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● Welcome

This month's issue will focus on 4D imaging of dynamic processes in rocks using the SkyScan 1275 micro-CT system. Examples of 4D (time-resolved) tomography of both step-wise as well as continuous processes will be shown.

● 4D CT in geosciences

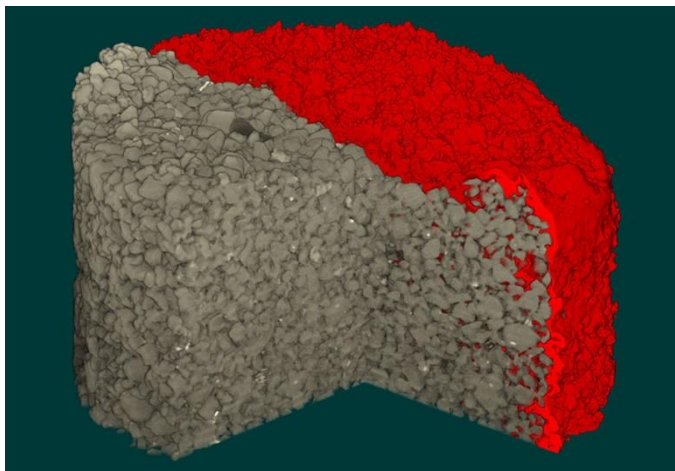
4D CT or time-resolved CT images dynamic processes in full 3D, where "time" is considered the 4th dimension. These processes can be imaged in steps, with no movement during a scan and in this case we speak of "time-lapse imaging". When processes happen fast, so-called "real-time imaging" is applied. This requires fast, continuous scanning of the sample, a task for which the SkyScan 1275 is an ideal system. The development of micro-CT technology made these 4D imaging methods possible in laboratory machines, and is now finding its way in the geoscience community where movement of fluids and crystallization of solids in pore spaces are the driving forces in e.g. oil and gas recovery or weathering of natural stone.

Time lapse CT of these processes is performed by scanning a slow process at intermediary steps, e.g. every day or after each cycle of a certain treatment. In time-lapse CT, image quality is often more important than acquisition speed, so this can be done on most

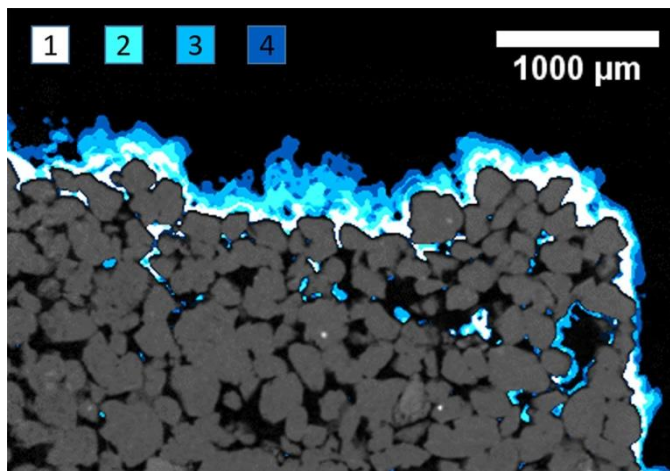
micro-CT systems.

Real-time imaging of dynamic processes requires short acquisition times, as samples are not stable during a scan. Making the scan time as short as possible minimizes the movement of the sample and the phases inside it during acquisition, reducing movement artefacts during reconstruction. Real-time imaging focusses mostly on imaging speed and less on image quality. The SkyScan 1275 can perform scans in 1 – 3 minutes, while keeping enough image quality for quantitative analysis of processes.

Method note "[MN087 Fast, real-time CT in geosciences](#)" will guide you through the entire process of analysis of a time series of very fast CT scans, from acquisition, over reconstruction, to 3D analysis. Method note "[MN088 Time-lapse CT imaging for geomaterials](#)" will do the same for time-lapse imaging. When comparing different CT scans, it is important that they are scanned and reconstructed using the same

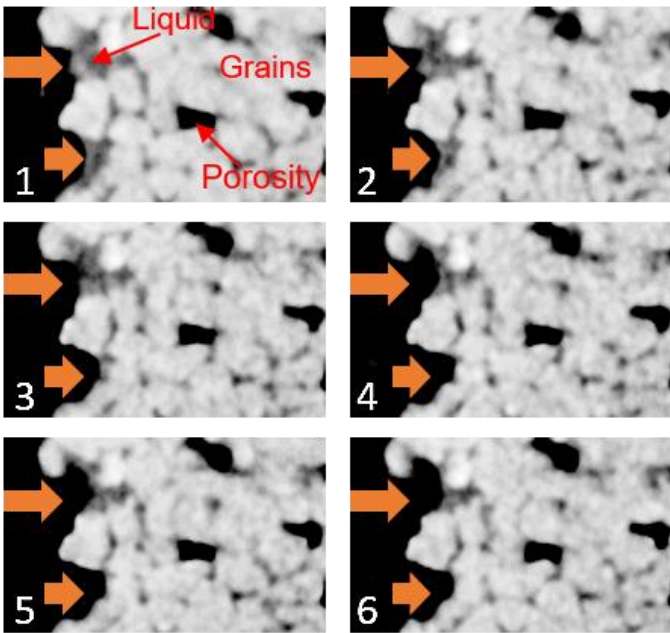


*Example of time-lapse imaging.
Volume render of a Bentheim sandstone sample with salt crust visualized over one half of the sample.*



Cross-section of the same rock with evolution of the salt crust in 4 cycles of saturation with salt liquid and drying at atmospheric conditions.

conditions, to minimize any error in later results. Image registration using DataViewer makes it possible to compare data pore-to-pore or grain-to-grain and create appealing images and movies of your data. Quantitative analysis of all datasets will provide the evolution of the features of interest over time. The method notes show that the entire analysis procedure can be done using the Bruker microCT software packages.



Example of real-time imaging. The evolution of fluid content of pores during 30 minutes is visualized in these cross-sections. The orange arrows indicate where fluids are clearly moving through the material.

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!

- [IADR](#) Jun. 22 – 25 Seoul, South Korea
- [SPWLA](#) Jun. 25 – 29 Reykjavik, Iceland
- [XRM](#) Aug. 15 – 19 Oxford, UK
- [ICXRI](#) Aug. 17 – 18 Putra Jaya, Malaysia
- [IGC](#) Aug. 27 – Sep. 02 Cape Town, South Africa
- [JASIS](#) Sep. 06 – 09 Chiba, Japan
- [WMIC](#) Sep. 07 – 10 New York, USA
- [ASBMR](#) Sep. 16 – 19 Atlanta, USA
- [ICE](#) Sep. 25 – 30 Florida, USA

Bruker microCT News

- We continuously develop new methods from which our users can benefit. To this end the new material testing stages which can apply up to 2200N or 4400N load are launched. Check [our website](#) for more details.
- All abstracts from the oral and poster presentations of 2016 annual Micro-CT User Meeting are now available on [our website](#).

Image of the Month

2016 Micro-CT User Meeting

Click [here](#) to view the full-size format.

