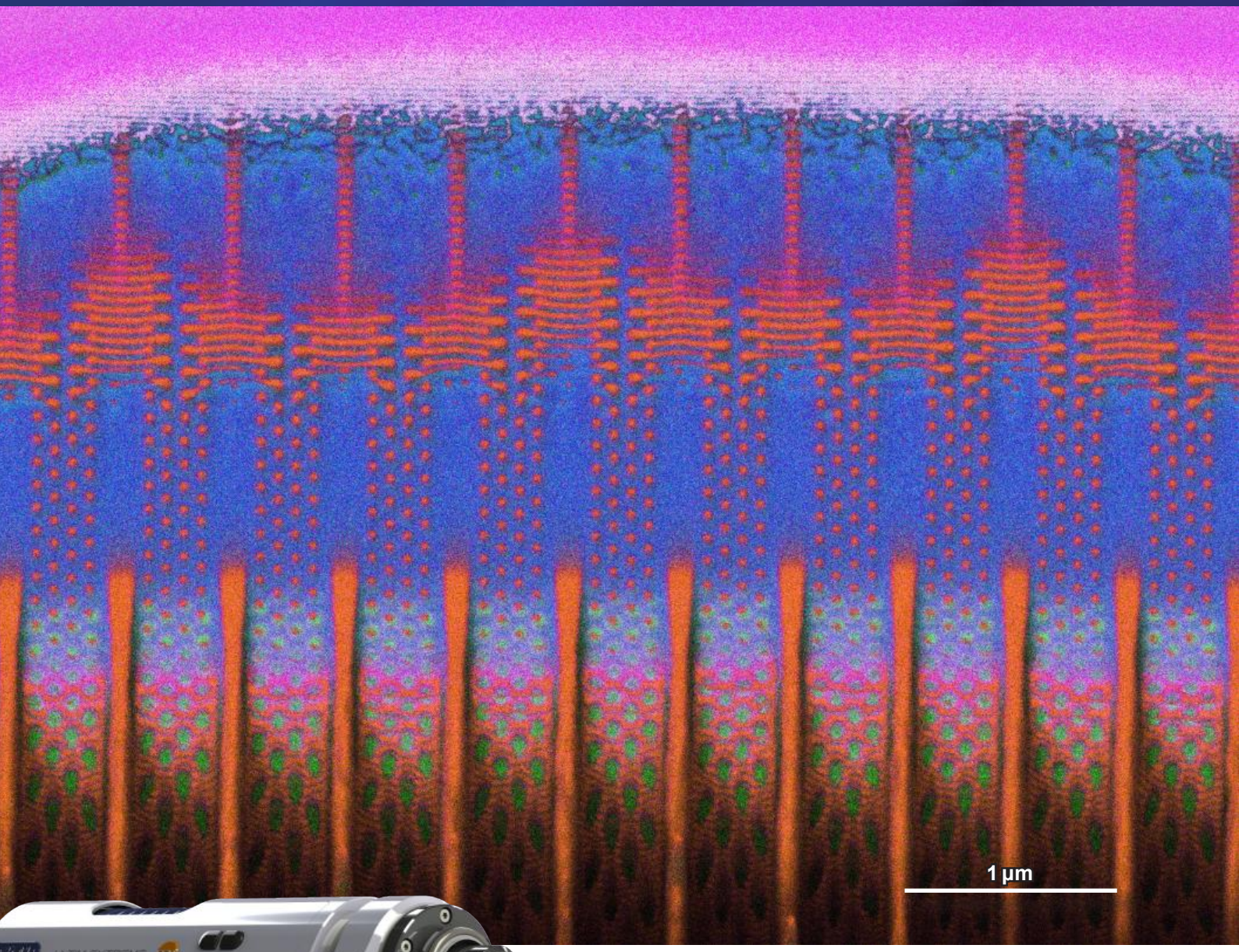
EDS

Ultim® Extreme Silicon Drift Detector

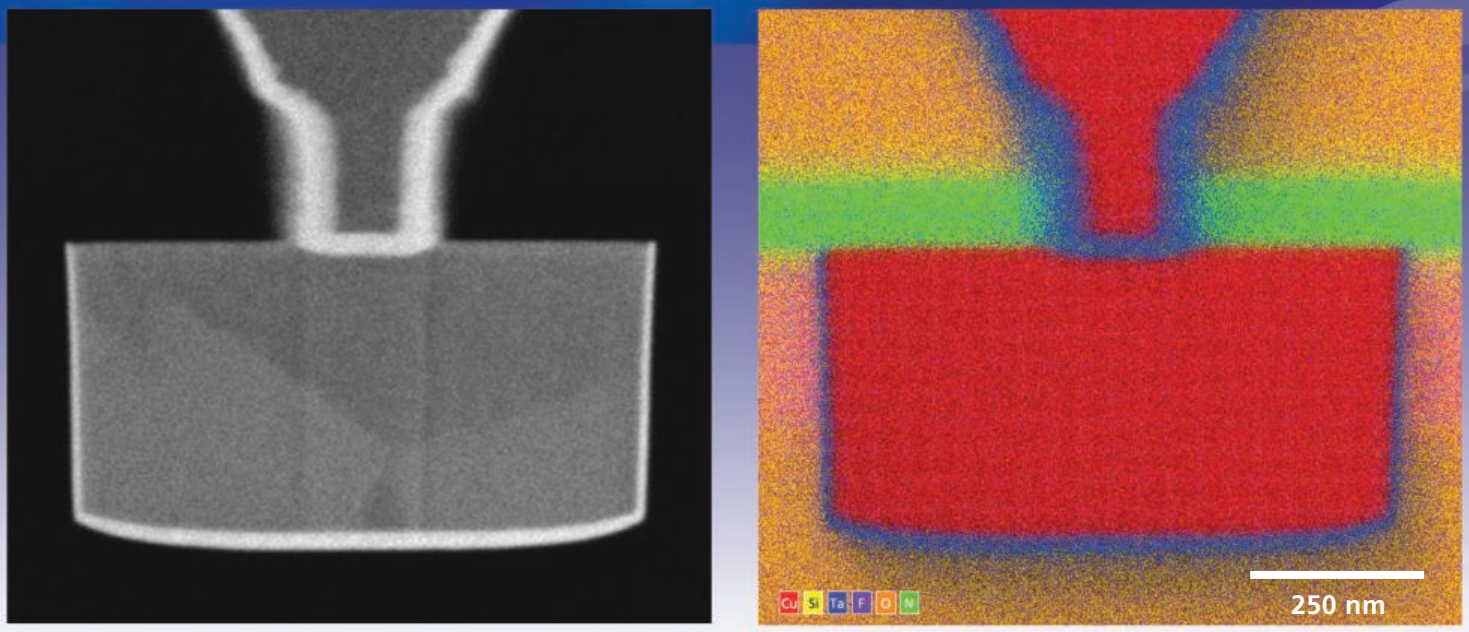
Delivering solutions beyond conventional nano-analysis in the SEM



OXFORD INSTRUMENTS

Ultim Extreme

Solutions beyond conventional nanoanalysis in the FEG-SEM...



Analysis of a bulk cross section of a smart phone SRAM device: the EDS X-ray map resolution approaches that of the SEM image. Data courtesy of MSS Corp.

A spatial resolution and sensitivity breakthrough for EDS in the FEG-SEM

Ultra-high resolution FEG-SEMs offer exciting new capabilities for the investigation of smaller nano-structures, interfaces and surfaces. However, under the operating conditions used to make use of new electron signal contrasts from in-lens detectors - very short working distance, very low kV and minimal beam current - no traditional SDD can provide supporting elemental characterisation.

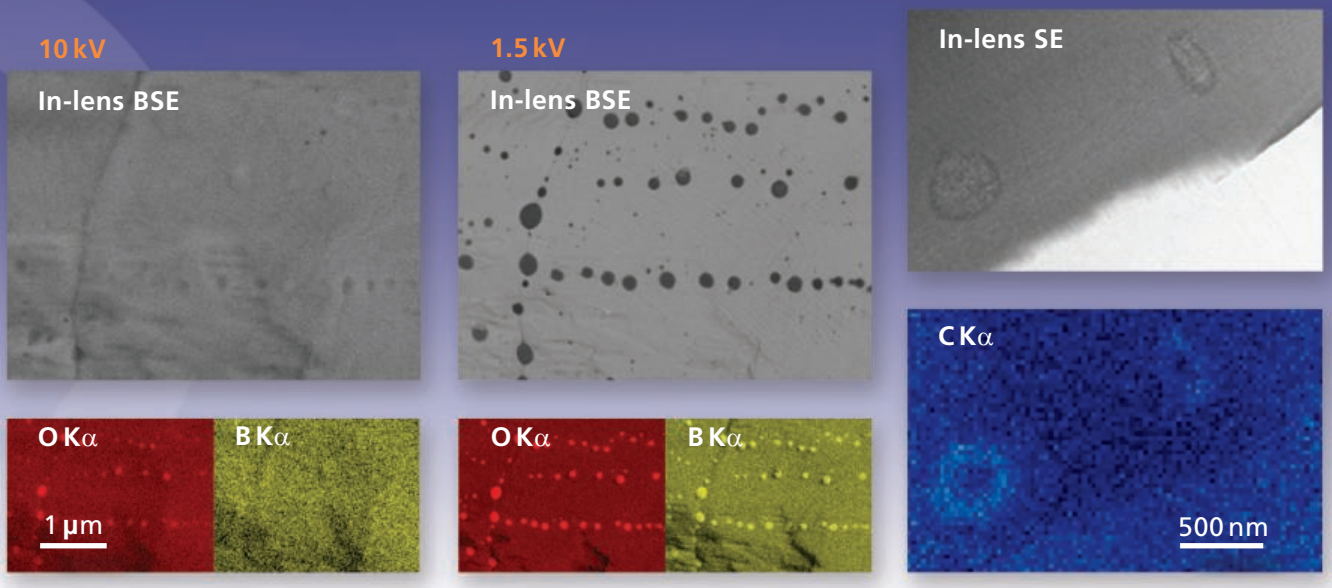
Until now. With **Ultim** Extreme, both imaging and EDS are performed simultaneously, while the EDS resolution approaches that of the SEM itself.

Radical new geometry maximises sensitivity and spatial resolution in FEG/FIB-SEM:

- Highest sensitivity conventional port-mounted EDS detector
- Windowless operation
- Typically 15 x greater sensitivity at low kV than conventional large area SDD
- Unique shape 100 mm^2 sensor for short working distance operation
- Reduced footprint electron trap configuration allows qualitative analysis up to 7 kV beam voltage
- Use immersion field to extend quantitative range up to 15kV and beyond
- New electronics boost sensitivity to very low energy X-rays and extends the low energy analytical performance at higher count rates
- Enhanced Tru-Q™ software turns the X-ray data into practical and accurate elemental information at this unrivalled spatial resolution

EDS resolution approaches that of the FEG-SEM

...new possibilities, better spatial resolution, more sensitivity



Reducing accelerating voltage from 10 kV to 1.5 kV allows electron image contrast to show the distribution of oxide particles. X-ray mapping under the same conditions characterises precipitates as MnOB.

X-ray map collected at 1 kV to characterise high-end electronic component stain detected using In-lens SE imaging.

Sub 10 nm element characterisation

Achieving practical EDS count rates and spectral quality at 2 kV or less, combined with short working distance for optimum beam size means unrivalled spatial resolution for element characterisation is now possible:

- Practical sub 10 nm element characterisation on real materials in the FEG/FIB-SEM
- X-ray map resolution close to SEM image resolution
- Characterise smaller nano-structures, particles and materials
- Use bulk samples to reduce workload on TEM and sample preparation time

Materials characterisation down to 1 kV

The latest in-lens detectors provide new types of image contrast for new information about nano-structures. **Ultim** Extreme works at the same collection conditions to add elemental information to this new image information.

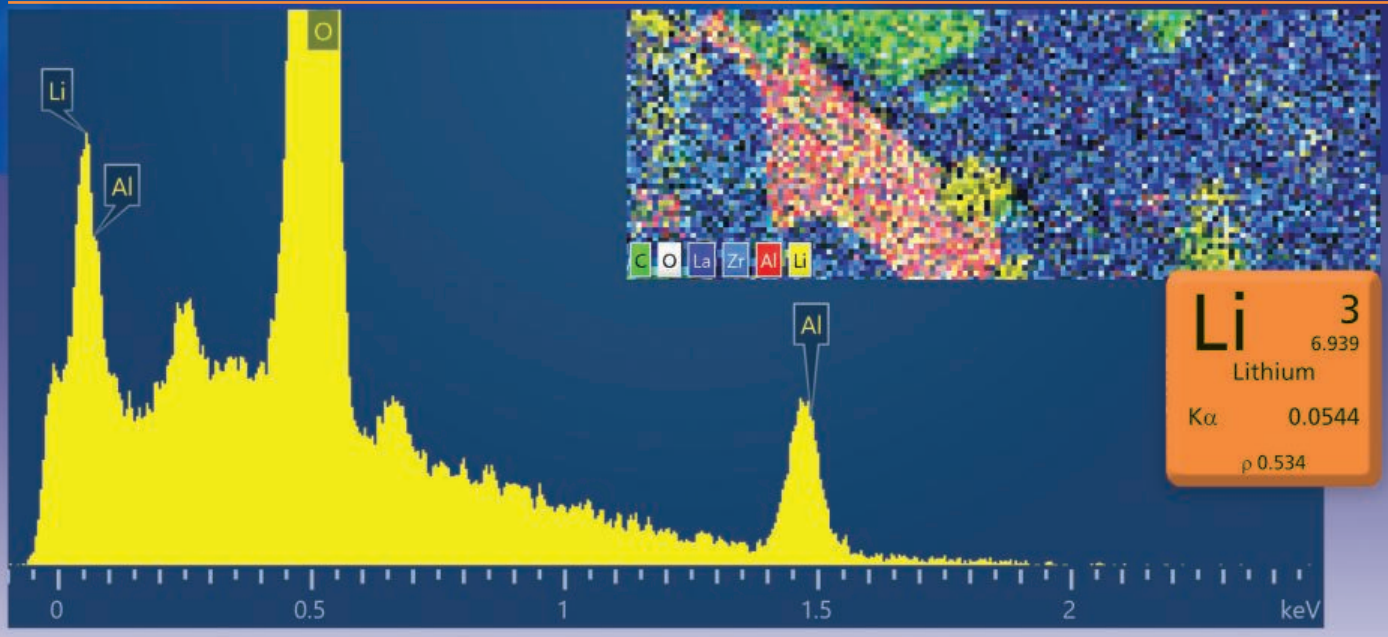
- Fully integrate EDS where very low kV electron microscopy benefits sample characterisation
- Enhanced signal contrast
- Reduction of sample damage e.g. for polymers and soft coatings
- Reduce charging, or achieve charge balance conditions

Surface science sensitivity

At very low accelerating voltages, X-ray information is emitted from the top few nm or atomic layers only, making the elemental characterisation of surfaces in the FEG/FIB-SEM possible:

- Characterise the composition and distribution of surface contaminants and layers a few atoms thick
- Integrate characterisation of surfaces with SEM investigation
- Analyse the surface structures only visible with in-lens detectors at very low kV and short working distance
- Save money and time compared to Auger/XPS

Ultim Extreme



Spectrum collected from LiAlO grain in a LiLaZrAlO solid battery electrolyte.

EDS map of solid electrolyte showing LiKα mapping (yellow)

Fastest and most accurate nano-characterisation

Ultim Extreme collects more and better quality EDS data at higher spatial resolution. With the **AZtec** Tru-Q™ processing engine, this provides the fastest, most accurate characterisation possible in the FEG/FIB-SEM.

- High speed collection
- Unrivalled low energy spectrum quality and integrity
- Real-time data processing
- Rapid autoID and TruMap peak overlap correction of low energy X-ray lines

Extreme light element sensitivity

The windowless configuration and ultra high sensitivity of **Ultim** Extreme offers the most sensitive light element detection.

- Up to 15x increase in signal over conventional detectors
- Work at lower kV to minimise sample damage and charging
- New potential for the detection and characterisation of difficult elements, such as nitrogen
- New ability to analyse polymers and soft biological materials

Lithium detection and mapping

Oxford Instruments announced the first successful detection of Li X-rays by EDS in 2012. We have developed this know-how adding new ultra low noise electronics for the detection of X-rays below 100 eV.

- First detection and X-ray mapping of Li Kα (only 56 eV)
- First detection of lithium in compounds e.g. LiH, Li_3N, Li_2O, Li_2S, LiF and LiCl by EDS
- First characterisation of Li in battery materials

nano.oxinst.com/ultim-extreme

OXFORD INSTRUMENTS

CE