BRUKER MICRO-CT ACADEMY

Innovation with Integrity

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● Welcome

This fourth issue of the Bruker micro-CT Academy will focus on porosity analysis. We will discuss the difference between open and closed porosity and how to visualize and quantify this. The method notes which registered users can download (registration: http://partners.bruker-microct.com/subscribe) will explain in details how to calculate a pore size distribution and how to extract a list of all pores and their respective 2D and 3D characteristic properties such as size, volume, and location. The second method note will describe how the visualization of open and closed pore networks can aid in the interpretation of the data.

● How to Generate Pore Size Distribution and Characterize Open Versus Closed Pore Networks

Porosity analysis refers to the measure of "void fraction" and the characterization of the empty space. There are numerous application fields for which the analysis of pores is crucial in the understanding of the 3D structure and its mechanical properties. For example, in the field of bone research porosity is a parameter for the overall mechanical strength of the bone, while petroleum engineers are interested in the pore network connectivity to allow for transportation of liquids in oil & gas applications. Porosity analysis refers to the counting of empty space and characterization of their connections. Empty space is either fully surrounded by material on all sides, making it a closed pore, or if the empty space is not fully enclosed but at some point in 3D it can find a connection to the space outside of the object, it is defined as an open pore. The method note MN059_PorosityAnalysis explains why the conventional 2D analysis is very different from the 3D analysis where the values

are obtained from the entire dataset. In addition, it describes in detail how to quantify the porosity in a dataset, both for open and closed porosity, and how to obtain a size distribution of the pores, as well as a list of all pores and their surface, volume, centroid location,…The method note also demonstrates how to use custom processing for noise removal functions as well as for automatic data analysis in a batch.

● Visualization of Open and Closed Pore Networks

Visualization of open and closed porosity is very important when interpreting the data. 3D visualization is a lot more than "pretty pictures" and it is worthwhile to explore the techniques and tools available in the SkyScan software. A visual representation of the calculated characteristic properties can put new insights to the meaning of the numbers that were generated when performing porosity analysis as described in previous section. The image below nicely illustrates how the

RED - Closed pores   GREEN - Open pores   GRAY - Rock

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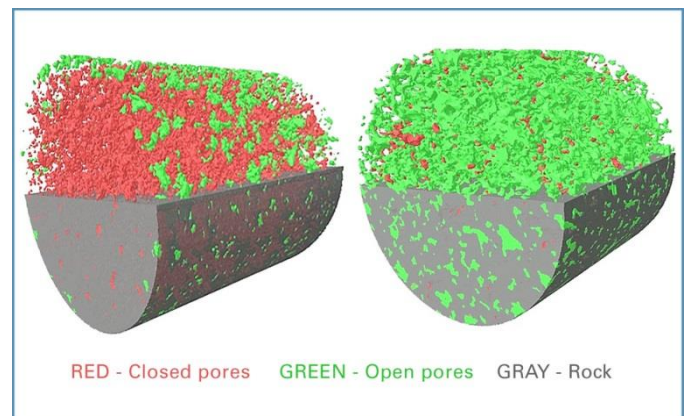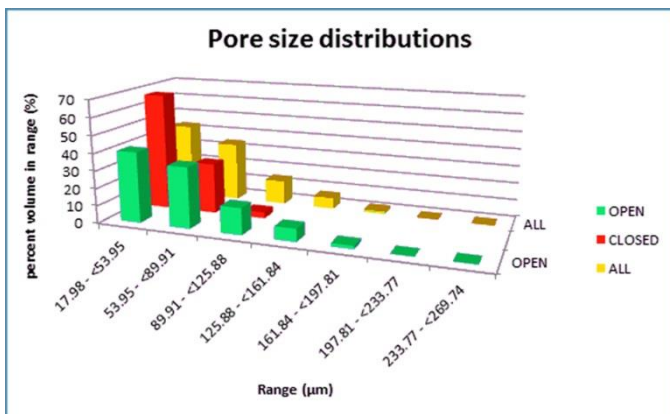
open porosity (shown in green color) for the sample on the right is a measure of the sample itself, while the reported value for the open porosity for the rock on the left is artificial and is due to the sample drilling or the VOI selection. In fact, the rock on the left actually contains a closed pore structure and no gas or liquid transportation is possible.

CTVox (volume rendering) is by far the easiest and hence most used, well known visualization tool of the SkyScan software package. On the other hand, CTVol (surface rendering), being slightly more challenging, opens up opportunities for visualization which are not possible in CTVox. After calculating a pore size distribution, the techniques discussed in the first Micro-CT academy Newsletter can be applied to generate color-coded images for size using CTVox. In this issue of the Bruker micro-CT Newsletter CTVol is used to visualize color-coded image for open and closed pore networks. The techniques mentioned in the previous section will be very useful when generating surface meshes for the different types of pore network for surface rendering. Even more, they allow restricting analysis to either the open or closed porosity characteristic. A detailed step by step procedure on how to obtain these results is described in _MN060_Extracting open and closed pore networks for analysis and visualisation_.

● Bruker micro-CT News

Bruker microCT is proud to announce the first Asia-Pacific User Meeting on November 18 & 19, 2014. This two-day event will take place in Taipei, Taiwan, and will be a combination of user presentations and workshops showing the latest developments in hardware and software as well as training sessions covering both life science and material science applications with hands-on exercises. Registration through our website will be available soon. Please reserve the dates in your calendar!

New version of DataViewer (ver.1.5.1) can now be downloaded at www.bruker-microct.com/products/downloads.htm

● Upcoming Events

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

- BRS   June 25-26,   Sheffield, UK
- 3D Materials Science June 29-July 2,   Annecy, France
- EORS   July 2-4,   Nantes, France
- ESB   Aug 31- Sep 3   Liverpool, UK
- IMA   Sep 1-5,   Gauteng, South Africa
- IMC   Sep 7-12   Prague, Czech Rep.
- ASBMR   Sep 12-15   Houston, USA

● Image of the Month: Which is it: a piece of scourer or tagliatelle? Find out in our next newsletter!