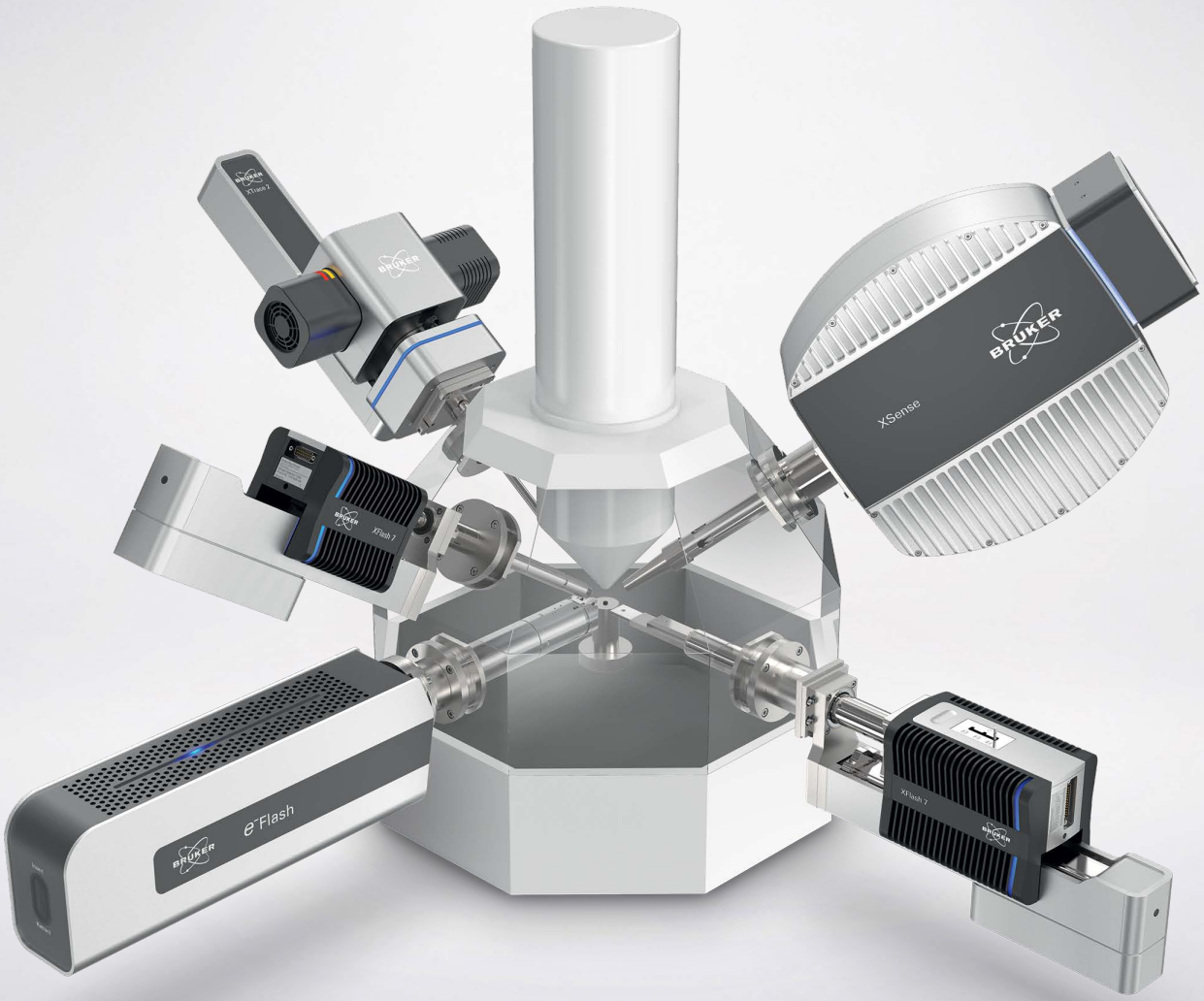
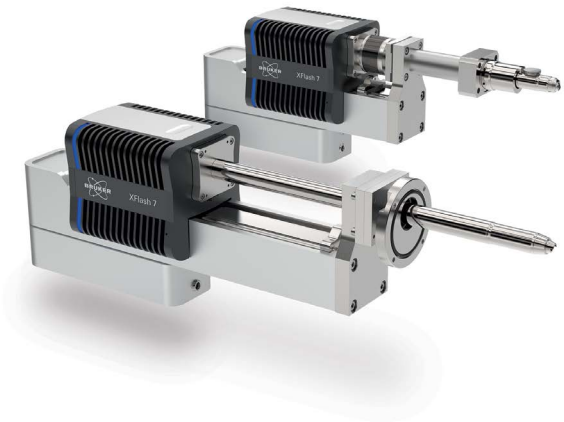


NANO-ANALYSIS

Electron Microscope Analyzers

Advancing Compositional and Structural Analysis

Innovation with Integrity



QUANTAX EDS for SEM and TEM

Our EDS systems provide highest energy resolution, maximum throughput and optimum geometry. QUANTAX EDS features the XFlash® 7 detector series with active areas from 30 to 100 mm².

- Best energy resolution down to 123 eV at Mn Kα for efficient light element and low energy analysis
- Slim-line detector technology for optimized geometry ensuring even more counts at lower beam currents
- Ultra-high throughput with up to 1,000 kcps output count rate at 2,500 kcps input with refined pile-up rejection for fastest measurements
- Large solid angles up to 1.1 sr and best take-off angles provided by the unique XFlash® FlatQUAD detector
- Even better solid angle and higher throughput when using multiple detector systems

Visit www.bruker.com/quantax-eds-for-sem and www.bruker.com/quantax-eds-for-tem

Semiconductor industry: SEM EDS analysis of a bulk 7 nm process CPU

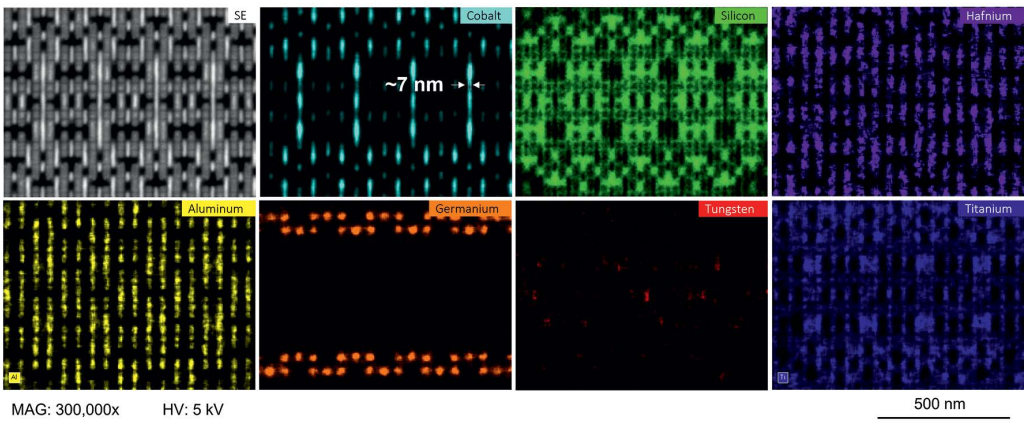


Figure 1
High spatial resolution EDS measurement at low kV of a CPU with FinFET devices, delayered using a plasma FIB. The Co structures shown on the left are ~ 7 nm thick. The high collection angle of the XFlash® 7 is ideal for low X-ray yield samples without compromising SEM performance.

Life science: Analysis of a stinging nettle plant by a dual EDS detector system

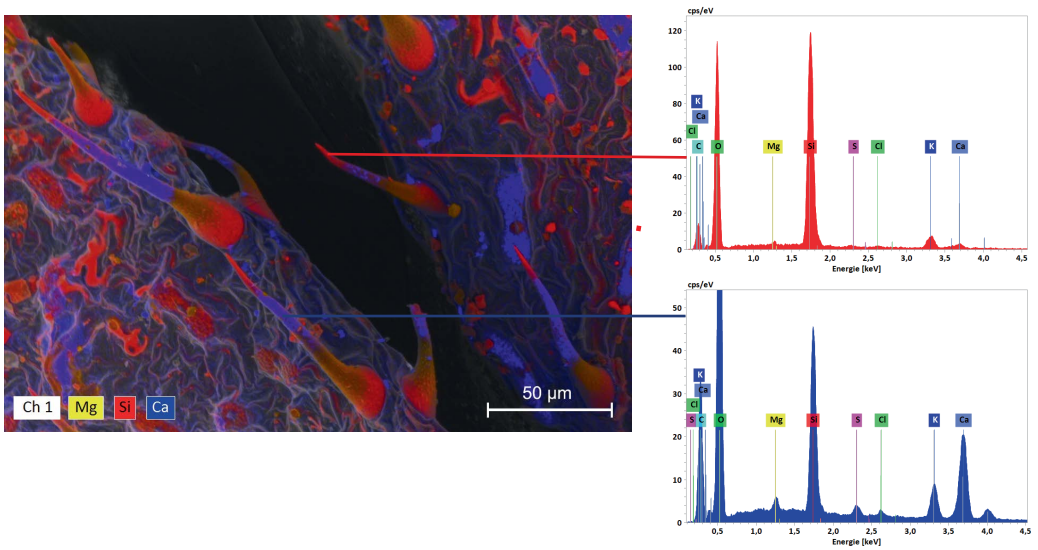


Figure 2
Element distribution map (left) of a stinging nettle (Urtica sp.). The results show the distribution of the elements Si, Ca, and Mg. EDS spectra (right) extracted from the ESPRIT HyperMap confirm the presence of three different biominerals: The tip and base of the trichome have Si-rich minerals, silicon dioxide acts as a hardening agent. The rest is made of Ca- and Mg-rich minerals, giving the structure the necessary flexibility.

QUANTAX WDS

The QUANTAX WDS system enables ultra-sensitive, high resolution X-ray microanalysis in the low energy range. The compact WD spectrometer XSense features distortion-free, non-magnetic parallel beam optics and incorporates the latest detector technologies.

- Energy range: 70 eV to 3.6 keV
- Energy resolution: ≤4.6 eV at Si Kα
- Up to six diffracting crystals: 200 Å, 80 Å, 60 Å (optional 30 Å) multi-layers, TAP, and PET
- Auto-aligning optics with secondary optics ensure optimum measurement conditions and large solid angle
- Reliable acquisition with pressure controlled proportional counter
- Easy setup and rapid start of measurement

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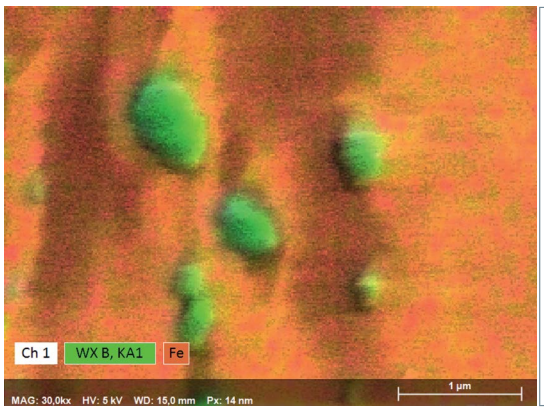
Light element determination



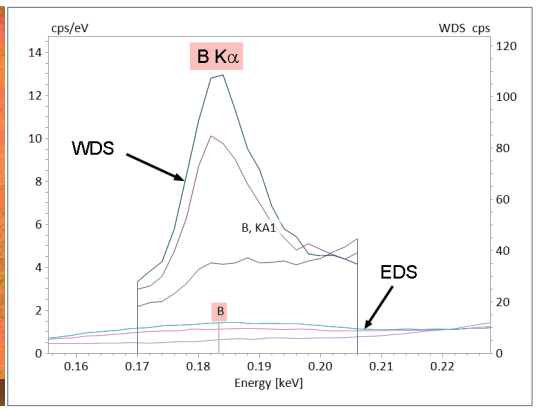
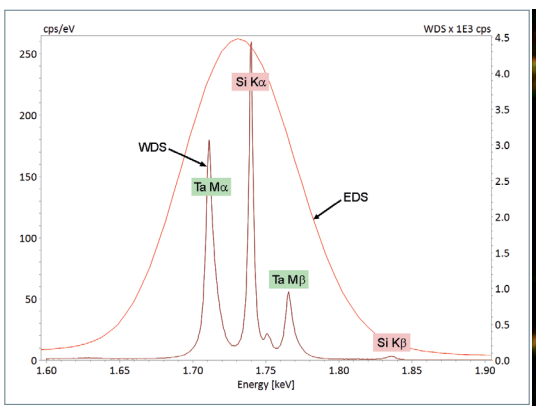


Figure 3 (left)
WDS mapping for boron distribution in a steel reveals sub-micron-size cementite grains (Fe_3C) with 0.4 wt.% B. Sample courtesy: Dr. Murugaiyan Amirthalingam, Indian Institute of Technology, Madras

Figure 4 (right)
Determination of boron contents in three different glasses (3.8, 2.0, 0.2 wt.% B). Measurement of uncoated samples in low vacuum (30 Pa).

Resolution of peak overlaps



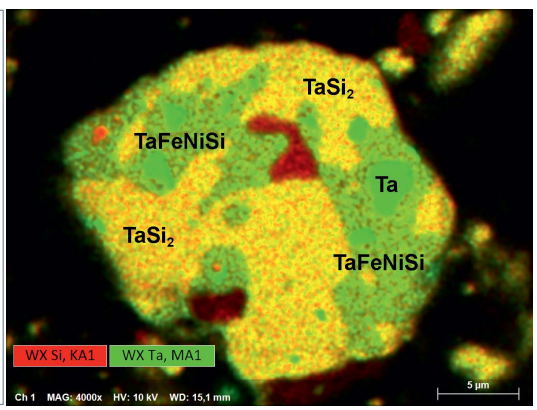


Figure 5 (left)
Resolution of EDS-peak overlaps in semiconductor tantalum silicide ($TaSi_2$).

Figure 6 (right)
WDS mapping for Si and Ta distribution in a polyphase alloy grain of 20 µm diameter.

QUANTAX EBSD

Our high-end EBSD system, featuring the eFlash detector, sets new standards in spatial resolution and combined EBSD/EDS analysis.

- Best spatial resolution down to 1.5 nm using OPTIMUS 2 detector head for On-Axis Transmission Kikuchi Diffraction (TKD) in SEM
- Bright Field (BF) and Dark Field (DF) imaging using ARGUS™ on OPTIMUS 2 detector head
- Unique ARGUS™ FSE/BSE imaging system for microstructure visualization in color when using EBSD geometry
- EBSPs with up to 720 x 540 pixels
- Fastest simultaneous EBSD and EDS acquisition
- In-situ vertically adjustable detectors for optimum sample-detector geometry

Visit www.bruker.com/quantax-ebsd

Best spatial resolution enabled by On-Axis TKD

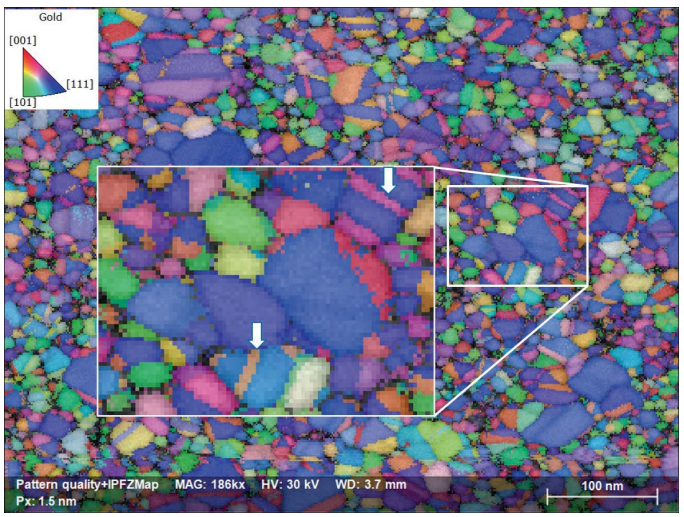


Figure 7
Raw orientation map depicting the very fine grained microstructure of a gold thin film sample. Annealing twins 4 to 6 nm wide are highlighted. The scale bar represents 100 nm.

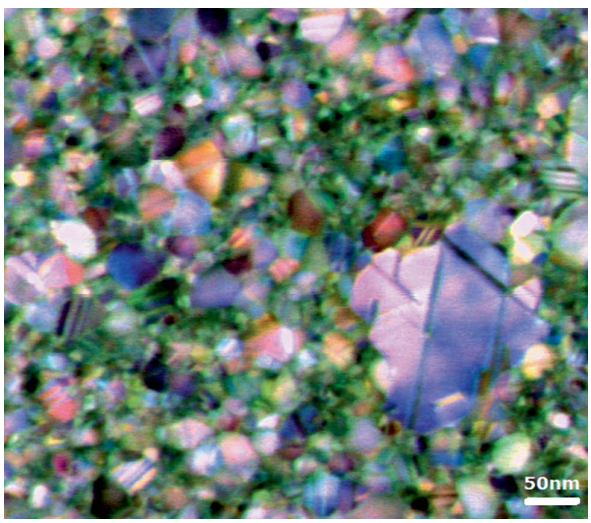


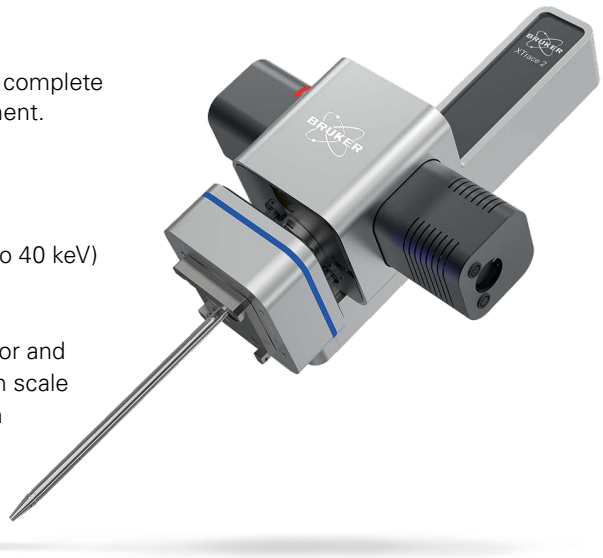
Figure 8
False-color ARGUS™ image acquired with a pixel size of 1 nm from a gold thin film. The scale bar represents 50 nm.

QUANTAX Micro-XRF

XTrace 2, our micro-spot X-ray source, adds the capabilities of a complete Micro-XRF spectrometer to your SEM – but without the investment.

- Non-destructive, micrometer scale measurements over cm
- Ideal for low kV and beam sensitive samples
- Low detection limits down to 10 ppm
- Detection of high energy X-ray lines (full spectrum range up to 40 keV)
- High information depth
- No charging effects, minimal sample preparation required
- Fast elemental X-ray mapping over large areas showing major and minor elements, as well as trace elements down to the ppm scale
- Optional film thickness analysis package for characterization of thin films or even multiple layer structures

Visit www.bruker.com/quantax-micro-xrf



High speed elemental X-ray mapping and trace element analysis

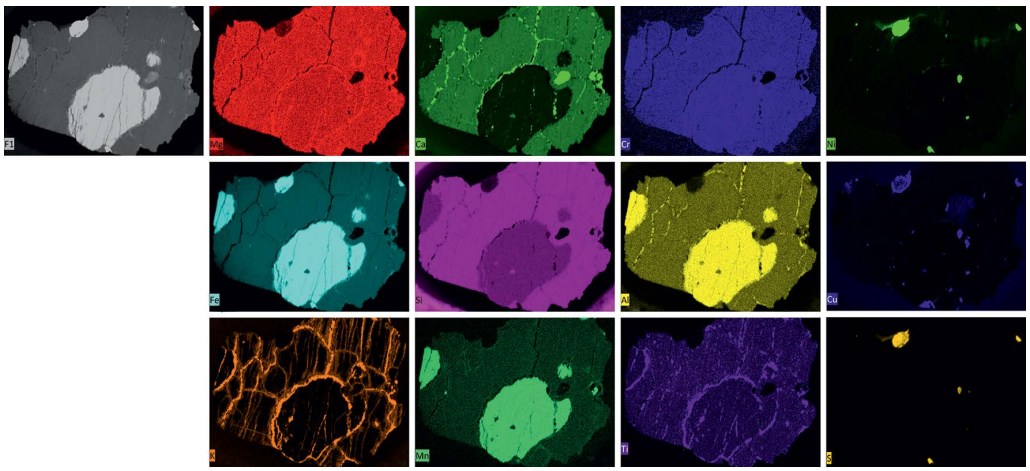
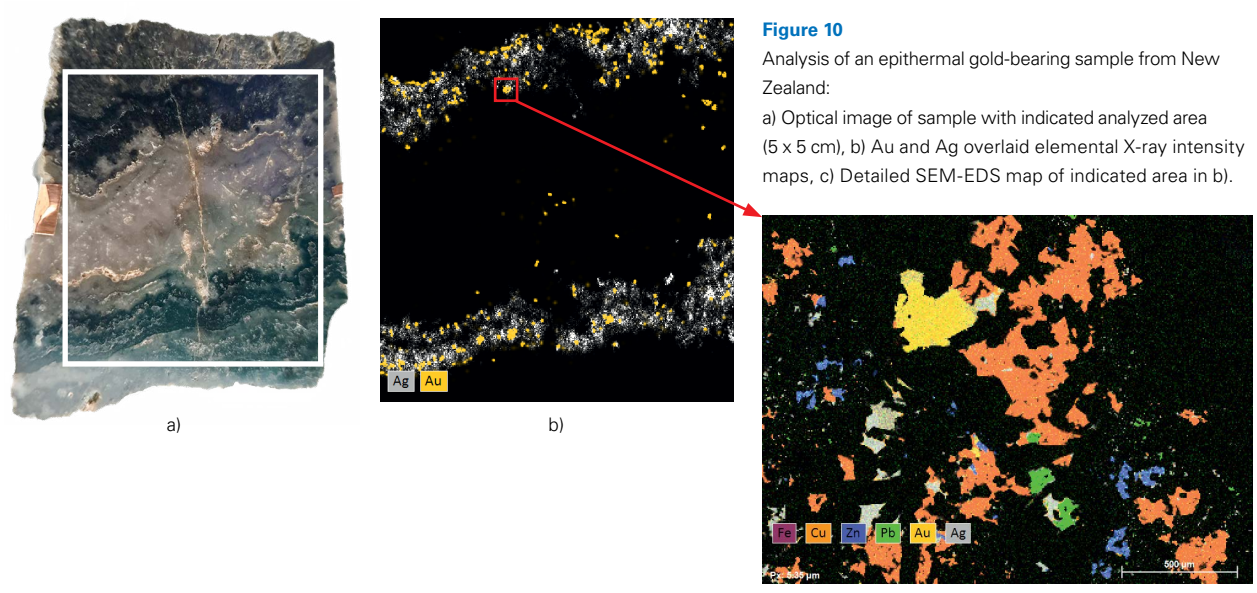


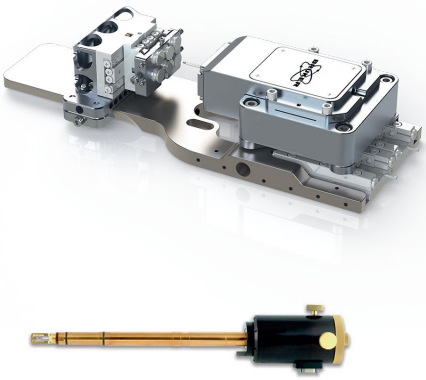
Figure 9
Micro-XRF on SEM analysis of a small diamond-bearing mantle eclogite from Newlands kimberlite in South Africa. The main phases are garnet and clinopyroxene, with minor sulphides and metasomatic minerals. The analytical area is approximately 3 cm x 2 cm.

Micro-XRF on SEM analysis of epithermal Au



a) b) c)

Figure 10
Analysis of an epithermal gold-bearing sample from New Zealand:
a) Optical image of sample with indicated analyzed area (5 x 5 cm), b) Au and Ag overlaid elemental X-ray intensity maps, c) Detailed SEM-EDS map of indicated area in b).



SEM and TEM PicoIndenters

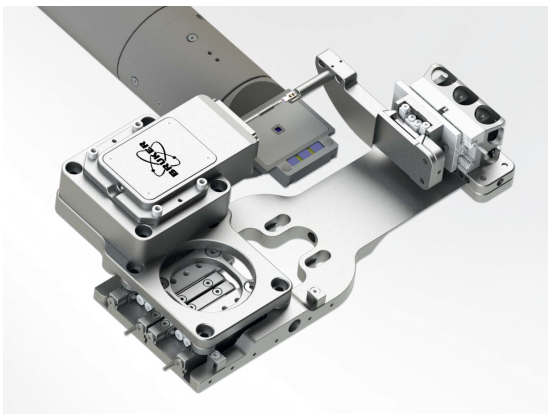
Hysitron PI 89 SEM (top left) and PI 95 TEM (bottom left) PicoIndenters enable quantitative measurement of in-situ SEM and TEM nanomechanical properties of small-scale materials.

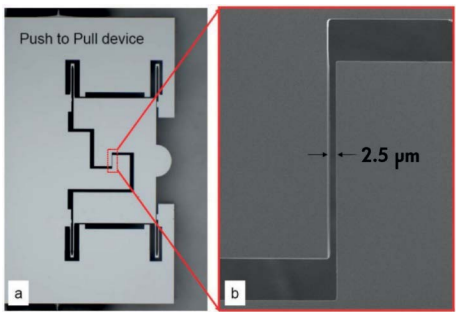
- Nanomechanical properties of interest are hardness, modulus, yield strength as well as fracture and dynamic properties
- Testing modes include nanoindentation, compression, tension, and bending
- PI 89 provides propriatary interchangeable transducer of extended load and displacement range and supports in-situ testing at extreme environment up to 1000°C and cryogenic
- Both systems are compatible with most major microscope models for SEM, FIB-SEM and TEM

Visit www.bruker.com/picoindenters

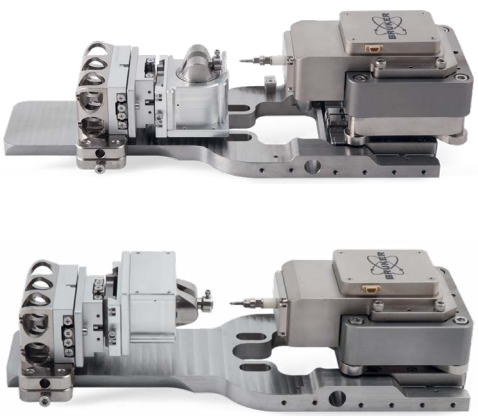
Deformation mapping on nanowires and thin films using TKD with PI 89

Figure 11
Nanowires and free-standing thin films can be mounted and tested in tension using a MEMS fabricated Push-to-Pull device. On-Axis Transmission Kikuchi Diffraction can be carried out with the OPTIMUS 2 detector head. Combined TKD with PI 89 helps understanding deformation of a sample as a function of strain.





Accelerated property mapping (XPM) with PI 89



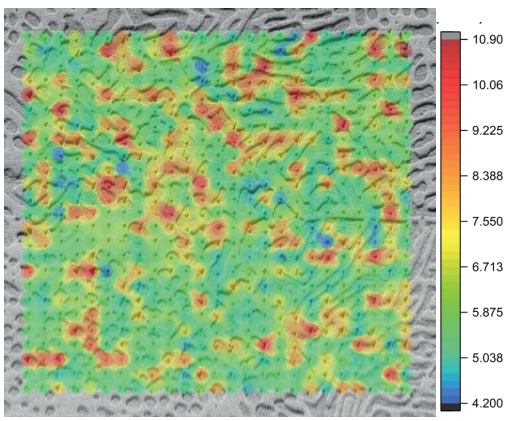


Figure 12
Bruker's XPM with PI 89 sets a new industry standard in terms of nanomechanical testing throughput paired with measurement resolution and accuracy. Arrays of individual measurements can be spatially arranged and plotted to generate maps of mechanical property gradients across a surface (here hardness in GPa). XPM mode is available with high temperature and rotation and tilt stages with 5 degree of sample positioning freedom for detectors such as EDS, BSE, EBSD.

ESPRIT

Our unique ESPRIT software suite allows for the full control and flexible combination of up to four analytical methods via a single user interface.

- Seamless integration of EDS, WDS, EBSD and micro-XRF on SEM
- Intuitive user interface and navigation
- Enhanced analytical power through synergistic combination of results delivered by different methods
- Extensive automation tools including new scripting environment for fully customized workflow solutions

Visit www.bruker.com/esprit

Integrating multiple methods in one software suite

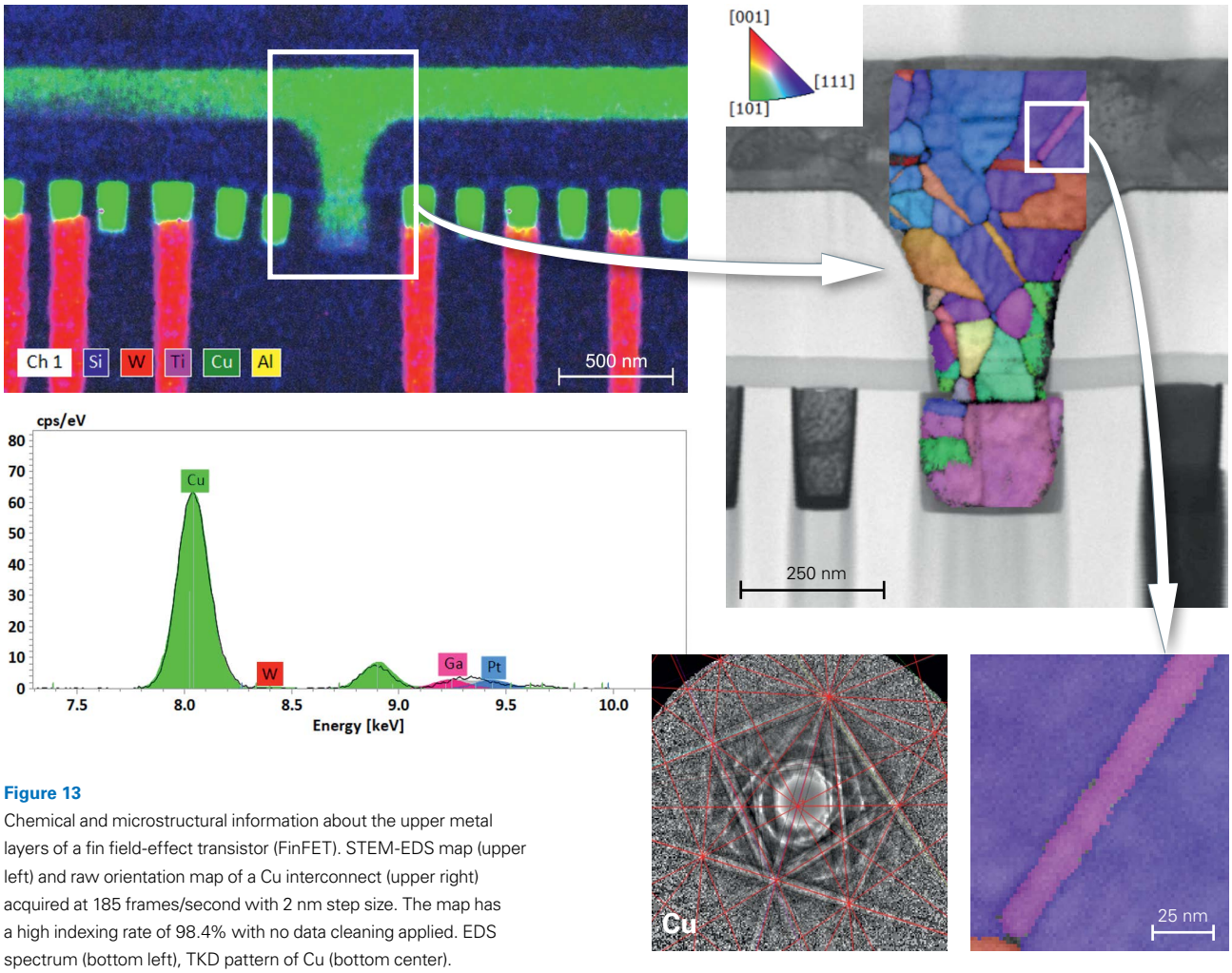


Figure 13
Chemical and microstructural information about the upper metal layers of a fin field-effect transistor (FinFET). STEM-EDS map (upper left) and raw orientation map of a Cu interconnect (upper right) acquired at 185 frames/second with 2 nm step size. The map has a high indexing rate of 98.4% with no data cleaning applied. EDS spectrum (bottom left), TKD pattern of Cu (bottom center).

Unique range of analytical tools for electron microscopes

Bruker's unique range of analytical tools for electron microscopes give researchers the ability to analyze the composition and structure of materials in great detail.
The portfolio, including EDS for SEM and TEM, WDS, EBSD and micro-XRF on SEM, provides the most comprehensive compositional and structural analysis of materials available. In addition, the full integration of each tool with ESPRIT software allows data obtained across these complementary measurement techniques to be easily combined - allowing researchers to see the whole picture and get the best results.

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