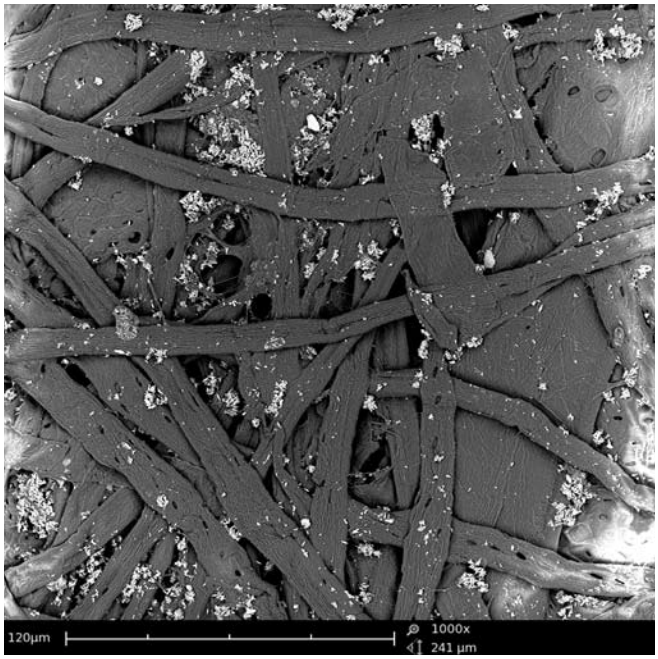

Figure 3: Image of non-conductive paper. The image is taken using the standard sample holder at 1000x magnification. The bright white area's on both sides of the image is charging. At increased zoom, the charging becomes more localized and more distortion typically occurs until the image is completely obscured, yielding no data.

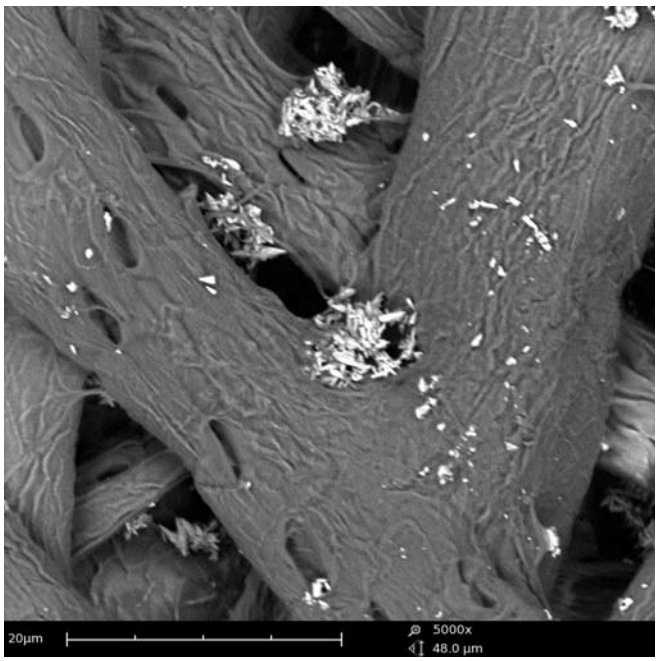

Figure 4: Image of same paper using charge reduction sample holder. No charging is visible at 5000x magnification and image details are still clear.

Additional sample preparation such as sputter coating is costly (equipment) and time-consuming, and deposits a layer on top of the sample. Imaging a coated sample with a back-scatter detector results in poor material contrast information, as the coating layer blocks the back-scattered signal. The state of a sample after sputter coating is changed permanently, thereby limiting its use for further fabrication or other laboratory techniques.

With the charge reduction sample holder, it is possible to image non-conductive samples in their original state, providing valuable material contrast information.

The images below were made using the charge reduction sample holder.

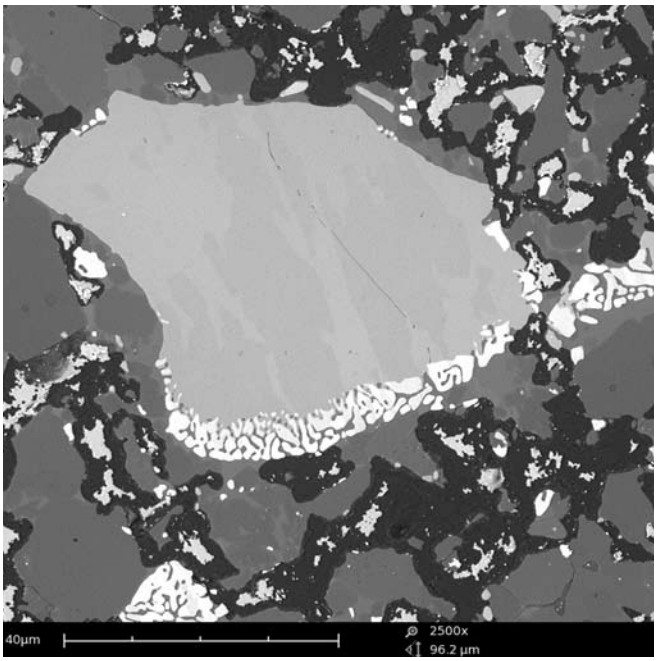

Figure 5: Ceramic at 2500x magnification.

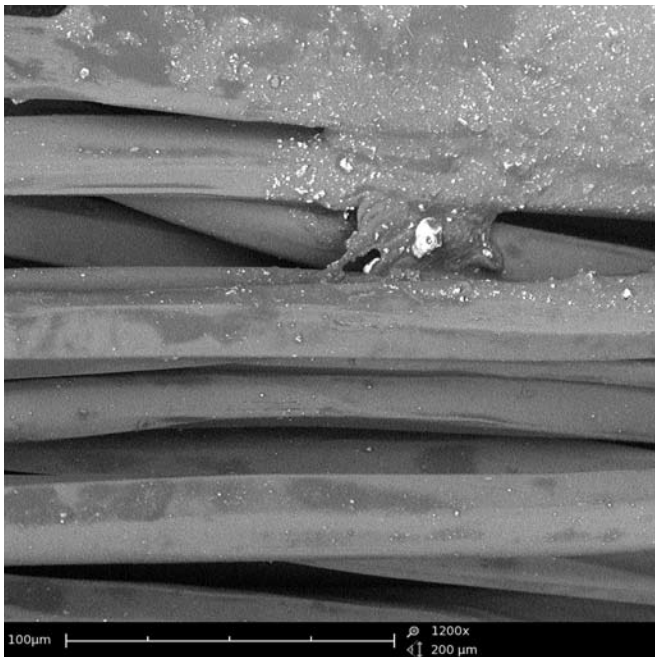

Figure 6: Coated textile fibers at 1200x magnification.

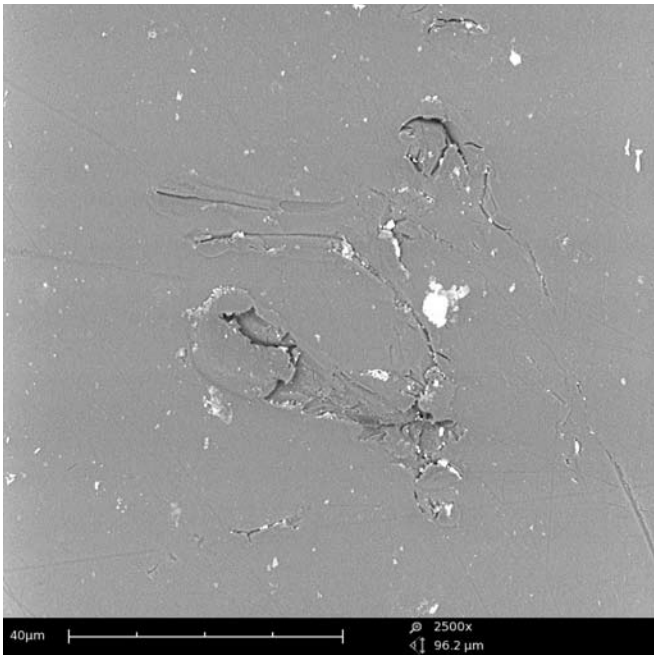

Figure 7: Defect in glass at 2500x magnification.

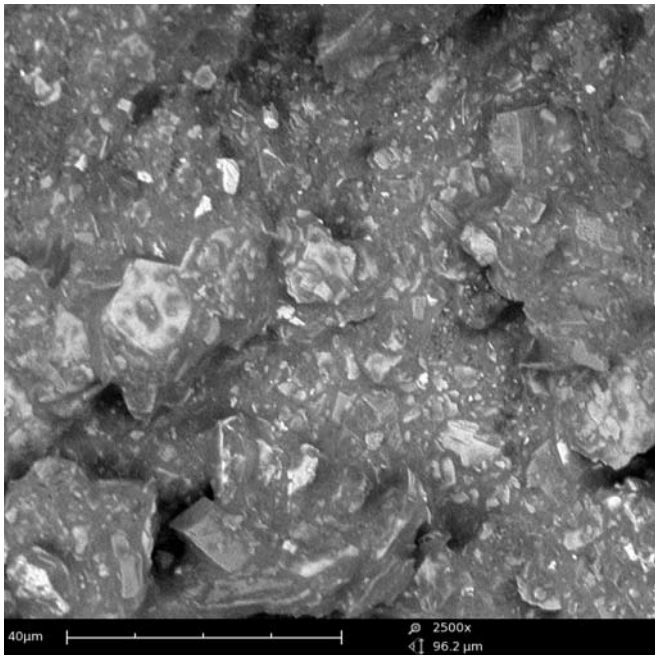

Figure 8: Rubber band at 2500x magnification.

The charge reduction sample holder is available in 2 models to accommodate different samples:

1. 3D objects or all non-flat samples on a pin stub; max. 25 mm diameter and 30 mm height.
2. Metallurgical mount samples with a max. 32 mm diameter and 30 mm height.

Figure 9: Inserting resin mount in metallurgical mount charge reduction sample holder.

Figure 10: Inserting pin stub in charge reduction sample holder.

SS 00301WWv1.0

Phenom-World BV
Dillenburgstraat 9E
5652 AM Eindhoven
The Netherlands

Find your Phenom-World contact information at
www.phenom-world.com

PHENOMWORLD