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Sample Preparation of Nanocomposites and Nanomaterials by *Ultramicrotomy*

a Powerful Alternative to FIB

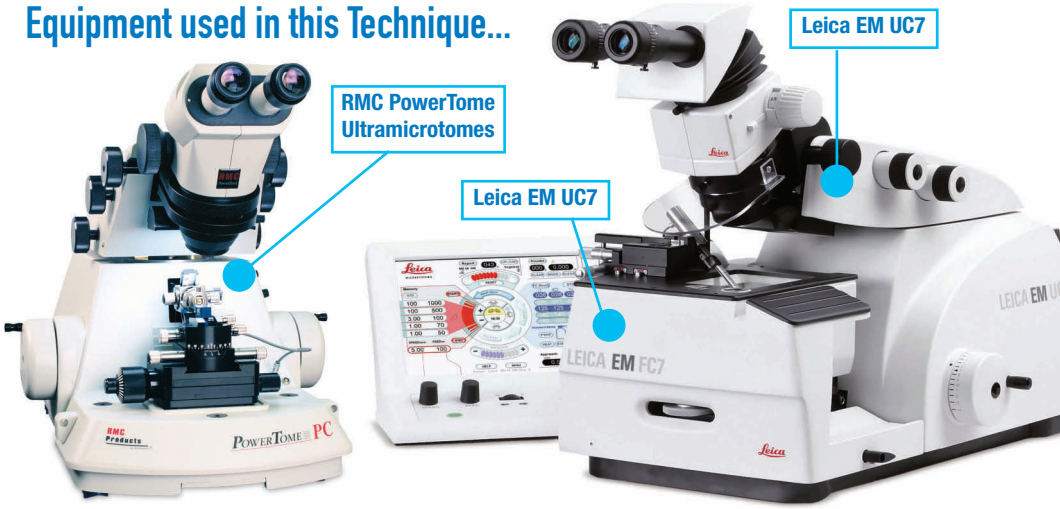
Join us at the ***EMS Microscopy Academy*** and learn the latest techniques to reveal internal structures of composites and polymers being investigated with transmission electron microscopy (TEM) and scanning transmission electron microscopy (STEM).

Sample preparation workflow will be illustrated using the Leica EM UC7 Ultramicrotome, its EM FC7 Cryochamber, and the RMC PowerTome Ultramicrotome. Differences between FIB (Focussed Ion Beam) and ultramicrotomy samples will also be covered.

Who can benefit from this alternative?

- Composite and polymer research companies - especially from the automotive and aviation industries
- Materials scientists already working with ultramicrotomy
- FIB users preparing TEM lamellas

Equipment used in this Technique...



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DiATOME cryo
sectioning of cryo-protected specimens, frozen hydrated specimens and industrial samples such as polymers and rubber.

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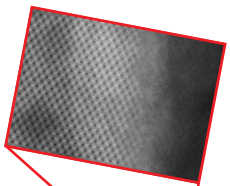
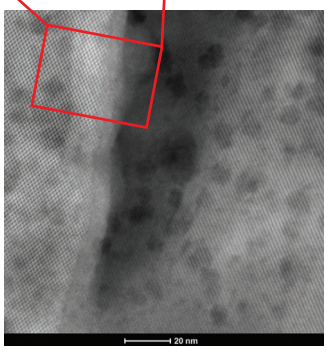
Applications...

Zeolite USY30 Crystal morphology
STEM analysis

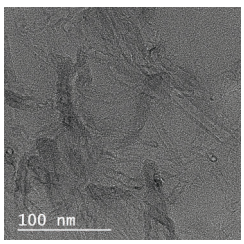


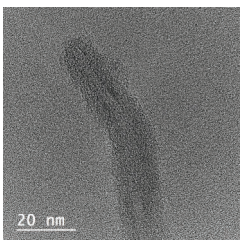
The mesopores (2-50 nm) and the crystalline micro-pores (0.7 nm) are clearly visualized.



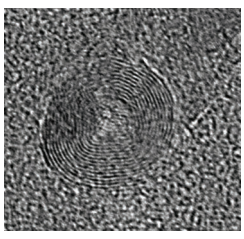
[110] Tom Willhammar, Sara Bals, EMAT Antwerpen

Epoxy loaded with amino-functionalized CNTs
TEM analysis





Good preservation of the interphase



Gravitational stroke!

Mert Kurttepeli, Sara Bals, EMAT Antwerpen

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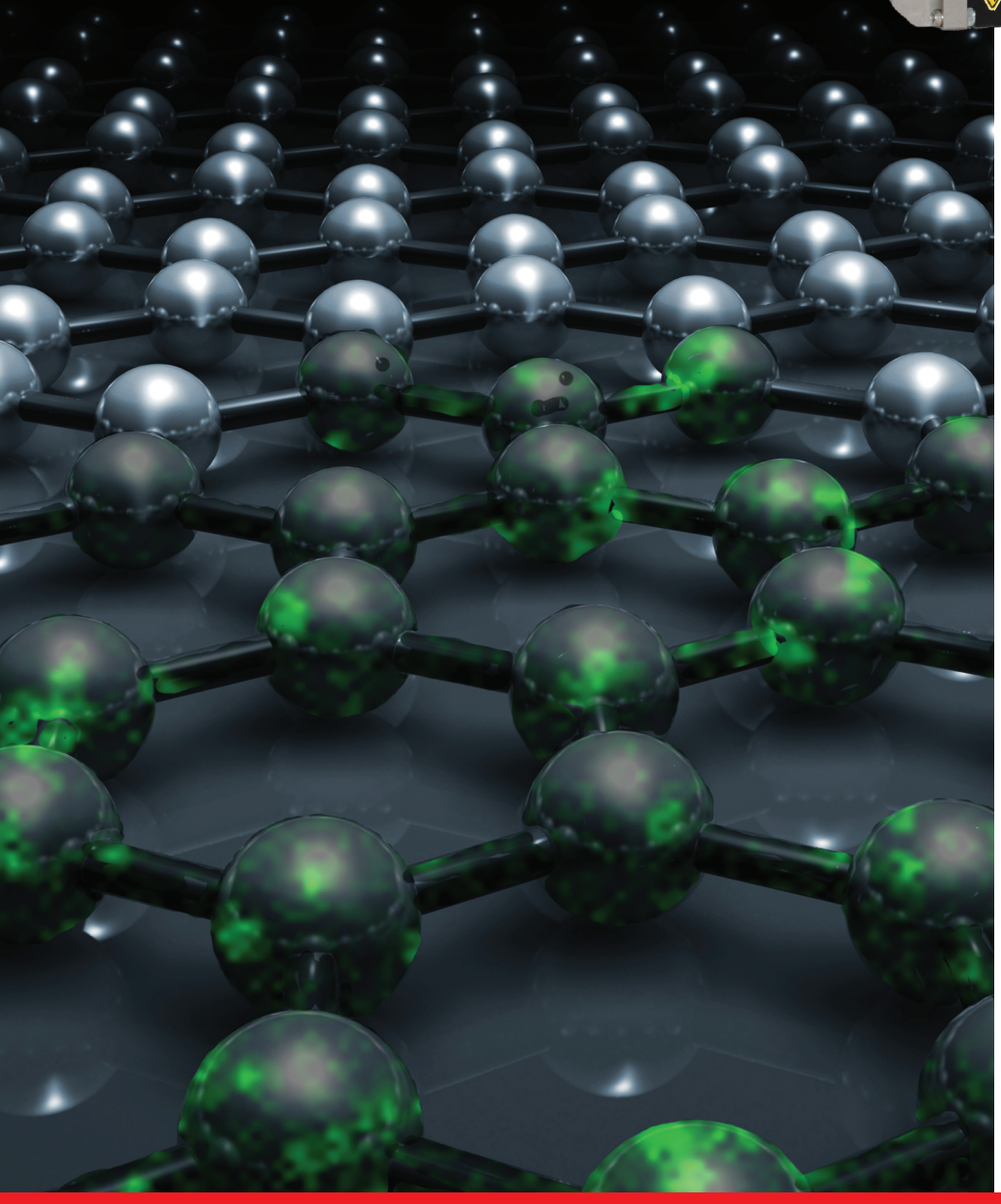
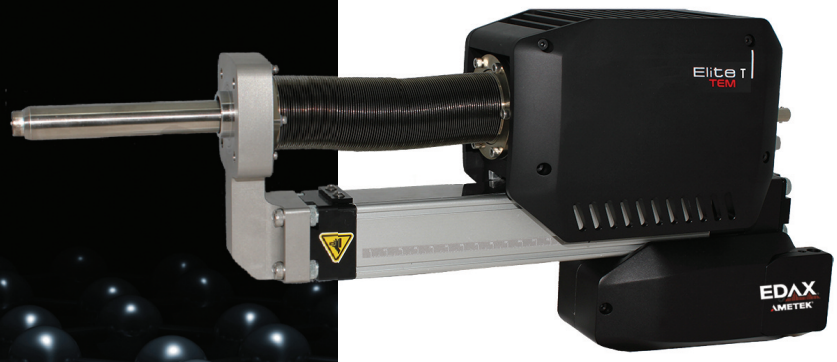
Elite analysis on supermaterials





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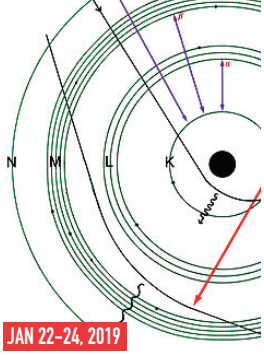
JAN 15–17, 2019

Sample Preparation for Semiconductor Devices: A Complete Picture

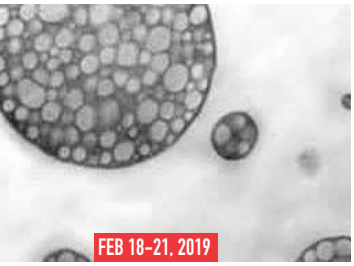


JAN 22–24, 2019

X-Ray Microanalysis Workshop: A Complete Picture

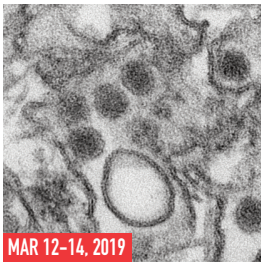
FEB 5–7, 2019

Introduction to Microscopy Techniques Workshop



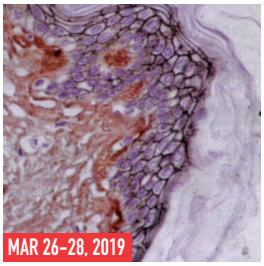
FEB 18–21, 2019

Materials Ultramicrotomy Workshop



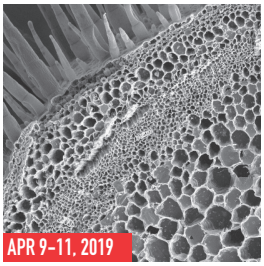
MAR 12–14, 2019

Biological TEM Workshop: A Complete Picture



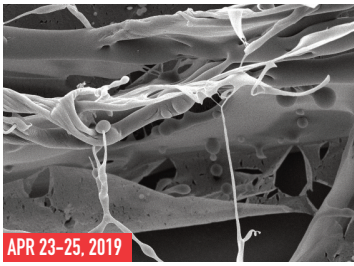
MAR 26–28, 2019

Aurion Immunogold Silver Staining



APR 9–11, 2019

Biological SEM Workshop: A Complete Picture



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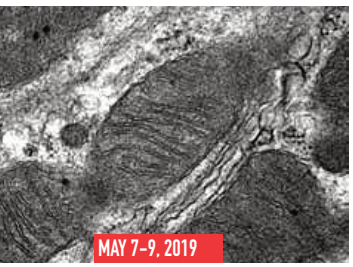
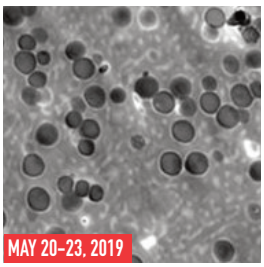
Cryo SEM Workshop



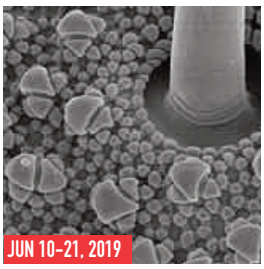
MAY 7–9, 2019

Automated and Rapid Specimen Processing for Electron Microscopy Workshop



MAY 20–23, 2019

Materials Ultramicrotomy Workshop

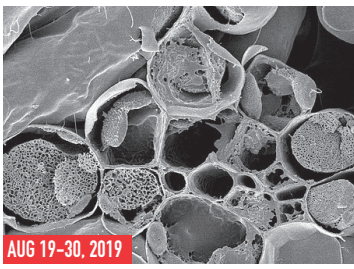


JUN 10–21, 2019

Microscopy: The Complete Image

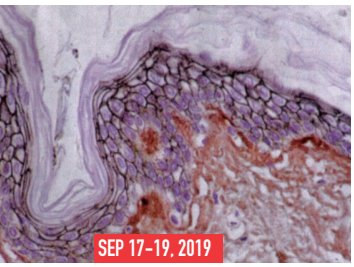
JUL 15–26, 2019

Microscopy: The Complete Image



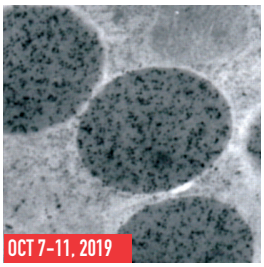
AUG 19–30, 2019

Microscopy: The Complete Image



SEP 17–19, 2019

Aurion Immunogold Silver Staining

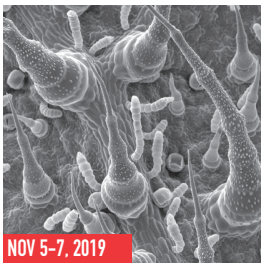


OCT 7–11, 2019

Cryosectioning/Immunogold Workshop

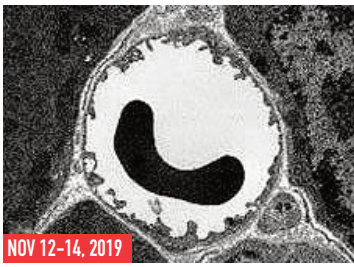
OCT 22–24, 2019

Introduction to Microscopy Techniques Workshop



NOV 5–7, 2019

Biological SEM Workshop: A Complete Picture



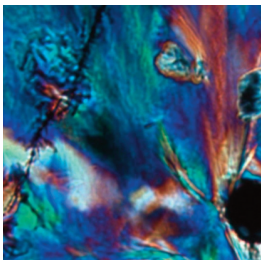
NOV 12–14, 2019

Biological TEM Workshop: A Complete Picture

Plus: Pharmaceuticals Workshops, dates to be determined...

- Pharmaceutical Microscopy Workshop
- Pharmaceutical Microscopy Workshop: Applications
- Pharmaceutical Chemical Imaging Workshop
- Pharmaceutical Microscopy Workshop: Polymorphism
- Pharmaceutical Microscopy Workshop: Techniques

Please check our website for scheduling updates.



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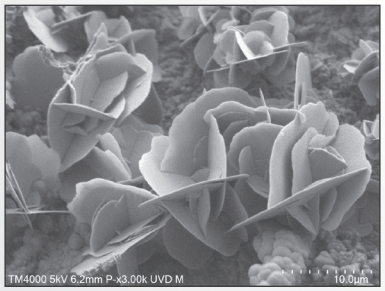
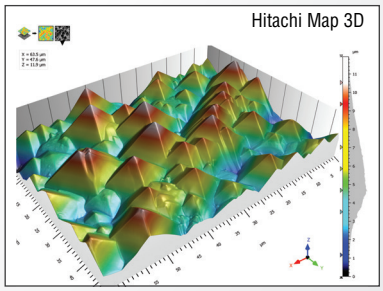


Copper Crystals
5 keV, 3,000x

Mouse Bronchus
10 keV, 7,000x



Sample: Solar Cell
Reconstructed Area: 63 µm x 48 µm x 11 µm
Voltage: 5 keV

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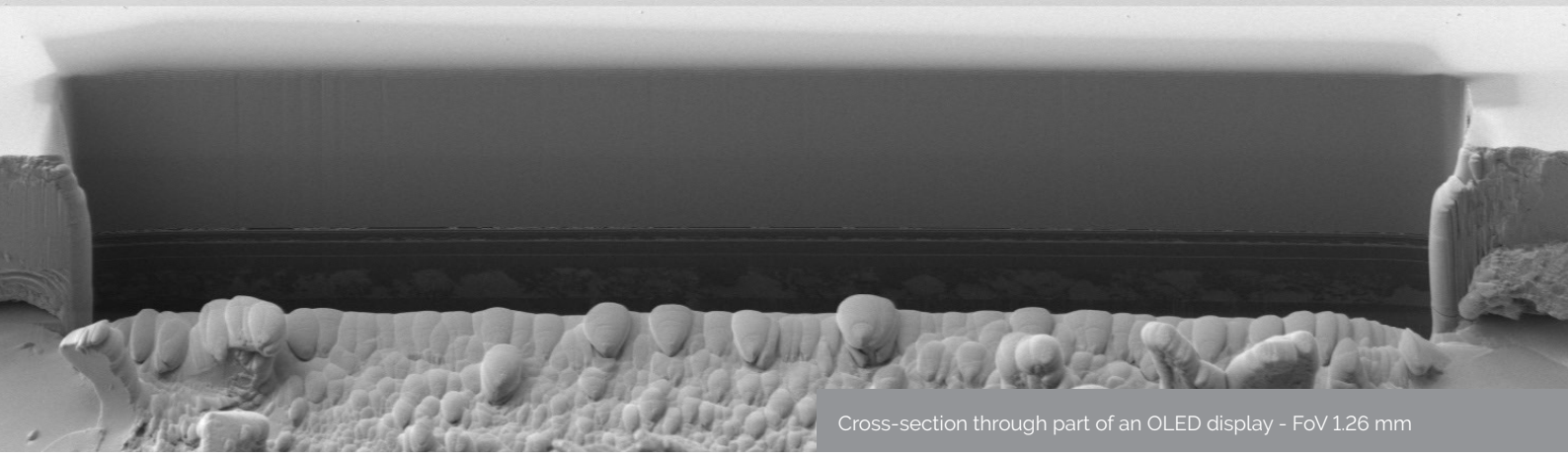

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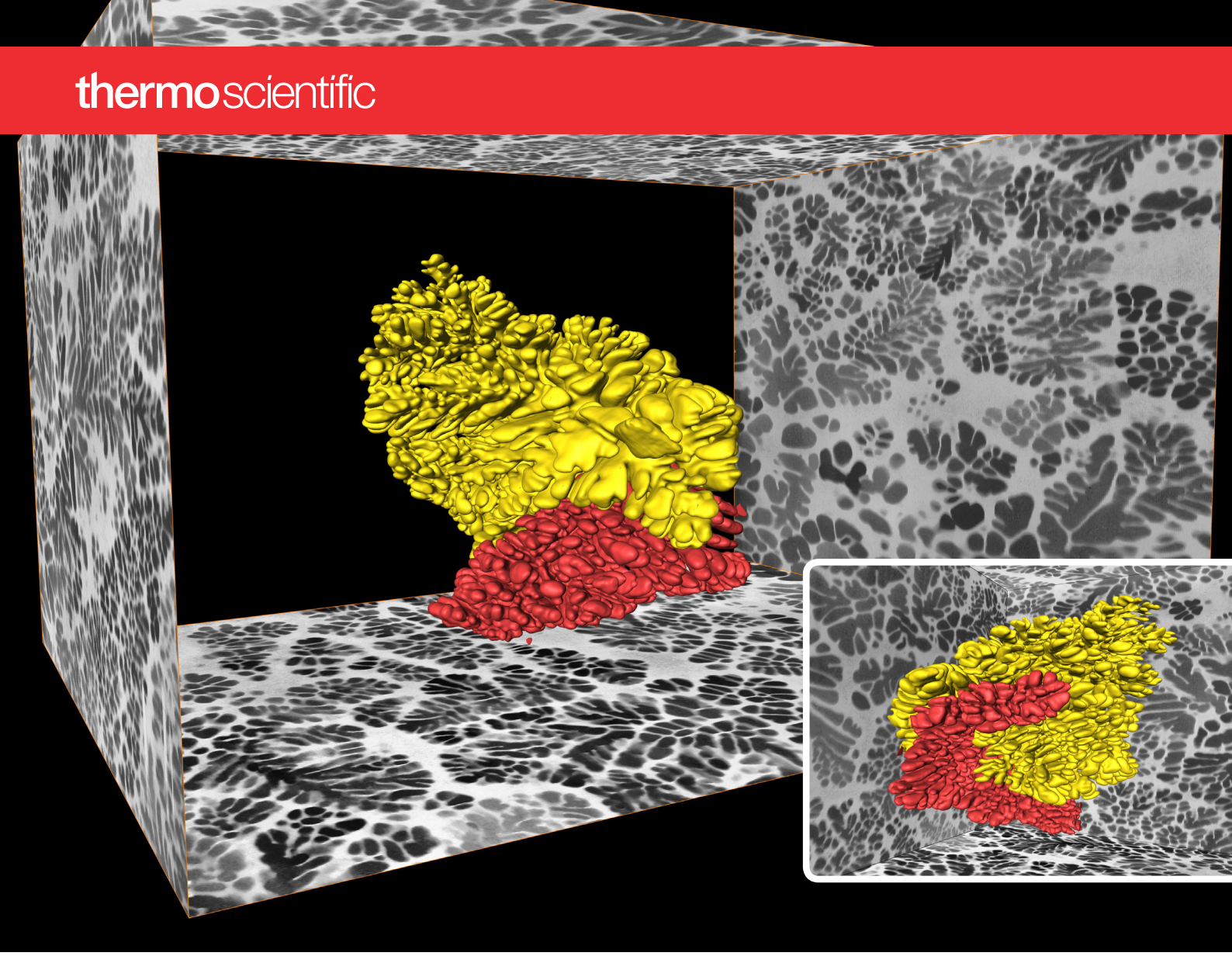

Thermo Scientific™ Avizo™ 3D visualization of two large adjacent crystalline dendrites of a bulk-metallic-glass matrix composite ($Zr_{58.5}Ti_{14.3}Nb_{5.2}Cu_{6.1}Ni_{4.9}Be_{11.0}$). Data was obtained by large volume serial sectioning tomography using the Thermo Scientific™ Helios™ PFIB DualBeam™ microscope. The sectioned block is about 90×80×70 μm^3. Sample from The University of Tennessee, USA. Images courtesy of The University of Manchester.

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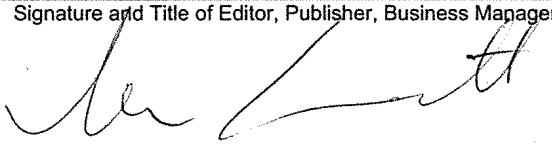	10/1/2018

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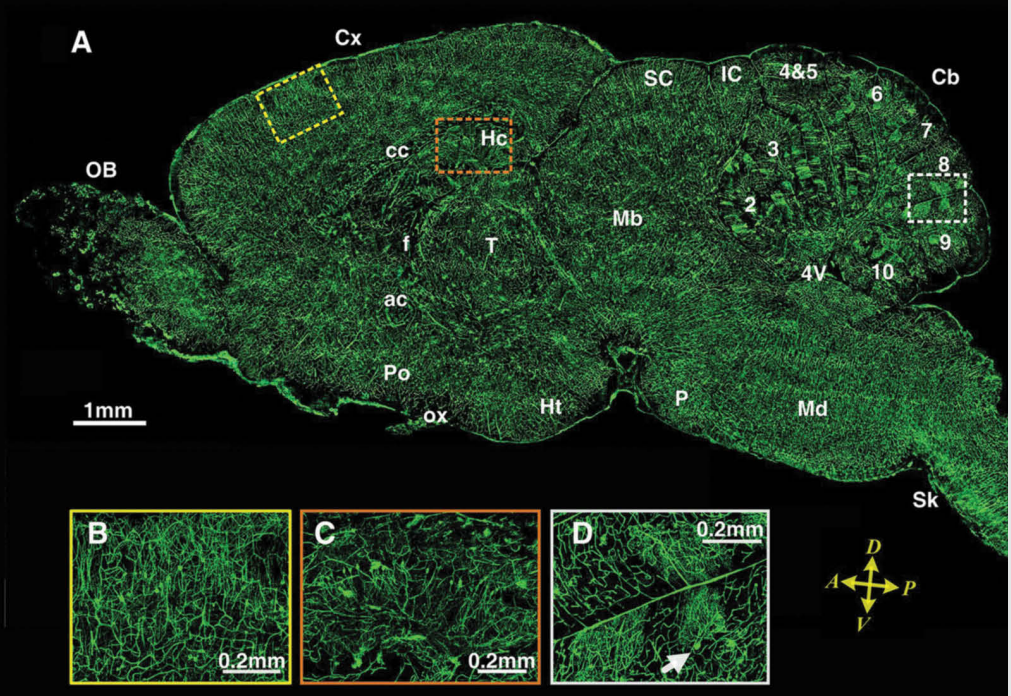

Creating a High Resolution Atlas of the Mouse Brain...

(A) A sagittal image reconstructed from a stack of 100 virtual sagittal sections (total thickness of 0.1 mm). These sections were transformed from the original coronal sections. The sagittal image was located in the right hemisphere about 0.4 mm lateral to the middle. Almost all major regions of the brain can be seen in this image, e.g., the Olfactory Bulb (OB), Cerebral Cortex (Cx), Hippocampus (Hc), Fornix(f), Anterior Commissure (ac), Thalamus (T), Cerebellum (Cb), Midbrain (Mb), Pons (P), Medulla (Md), Corpus Callosum (cc), Superior Colliculus (SC), Inferior Colliculus (IC), Hypothalamus (Ht), Preoptic Area (Po), Optic Chiasm (ox), 4th ventricle (4V) and nine lobules of the cerebellum (Arabic numerals, 2 to 10). The three regions inside the different colored rectangle in (A) are the positions of (B), (C) and (D), which illustrate the cerebral cortex, hippocampus and cerebellum, respectively. In the reconstruction of sagittal image, no dislocation was observed along the D-V axis, i.e., the coronal sections are inherently aligned along the A-P axis.

DiATOME QUALITY AND INNOVATION APPLIED...

Micro-Optical Sectioning Tomography to Obtain a High-Resolution Atlas of the Mouse Brain

Existing imaging tools have limitations for brainwide mapping of neural circuits at a mesoscale level. In collaboration with DiATOME, researchers developed a Micro-Optical Sectioning Tomography (MOST) system utilizing a DiATOME Diamond Knife that can provide micron tomography of a centimeter-sized whole mouse brain.

Slicing was performed by moving the specimen to generate ribbons, and each ribbon was simultaneously imaged. The illuminating beam passed through a beam splitter, mirror and objective to irradiate the ribbon. The imaging beam collected by the objective and passed through the mirror, beam splitter and tube lens was then recorded by a line-scan CCD.

A 3D structural dataset of a Golgi-stained whole mouse brain at the neurite level was obtained. The morphology and spatial locations of neurons and traces of neurites were clearly distinguished. Researchers found that neighboring Purkinje cells were sticking to each other.

Acknowledgement

Micro-Optical Sectioning Tomography to Obtain a High-Resolution Atlas of the Mouse Brain Anan Li, Hui Gong, Bin Zhang, Qingdi Wang, Cheng Yan, Jingpeng Wu, Qian Liu, Shaoqun Zeng, Qingming Luo

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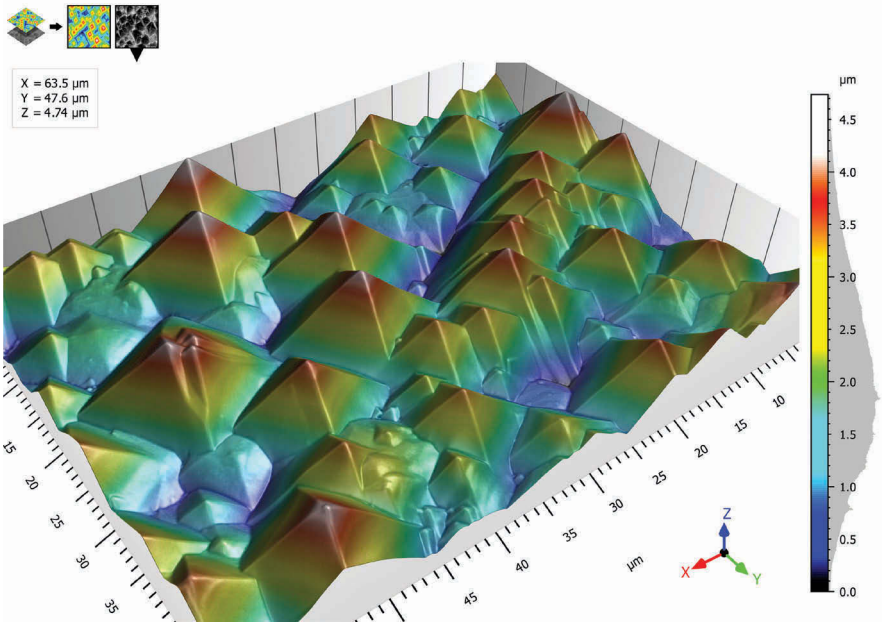

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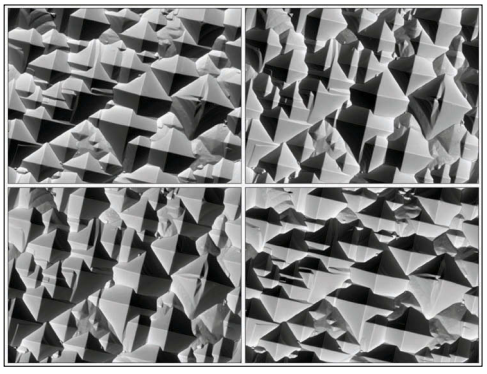

Height Parameters			
Sq	1.38	µm	*Root-mean-square height*
Ssk	0.148		*Skewness*
Sku	2.63		*Kurtosis*
Sp	4.32	µm	*Maximum peak height*
Sv	4.07	µm	*Maximum pit height*
Sz	8.39	µm	*Maximum height*
Sa	1.12	µm	*Arithmetic mean height*
Functional Parameters			
Smr	0.642	%	*Areal material ratio*
Smc	1.88	µm	*Inverse areal material ratio*
Sxp	2.45	µm	*Extreme peak height*
ISO 12781			
Flatness Parameters			
FLTt	5.40	µm	*Peak-to-valley flatness deviation of the surface*
FLTp	2.58	µm	*Peak-to-reference flatness deviation*

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