Optimization and Analysis of Tomograms

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Background

Quantitative analyses based on images obtained with X-ray absorption contrast tomography are often difficult because of weak contrast between some materials e.g. water, hydrocarbon in the solid phases. Furthermore the reconstructed image can be affected by a number of artefacts, e.g. ring like features due to imperfections in the detector system. This can obscure significant features and might result in derivation of erroneous parameters. This motivates further work into development of new methods for reduction of artefacts and optimisation in analysis of the tomograms.

Development

Ring artifacts: The presence of ring artifacts superimposed on tomography images significantly impairs the volumetric analysis. Therefore a reliable hybrid method is developed to suppress the rings in the polar space. The results confirm their reliability even when the rings are not centered at the center of the tomograms.

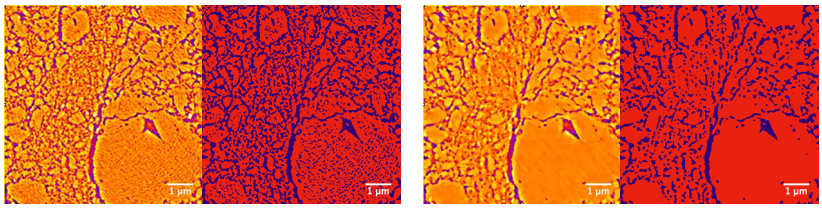

Figure 1: left: Raw image and pore (blue) matrix (red) segmented without correction($\phi = 24\%$). right: Ring suppressed image and it's segmented form ($\phi = 21\%$)

Pore structures: The innerlying pore structure and their distribution accounts for the fluid dynamics within the 3D volume, hence their segmentation methods are studied.

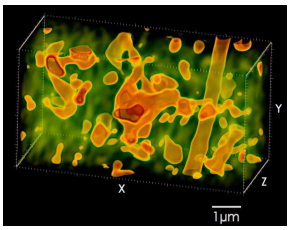

Figure 2: Innerlying pore structure after segmenting out the material matrix from a 7.5 µm x 4 µm x 3.2 µm chalk sample.

FIB-SEM volumes: The pores in the volume imaged by FIB-SEM is segmented and then characterized.

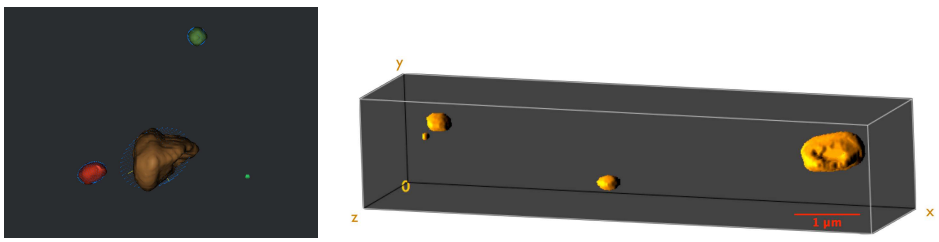

Figure 3: *left:* Ellipsoid fit on the segmented pores to calculate the size distribution, *right:* dead pores in quartz grain.