MAPEX Bremen
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06
12-2017

INSTRUMENT DATABASE
Non-destructive 3D imaging and testing of materials

Universität Bremen

X-RAY MICROSCOPY (XRM)

3 D X-ray microscopy provides non-destructive access to the internal microstructure and composition of materials. In contrast to conventional X-CT (only geometric magnification), the X-ray microscope Versa 520 offers a two-stage magnification. The additional optical magnification (Fig. 1) enables high resolution at large source-sample distances and therefore provides a large flexible working distance while maintaining submicron resolution (Fig. 2). This allows high-resolution for large samples as well as for in-situ experiments. The latter can be performed with the 5kN in situ tensile stage (Deben CT5000), operating from -20°C to 160°C.

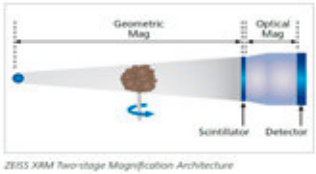

Fig. 1: Two-stage magnification architecture (Zeiss).

Fig. 2: Resolution as a function of source to sample distance (Zeiss).

Additional unique features of the XRM are laboratory **diffraction contrast tomography (DCT)** for the mapping of grain orientations in polycrystalline materials even without grain contrast and **propagation phase contrast** for the visualization of low absorbing or low contrast materials such as: low atomic number (low Z) materials, soft tissue, polymers, fossilized organisms encased in amber, and other materials of low contrast. This enables e. g. the separation of carbon fibres from its polymer matrix and consequently the analyses of fibre orientation (Fig. 3).

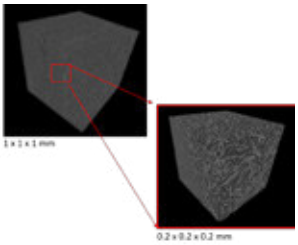

Fig. 3: Section of a short fibre (length 200 µm, diameter 7 µm) injection moulded part. The unique combination of high resolution and phase contrast enables the 3D determination of single fibre orientation

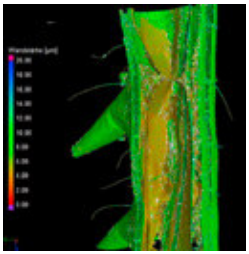

Fig. 4: Wall thickness analyses of a grasshopper leg.

II X-RAY MICROSCOPE ZEISS XRADIA VERSA 520

01 II General Information

Keywords: X-ray, non-destructive testing, tomography, CT, XRM, X-CT, NDT

Categories: Microscopy, Material Properties, Dimensional Properties

Main Application: non-destructive testing, material characterization, 3D microstructure, in situ experiments

Measured Quantities: 3D-shape, pores, defects, interfaces

Features:

- spatial resolution <700 nm
- Flat panel and CCD (2K x 2K) detector high contrast
- 5 kN tensile & compression testing system, operating between -20°C and 160°C

Year of Fabrication: 2016

Manufacturer: ZEISS

02 II Specifications

- Two-stage magnification providing resolution at a distance, enabling large, flexible working distances while maintaining submicron resolution.
- Direct visualization of 3D crystallographic grain orientation in a non-destructive tomography environment, with diffraction contrast tomography (DCT).
- Scout large samples to identify a region of interest (ROI), and then zoom to image targeted volumes at high resolution,
- Tunable propagation phase contrast to visualize low Z materials and biological samples that tend to have limited absorption contrast. (Fig. 3 and Fig. 4).

03 II Contact:

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