Innovation with Integrity

BRUKER MICRO-CT ACADEMY

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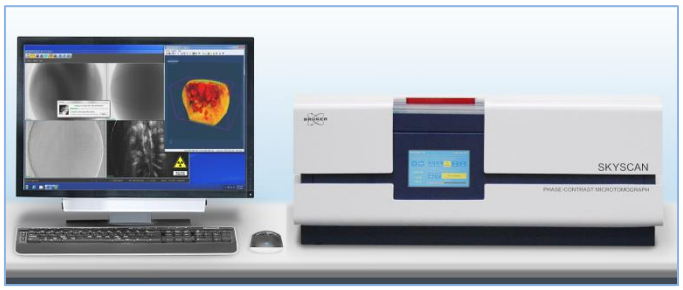
In this issue:

Welcome

We would like to thank all participants to the Bruker microCT User Meeting 2015 for making this year's edition a success! We had three days of scientific talks covering applications in both life science and material science and great networking opportunity in the wonderful city of Bruges, Belgium.

Earlier this year Bruker microCT launched the SkyScan 1294, the world's first commercially available desk-top phase-contrast X-ray micro-CT. In this issue of the Bruker microCT Academy newsletter we outline the working principles of this novel device.

SkyScan 1294 – Phase-Contrast Desk-Top X-Ray micro-CT



Phase contrast microtomography allows us to non-destructively visualize previously inaccessible information inside an object in 3D. The SkyScan 1294 makes use of unique technology developed at and patented by the Paul Scherrer Institute in Switzerland, licensed to Bruker microCT for commercialization.

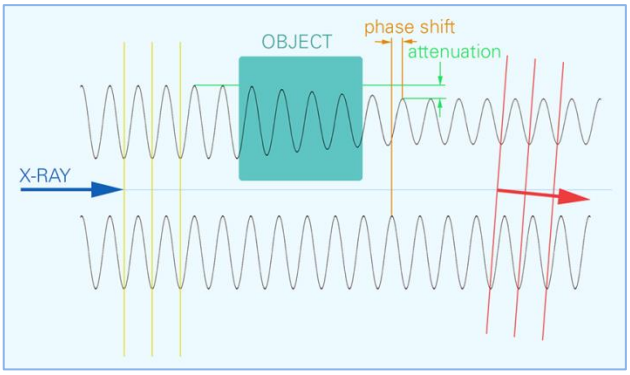
Phase contrast and scattering

When passing through a material an X-ray beam is affected in several ways. Firstly, the overall intensity is reduced due to absorption processes. In conventional X-ray micro-CT this attenuation is the only information used for imaging. Additionally, the direction of the incident X-rays can be altered, something traditional detectors are not sensitive to. The SkyScan 1294 allows retrieving the refraction and scattering information, enabling two additional imaging modalities referred to as phase-contrast and dark-field imaging respectively.

Phase-contrast vs. absorption imaging

The phase shift amplitude is a couple magnitudes of order larger than absorption for light elements. This holds the promise of attaining higher image contrast in weakly absorbing low Z materials or between similar such materials respectively.

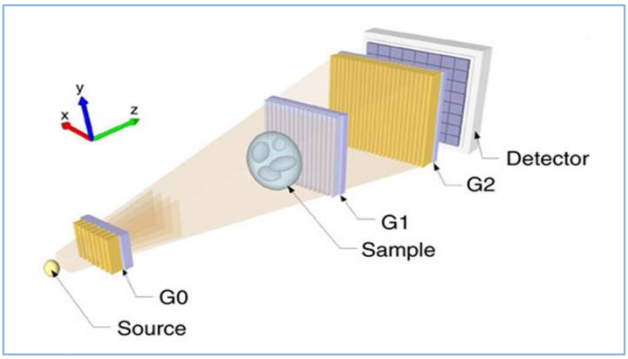
Also, even objects with very small absorption can deflect the X-ray beam. This is why imaging of X-ray deflection is very often more sensitive than absorption imaging for small and transparent object details. At the same time absorption imaging is limited by the resolution of the system, whereas deflection and scattering can be detected from much smaller structures inside the object.



Talbot-Lau X-ray interferometer

As conventional X-ray cameras are not sensitive to the direction of incoming X-rays, the phase-shift information should be converted into an intensity signal first. This is achieved by the use of

interferometry with two absorption and one phase shift gratings, a set-up known as the Talbot-Lau interferometer. The first grating transforms the beam to a more coherent signal, the second generates the interference pattern and the last one strips the pattern and converts it in to a detectable signal. By moving one of three gratings over a number of discrete steps, the phase shift and scattering information can be retrieved and separated from the absorption contrast.



For more information we kindly refer to method note *MN078 Phase Contrast micro-CT*. The image of the month represents an application in diamond analysis, more examples can be found in the product brochure.

Bruker microCT News

The 2015 edition of the Bruker microCT User Meeting took place earlier this month in the medieval city of Bruges, Belgium. Our gratitude goes out to the authors of the over 60 scientific contributions, covering a wide range of microCT applications. All abstracts from the oral and poster presentations can be downloaded from the website.

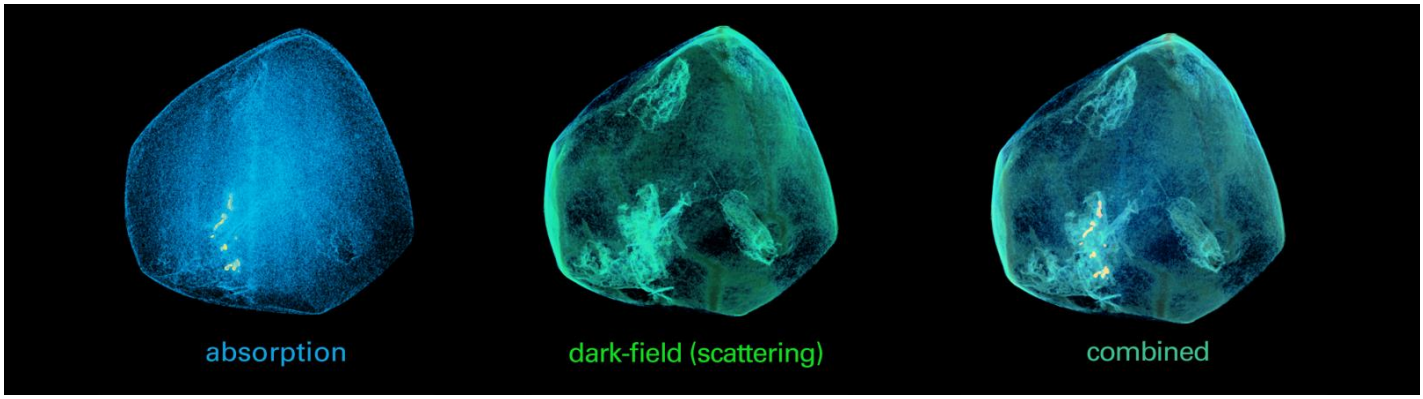
We hope to welcome you all again or for the first time next year!

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!

ATS	May. 15-20	Denver, USA
INTERPORE	May 18-21	Padova, Italy
ICEF12	Jun. 14-18	Québec, Canada
DIR	Jun. 22-25	Ghent, Belgium
ICTMS	Jun.29-Jul.03	Québec, Canada
TCES	Jul. 17-21	Southampton, UK
SCA	Aug. 16-20	Newfoundland and Labrador, Canada
Metfoam	Aug.31-Sep.02	Barcelona, Spain

Image of the Month



3D volume rendering of a 5 carat rough diamond scanned with the SkyScan 1294 phase-contrast micro-CT. Absorption contrast visualizes the external surface and metal-oxide inclusions. The scattering image clearly displays all internal defects: even cracks or cleavages (known as “feathers” or “gletzes”) too small to be resolved on such a large sample using conventional microCT. Also, a massive carbon (graphite) cluster in the left bottom corner appears. This cluster can be seen visually as a black inclusion, but does not appear in the absorption image due to the identical chemical composition of graphite and diamond.