Superior peak separation and trace element detection using WDS
Microprobe Accuracy on a SEM

Accuracy
Achieve the Accuracy of an EPMA on a SEM
• Accurate quantitative analysis below 500ppm

Resolutions
More resolution than any other X-ray spectrometer
• Less than 10eV resolution for resolving important overlaps like Sulfur/Molybdenum

Mapping
Accurate Maps Immediately
• Easily and unambiguously determine the distribution of all elements in a sample even where peaks overlap (figure 4)

Sensitivity
Improved Sensitivity
• INCAWave is up to 100 times more sensitive than an EDS system for trace element detection (figure 5)
INCA Wave delivers the power of WDS sensitivity and resolution with the productivity of the INCA platform.

**Energy+ combines the Accuracy of WDS with the Speed of EDS**
Investigating peak overlaps has never been easier.

- The EDS system features a faster peak acquisition rate than EDS.
- The WDS system features a faster peak acquisition rate than EDS.
- The INCA Wave system features a faster peak acquisition rate than EDS.

Combined ED / WDS Quant Results for Speed and Accuracy
Analyze samples quickly and accurately by combining ED and WDS Quant.

<table>
<thead>
<tr>
<th>Component</th>
<th>INCA Energy</th>
<th>INCA Wave</th>
<th>EPMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cr</td>
<td>0.07</td>
<td>0.07</td>
<td>0.07</td>
</tr>
<tr>
<td>Mn</td>
<td>19.71</td>
<td>19.71</td>
<td>19.71</td>
</tr>
<tr>
<td>Fe</td>
<td>18.60</td>
<td>18.60</td>
<td>18.60</td>
</tr>
<tr>
<td>Ca</td>
<td>0.33</td>
<td>0.33</td>
<td>0.33</td>
</tr>
<tr>
<td>Mg</td>
<td>0.32</td>
<td>0.32</td>
<td>0.32</td>
</tr>
<tr>
<td>Al</td>
<td>0.39</td>
<td>0.39</td>
<td>0.39</td>
</tr>
<tr>
<td>Si</td>
<td>0.58</td>
<td>0.58</td>
<td>0.58</td>
</tr>
<tr>
<td>Na</td>
<td>0.31</td>
<td>0.31</td>
<td>0.31</td>
</tr>
<tr>
<td>K</td>
<td>5.31</td>
<td>5.31</td>
<td>5.31</td>
</tr>
<tr>
<td>Ti</td>
<td>0.53</td>
<td>0.53</td>
<td>0.53</td>
</tr>
<tr>
<td>V</td>
<td>0.37</td>
<td>0.37</td>
<td>0.37</td>
</tr>
<tr>
<td>MnO</td>
<td>41.96</td>
<td>41.96</td>
<td>41.96</td>
</tr>
<tr>
<td>FeO</td>
<td>11.96</td>
<td>11.96</td>
<td>11.96</td>
</tr>
<tr>
<td>CaO</td>
<td>7.85</td>
<td>7.85</td>
<td>7.85</td>
</tr>
<tr>
<td>MgO</td>
<td>0.28</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>Al₂O₃</td>
<td>5.31</td>
<td>5.31</td>
<td>5.31</td>
</tr>
<tr>
<td>SiO₂</td>
<td>99.72</td>
<td>99.72</td>
<td>99.72</td>
</tr>
<tr>
<td>Garnet Na</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>Garnet Al</td>
<td>19.56</td>
<td>19.56</td>
<td>19.56</td>
</tr>
<tr>
<td>Garnet Ca</td>
<td>19.34</td>
<td>19.34</td>
<td>19.34</td>
</tr>
<tr>
<td>Garnet Si</td>
<td>0.28</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>Garnet O</td>
<td>5.31</td>
<td>5.31</td>
<td>5.31</td>
</tr>
<tr>
<td>Garnet K</td>
<td>0.37</td>
<td>0.37</td>
<td>0.37</td>
</tr>
<tr>
<td>Garnet Ti</td>
<td>7.85</td>
<td>7.85</td>
<td>7.85</td>
</tr>
<tr>
<td>Garnet V</td>
<td>99.72</td>
<td>99.72</td>
<td>99.72</td>
</tr>
</tbody>
</table>

**Table:**
This dataset compares results from a mineralogical sample taken on (1) a dedicated EPMA with multiple WDS spectrometers (2) an EDS spectrometer using the **INCA Wave**. The combined ED / WDS Quant results show clear benefits in terms of resolution and peak overlap rejection. This is due to the unrivalled peak to background ratio of the fully focussing design and the high precision of the wavelength position reproducibility. The unrivaled peak to background ratio of the fully focussing design means signals from trace elements can be easily measured, allowing you to map a sample 3mm long by 2mm wide. This is a montaged Cr WD X-ray map for garnet, with a WDS system that has a guaranteed performance. The use of EDS for a quick and rapid analysis of the sample means signals from trace elements are very sensitive to any tiny changes in the sample position & the height of the sample. This dataset shows that if the sample is not accurately focused, no WDS signal may be gathered at all, and positioning the sample accurately becomes difficult and time-consuming.

**How is INCA Wave different from other WDS spectrometers available for the SEM?**
INCA Wave is a fully focussing spectrometer with a geometry similar to EDS. This means the sample first passes through a fixed focal length, followed by a fixed focal length, which is the same length as the WDS sample height. This geometry is ideal for elemental analysis by a fixed position detector. This allows for reproducible and accurate results.

**Easy and quick to set up for analysis**
The peak selection for a quick and accurate analysis of the sample is as simple as selecting the peak on the spectrum.

**Guaranteed system performance**
All INCA WAVE spectrometers have pre-programmed parameters to ensure reproducible and accurate results.

**Rapid long lifetime operation**
The instrument for the in-line focussing optics is the only SEM spectrometer that has a guaranteed performance for up to 5 years.

**Most accurate elemental analysis available for SEM**
The instrument for the in-line focussing optics is the only SEM spectrometer that has a guaranteed performance for up to 5 years.

**Energy+ combines the Accuracy of WDS with the Speed of EDS**
Investigating peak overlaps has never been easier.

- EDS for quick and rapid analysis of the sample.
- Switch to WDS for in situ peak overlap and minor elements.
- Traditional WDS spectrometers work at higher beam currents than EDS detectors but with the introduction of EDS EDS, there is no compromise required.

**Energy+ combines the Accuracy of WDS with the Speed of EDS**
Investigating peak overlaps has never been easier.

- EDS for quick and rapid analysis of the sample.
- Switch to WDS for in situ peak overlap and minor elements.
- Traditional WDS spectrometers work at higher beam currents than EDS detectors but with the introduction of EDS EDS, there is no compromise required.

**Energy+ combines the Accuracy of WDS with the Speed of EDS**
Investigating peak overlaps has never been easier.

- EDS for quick and rapid analysis of the sample.
- Switch to WDS for in situ peak overlap and minor elements.
- Traditional WDS spectrometers work at higher beam currents than EDS detectors but with the introduction of EDS EDS, there is no compromise required.

**Energy+ combines the Accuracy of WDS with the Speed of EDS**
Investigating peak overlaps has never been easier.

- EDS for quick and rapid analysis of the sample.
- Switch to WDS for in situ peak overlap and minor elements.
- Traditional WDS spectrometers work at higher beam currents than EDS detectors but with the introduction of EDS EDS, there is no compromise required.
History of INCA® Wave WDS Technology

1940s
- First EPMA developed

1950s
- The first commercial high-performance (for XRD) Magna Meters WDX-210 is launched by Microspec Corporation
- First WDX-2A shipped

1960s
- Microspec WDX-2A with computer control for all operations is launched
- First WDX-2BC shipped
- Microspec WDX-2BC with PC control for all operations is launched
- First WDX-2BC shipped

1970s
- Microspec WDX-2B with 2 symultaneous detection channels is launched
- ISIS Theta is the first combined WDS/EDS software to be launched
- Oxford Instruments acquire Microspec Corporation
- First ISIS-200WDS shipped

1980s
- First INCA Wave analysis system launched
- INCA Wave software combining the power and simplicity of the Microspec spectrometer with the speed and ease of use of the INCA system

1990s
- First WDX-400/600 shipped
- INCA Energy+ launched making combined ED/WD analysis easy
- AutoMate+ and Montage are launched providing automated unattended data collection and large area ED/WD mapping

2000s
- INCA® Wave is launched making combined ED/WD analysis easy
- ED/WD Nets and In-Element are launched providing automated unattended data collection and large area ED/WD mapping

Go to www.oxford-instruments.com for more information