Innovation with Integrity

BRUKER MICRO-CT ACADEMY

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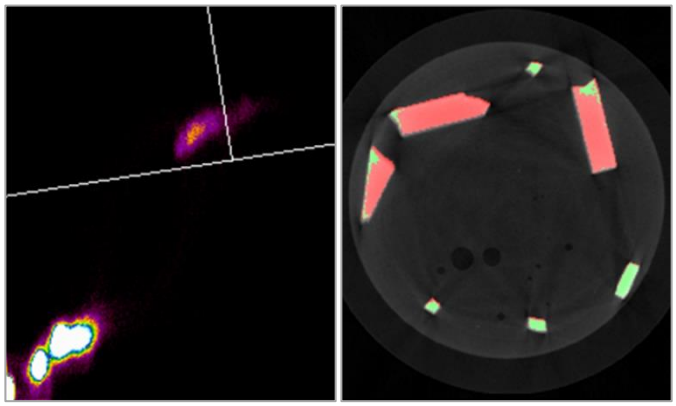
In this issue:

Welcome

In this issue we have a look at a method to potentially improve material contrast by means of dual energy scanning. We also outline two techniques to improve reconstruction results specifically for data acquired with the micro-CT attachment for SEM. Finally we proudly announce the launch of the SkyScan1278 ultra-low dose, high-throughput *in-vivo* X-ray microtomograph.

Enhanced Material Contrast by Dual-Energy MicroCT Imaging

X-ray microCT provides 3D information about local attenuation within a sample. To visualize and quantify different features of a sample requires a sufficient spatial difference in attenuation – we call this "contrast". In certain cases different materials, composed of different mixtures of elements, produce highly similar and/or overlapping X-ray attenuation profiles, making segmentation difficult or impossible. X-ray attenuation by a given material is the sum of the attenuation of its constituent elements. However, absorption of X-rays changes with different photon energy in a way that is nonlinear and differs between elements. By scanning an object at two different X-ray energies and combining the information from these, we can take advantage of such differences and nonlinearities in attenuation between different materials, and achieve an improved segmentation between those materials. In this way we can find differences in attenuation that would not appear in a single scan only. We use the Bruker microCT "DEhist" software (short for "Dual Energy histogram") which plots an X-Y intensity map based on the attenuation values of two reconstructed slices with an identical position in a sample but acquired at different energy. As with all Bruker microCT software the latest version of DEhist can be downloaded from: http://www.bruker-microCT.com/products/downloads.htm, together with the method note: "*MN038 Enhanced material contrast by dual-energy microCT imaging*"

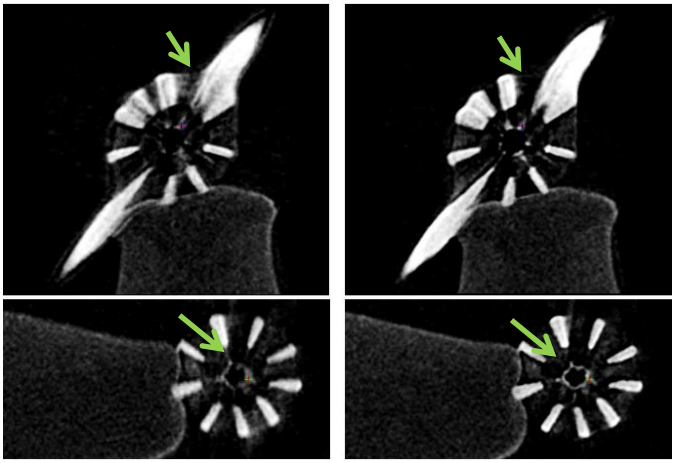


The left image is the dual energy space plot with the T-bar defining the segmentation areas. The right image shows the segmentation of different materials. The sample is a resin containing particles of silicon (N=14) and aluminum (N=13).

Advanced Reconstruction for SEM-CT

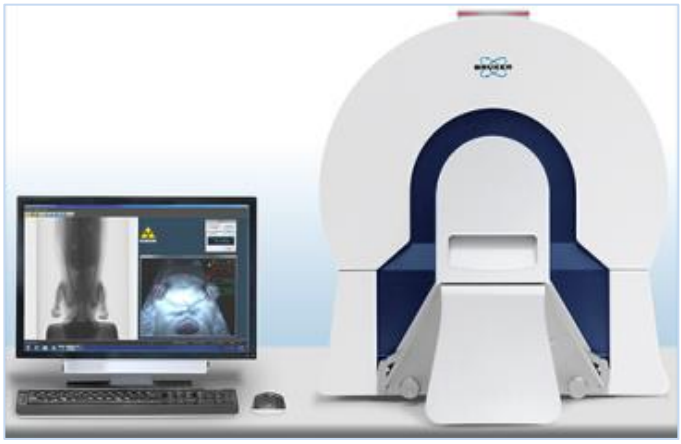
The method note "*MN046 Advanced reconstruction for SEM-CT*" describes two techniques for improving reconstruction results from the microCT attachment for SEM using that advanced functionality of NRecon. The first part describes a method for compensating possible angular misalignment between the X-ray camera and the object's rotation axis, which can create difficulties in finding a suitable misalignment value for all slices. NRecon compensates such camera tilt by determining the misalignment near the top and bottom of a projection image, then automatically re-rotates all shadow projections.

The second part describes the possibility to improve sharpness of reconstructions for highest (submicron) spatial resolutions by removing artifacts from random shift of the rotation axis during acquisition. After position adjustments, the second reconstruction produces sharp results not affected by object displacement during rotation.



Example of a reconstruction image before (left) and after (right) the iterative x/y alignment procedure. The sample is a micro-fossil scanned with micro-CT attachment for SEM with an image pixel size of 570nm.

- Introduction of SkyScan1278 Ultra-Low Dose, High-Throughput *In-Vivo* X-Ray Microtomograph



We are pleased to introduce the SkyScan1278 ultra-low dose, high-throughput *in-vivo* X-ray microtomograph. It is the world's fastest low-dose high-resolution *in-vivo* scanner available. The system was officially launched at the World Molecular Imaging Conference WMIC 2014 this month, with a functional system on display. For detailed information please visit our website.

- Upcoming Events

Bruker microCT will participate with an exhibit in the forthcoming conferences. Please click the links for more information. We hope to see you there!

▪ WMIC	Sep 17-20,	Seoul, South Korea
▪ IMPC	Oct 20-24,	Santiago, Chile
▪ XRM	Oct 26-31,	Melbourne, Australia
▪ Process Mineralogy	Nov 17-19,	Cape Town, South Africa
▪ MRS Fall	Nov 30 - Dec 5,	Boston, USA

- Image of the Month:

Volume rendering from a full body mouse scan with contrast agent injection. The scan was made using the SkyScan1278 with following scanning protocol: 65kV, "low dose" filter, 50µm isotropic pixel size.