EDAXinsight

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INSIDE

EDS NEWS

Octane Silicon Drift Detectors – Maximize Your Materials Insight

Performance without Compromise

EDAX launched the Octane Series Silicon Drift Detectors in August at Microscopy & Microanalysis 2012 in Phoenix, AZ and immediately established a new level of performance in EDS technology. By incorporating the latest advancements in Silicon Drift Detector technology, the Octane Series SDDs delivers high-quality EDS data at previously unachievable speeds. Until now, the potential speed advantages of SDD technology have been unrealized due to losses in data quality at high-count rates.

With the Octane Series, customers are no longer forced to choose between fast data collection and high-quality results. They can now benefit from both to maximize their materials insight (Figure 1).

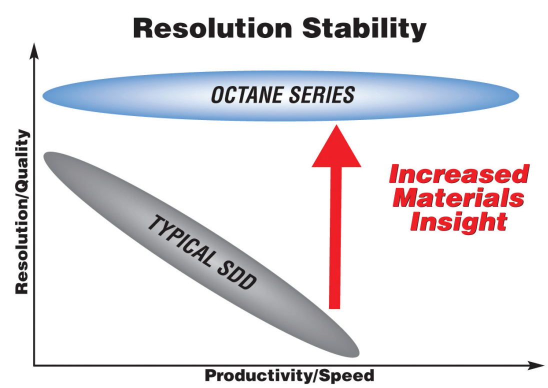

Figure 1. With stable resolution regardless of speed, Octane SDDs enable users to maximize their materials insight

(Continued from Page 1)

Application Driven Detector Design

The Octane Series includes four models (Figure 3) —the Pro, Plus, Super and Ultra—that are designed specifically to meet the demands of key microanalysis applications.

Octane Model	Application
Pro	Quantify light elements Resolve low energy lines
Plus	Superior performance across a wide range of applications
Super	Nanoanalysis and low count rate applications
Ultra	4D analysis situation where collection time is critical

Figure 3. Recommended Octane detector by application

Industry Best Resolution

At the core of the Octane family is an advanced spectrometer design and state-of-the-art electronics that enable energy resolution down to 121 eV (Figure 4) with world-class efficiency in converting input counts into stored data.

Octane Model	Available Mn Resolution(eV)			
Pro	121	123	126	129
Plus		123	126	129
Super			126	129
Ultra				129

Figure 4. Available Mn resolutions for Octane SDDs

Resolution Stability delivers quality at any speed

Octane detectors take advantage of optimal chip design and state of the art electronics to tap into the full potential of SDD technology. Competitive solutions quickly lose data quality as throughput counts are increased. Octane technology provides a Resolution Stability of 90% up to 200 kcps, in typical EDS working conditions. As shown in Figure 5, this allows working at a very high throughput while maintaining high quality data.

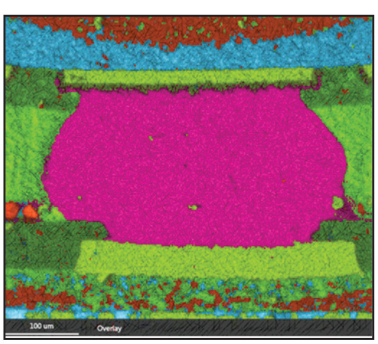

Figure 5. 256 x 200 map of solder bump collected with Octane Super SDD 2 minute livetime, 150 kcps throughput, 140 eV resolution

Additionally, the tuned electronics process counts with a much higher degree of efficiency than typical SDDs on the market, as shown in Figure 6 below.

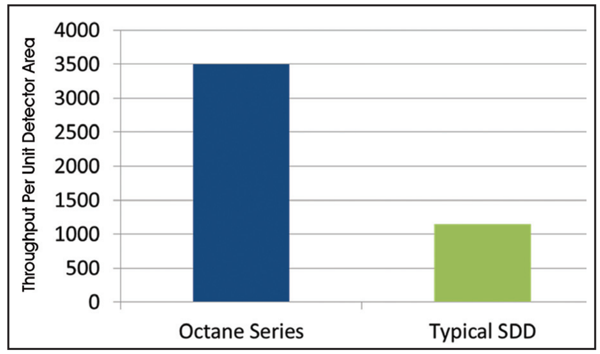

Figure 6. Octane Throughput Advantage

Low Energy Performance

Low energy performance has become a more critical factor in EDS analysis. As materials move to the nanoscale, the ability to analyze them at that level imposes new demands on hardware. The Octane SDD excels in the low current and low accelerating voltage conditions that are often needed to resolve nano features. Figure 7 shows Si L and Al L peaks clearly resolved.

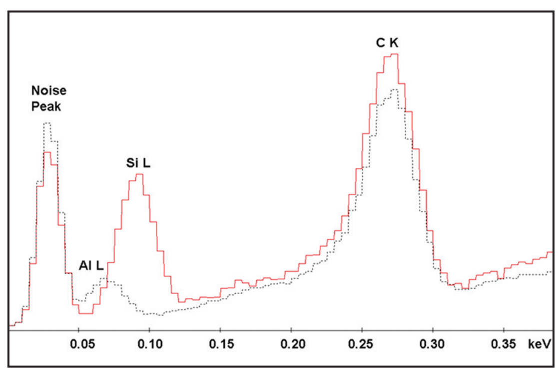

Figure 7. Excellent resolution and noise design clearly resolve Si L and Al L

Ease of Use

Fully integrated into TEAM™ EDS, the Octane Family benefits from the advanced Smart Features that form the backbone of the TEAM™ Platform. Smart Track, EXpert ID and Smart Phase Mapping apply the ease-of-use design philosophy of TEAM™ to optimize the capabilities of the Octane detectors, making EDS data collection and analysis straightforward for users at any level.

Conclusion

The Octane Series Silicon Drift Detectors takes SDD technology to the next level, opens new levels of materials insight and delivers performance without compromise to EDAX customers.

TIPS AND TRICKS

Dead-Time Optimization for High Productivity Data Analysis

For a microanalysis system, the dead time is the time when the X-ray processing system is busy processing X-ray events or rejecting X-ray events when pileup occurs. Historically, one of the first rules or guidelines that an EDS user learned was how to keep the percentage dead time within a recommended range, typically 20 to 30 percent. This dead time range is also noted in several relevent ISO and ASTM standard procedures. This tip will examine dead time with the goal of obtaining high quality throughput from the current generation of Silicon Drift Detectors (SDD).

Previously, if a user wanted to collect a spectrum and the dead time was too high, system parameters were normally adjusted in one of two ways: reduce count rate by decreasing beam current or select a shorter amp time. On the other hand, if the user had a dead time that was lower than the normal optimal range of dead times, the system was adjusted by increasing the count rate by increasing beam current, selecting a longer amp time, or choosing to let dead time remain lower than what had been considered optimal. Typically, users did not consider the last choice as an option because they would effectively be sacrificing throughput for resolution. The longest amp time typically yielded the best resolution.

By contrast, with EDAX's new SDD technology, the intermediate to long amp times do not exhibit a significant decrease in resolution with increased throughput, giving rise to the concept of Resolution Stability. For example, at an input count rate of 30 kcps, the longest amp time would allow a throughput of 18 kcps, while moving to an amp time eight times shorter would provide a throughput of 28 kcps, with a change in resolution of less than 4 eV (see Figure 1 below.) Although the dead time at that shorter amp time is outside of the traditional range (8.4 percent vs. 20-30 percent), this is obviously a much more efficient and productive mode of collection with very little sacrifice in resolution.

In summary, with today's Silicon Drift Detectors some guidelines for dead time still apply but others do not. The rule that dead time should typically fall within the range of 20 to 30 percent should be modified. It still makes sense to maintain a maximum of 30 percent dead time in most conditions, but users should primarily focus on resolution as the benchmark for collecting high quality data as throughput increases. In many instances, operating at relatively low dead times can provide a throughput improvement that is significant with minimal degradation of resolution.

a.	Input CPS: 30164	Output CPS: 18194	Dead Time: 39.7	Amp Time: 7.68	Detector Resolution: 124.1
b.	Input CPS: 30024	Output CPS: 24793	Dead Time: 17.4	Amp Time: 3.84	Detector Resolution: 124.4
c.	Input CPS: 30145	Output CPS: 26073	Dead Time: 13.5	Amp Time: 1.92	Detector Resolution: 125.3
d.	Input CPS: 30073	Output CPS: 27538	Dead Time: 8.4	Amp Time: 0.96	Detector Resolution: 128.0

Figure 1. Four status bars are shown from the TEAM™ software illustrating the throughput at the 7.68 (a), 3.84 (b), 1.92 (c), and the 0.96 (d) amp times.

Defining Silicon Drift Detector Performance

Materials Challenge

Silicon Drift Detectors (SDD) have become the standard for EDS microanalysis for a wide range of materials characterization applications. As generations of SDDs progress, it is increasingly useful to define direct parameters to measure all aspects of detector performance. No longer does a simple value of chip size, or raw input counts, completely define the detector's full merit. High input count rates and high throughput data are important; however, the best analysis is achieved when data are collected both at high resolution quality and high throughput rates. If spectral resolution is allowed to degrade, a high volume of data may still lead to uncertain results.

Comparison with Existing Solutions

With a well-defined approach to measuring detector performance, the full power of TEAM™ EDS Analysis System with Octane SDDs stands ahead of the competition. The traditional use of detector size as a performance gauge only provides a simple snapshot of raw counts into the detector but does not characterize the number of counts that are captured as data points or the quality of the data. By looking at a parameter called resolution stability, both the throughput of the X-ray counts and the data quality can be assessed.

Throughput is the number of X-rays that are collected at the chip (input) and subsequently are processed by the pulse processor and stored as data. This stored count rate is the true measure of usable data in the form of spectra, qualitative and quantitative results, and map sets. High throughput, not just high input, captures the full merit of the analysis system, including not only the SDD chip, but also the electronics.

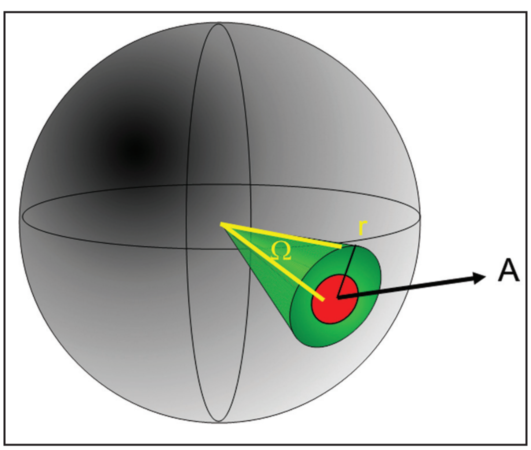

Figure 1. Intersection of the "sphere" where X-ray radiation occurs. Solid angle Ω, SDD chip area, A, and distance of chip to sample, r.

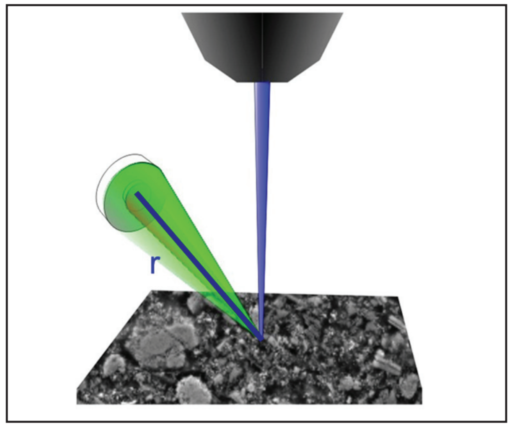

Figure 2 shows r= distance from sample to SDD chip. This is why solid angle, or input collection efficiency, is not directly proportional to the size of the SDD chip.

Input Count Rate:

The input count rate is determined by the solid angle of the detector. Solid angle is defined as:

Solid Angle = SDD area/(Distance from the sample)^2

$\Omega = A/r^2$, (See Figures 1 & 2)

Solid angle determines how many X-rays are captured by the SDD chip.

Throughput Count Rate:

Throughput is the number of these input counts that are stored in the system as usable data. Throughput is defined as:

Throughput (cps)

= Input Count Rate (cps) x (100% - Dead Time%)

Both input count rate and throughput are typically measured in counts per second (cps).

One useful metric that can be used to compare detector performance is throughput per unit of SDD chip area. In many applications, electronics design can help a detector with smaller area to outperform a detector with larger area.

Resolution stability is the second measure and often the most important performance parameter for a latest generation SDD system. It defines how well the detector's resolution is being maintained over a large range of collection rates. A starting value of high quality resolution is important, but it is equally as important to maintain that quality even as collection rate increases. If a quality resolution is only obtained at low throughput rates, then the full detector performance is being sacrificed. SDDs with high resolution stability will obtain premium quality data at both low and high collection rates and thus do not require compromises from the user.

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Resolution Stability

$$\text{Resolution Stability} = \frac{\text{Resolution Mn K}\alpha \text{ @ calibration}}{\text{Resolution Mn K}\alpha \text{ @ input count rate}}$$

Calibration at minimum count rate according to ISO15632:2012

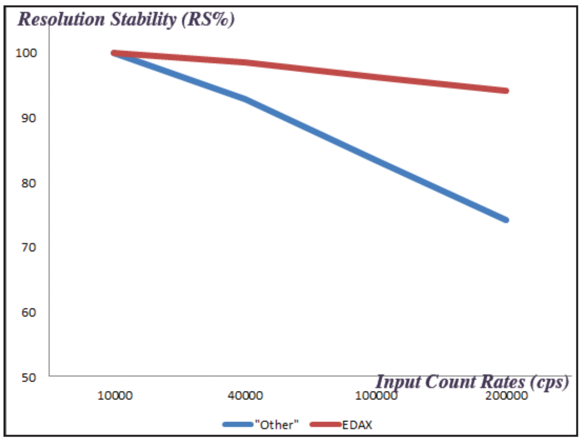

Figure 3. Octane Series SDDs are able to maintain their resolution performance at count rates up to 200 kcps, whereas competitive detectors may degrade significantly even at moderate count rates.

Overall, the ability to maintain high throughput for fast data acquisition while holding the resolution quality stable delivers the ultimate in SDD technology performance - see Figure 3, which shows the amount of performance loss for competitive SDDs. This provides the X-ray counts that matter – those that pass into the chip, through the electronics and are converted into high quality data in the forms of spectra, quantitative analysis and vivid live time X-ray maps with volumes of statistically confident data.

Microanalysis Results

Achieving the benefits of high speed collection and throughput for microanalysis can be realized in several different types of data acquisition. At its most basic, a high quality, low resolution spectrum will contain peaks that are separated, or resolved, from other peaks within the spectra. This is particularly challenging when the spectrum contains peaks that are overlapping or nearly overlapping. One of the most common spectral overlaps occurs with a lead (PbM) and sulfur (SK) overlap. While higher energy lead (PbL) lines can be used to determine the presence of lead, it is more challenging to determine if sulfur is present in addition. In a high quality spectrum at 121 eV, the separation of these peaks is discernible (Figure 4). Even when the resolution degrades to 141 eV (within 90% resolution stability of a 129 eV spectrum), the peaks are slightly more blended, but a characteristic shape is still observed (Figure 5). This is the performance that is obtained at resolution stabilities of the EDAX Octane series. However at the resolution quality of competitive SDDs, the peak shape is completely unresolved and the lead (PbM) peak is no long observed (Figure 6).

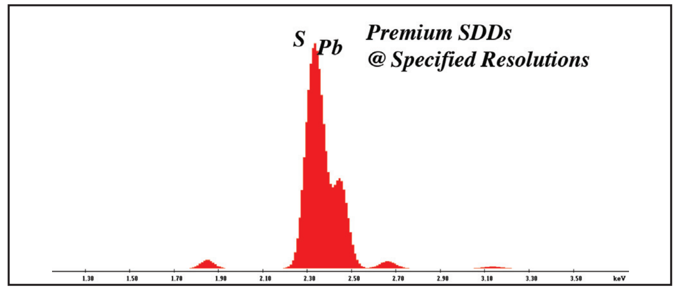

Figure 4. Octane at 121 eV.

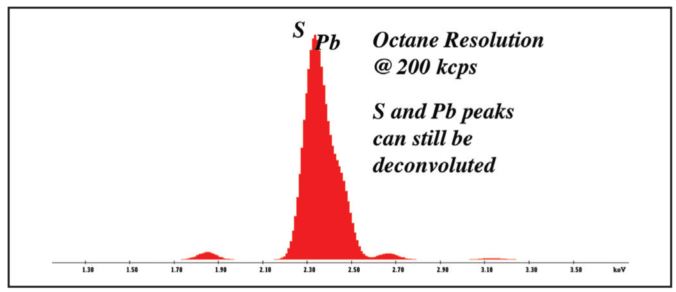

Figure 5. Octane at 141 eV.

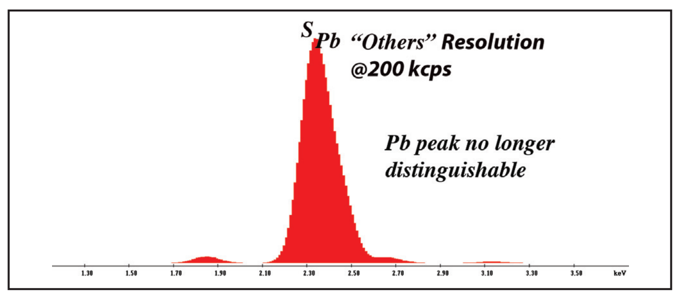

Figure 6. "Others" showing 165 eV.

Recommended EDAX Solution

The power and performance of the EDAX TEAM™ EDS Analysis System is strengthened with the addition of the Octane family of Silicon Drift Detectors. This entirely new line of SDDs processes high quality X-ray counts into data at ultra-fast speeds by use of new detector components including front end SDD chips through to electronics processing. The result is highest net throughput X-ray counts into spectral and mapping data while retaining high quality performance with no compromises.

Worldwide Events

Please visit www.edax.com for a complete list of our tradeshows

2013 Worldwide Training

To help our present and potential customers obtain the most from their equipment and to increase their expertise in EDS microanalysis, WDS microanalysis, EBSD/OIM™ , and Micro-XRF systems, we organize a number of Operator Courses at the EDAX facilities in North America; Tilburg, NL; Wiesbaden, Germany; Japan, and China.

Please visit www.edax.com/support/training/index.aspx for a complete list and additional information on our training courses.

EUROPE

EDS Microanalysis	
March14-15, 2013	Tilburg
February 18-20, 2013	Wiesbaden
TEAM™ EDS	
February 5-7, 2013	Tilburg
May 28-30, 2013	Tilburg
Genesis	
April 9-11 2013	Tilburg
March 11-13, 2013	Tilburg

EBSD	
March 11-13, 2013	Tilburg
February 20-22, 2013	Wiesbaden

EDS & EBSD (Pegasus)	
March 11-15, 2013	Tilburg
February 18-22, 2013	Wiesbaden

WDS	
March 26-27, 2013	Tilburg
April 16-17, 2013	Wiesbaden

Orbis: Course & Workshop Presented in German	
February 26-27, 2013	Wiesbaden

JAPAN

EDS Microanalysis	
Genesis	
February 14-15, 2013	Tokyo
April 11-12, 2013	Osaka
October 10-11, 2013	Tokyo
November 14-15, 2013	Osaka
TEAM™ EDS	
June 13-14, 2013	Tokyo
July 11-12, 2013	Osaka

EBSD	
February 2013	Tokyo

CHINA

EDS Microanalysis	
TEAM™ EDS	
March 19-21, 2013	ACES
May 8, 2013	Beijing

EBSD	
April 16-18, 2013	ACES

Particle Analysis	
June 4-6, 2013	

NORTH AMERICA

EDS Microanalysis	
TEAM™ EDS & Genesis	
February 5-7, 2013	Mahwah, NJ
TEAM™ EDS	
March 11-15, 2013	Mahwah, NJ
July 16-18, 2013	Draper, UT

EBSD	
August 20-22, 2013	Mahwah, NJ

EDS & EBSD (Pegasus)	
May 13-17, 2013	Mahwah, NJ

Micro-XRF	
April 9-11, 2013	Mahwah, NJ

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EMPLOYEE SPOTLIGHT

Felix Reinauer

Felix joined EDAX in 2006 with a part-time job translating the company's technical manuals into German. He began to work full time as a product specialist in the European applications group in 2007. He is located in the Wiesbaden office. Felix is responsible for supporting customer demos, hosting training courses, and testing software for EDS and EBSD products. Felix represents EDAX at workshops and conferences in Europe and has visited places including Germany, Switzerland, Austria, France, Bahrain, and Malaysia. He has also traveled to Oulu, Finland.

Felix wrote his doctoral thesis in the inorganic and analytical department at the University of Gießen. His topic was defect structures using X-ray diffraction methods combined with TEM investigations. After a little detour to the glass industry he went to the University of Bonn as a scientific worker in the analytical department. Felix was part of the group that works on the characterization of solid phases without translation symmetry, such as glass.

Felix was born in the Black Forest in the southwest of Germany. He now lives together with Karthin in Darmstadt near Frankfurt. His hobbies are volleyball, hiking, and reading. He enjoys cooking and enjoys time spent sharing the results with friends.

Laurie Krupa

Laurie joined EDAX in July 2007 as the Midwest Regional Sales Manager. Within her territory she is responsible for assisting both prospective customers and current tool owners with EDS, EBSD, WDS, and micro-XRF systems. She also represents EDAX at trade shows and local microscopy society events, occasionally serving as a guest speaker. Laurie believes the best part of her job is the opportunity it gives her to learn about the wide range of her customers' applications and helping them advance their microanalytical capabilities.

Laurie completed her bachelor's studies in Chemistry and Physiology and her Master's Degree in Forensic Science at Michigan State University. While in school, she interned with a state forensic laboratory in the toxicology and trace evidence units and with a federal laboratory in an arson and explosives section. Laurie was later employed as a forensic chemist at the lab. Her responsibilities included analyzing evidence, assisting in crime scene processing, and serving as a training instructor. It was in this role that Laurie was introduced to EDAX, working with the micro X-ray fluorescence (XRF) and energy dispersive spectroscopy (EDS) systems. She first visited our Mahwah headquarters as a student in the EDS training school and enjoyed interacting with sales, service, and applications as a customer.

Laurie was born in Detroit, Michigan and after two moves to two different states, remains a loyal Detroit sports fan. She currently resides in Chicago, where she enjoys running along the shore of Lake Michigan, discovering new restaurants, and learning about Chicago history.

EDAX® Smart Insight

CUSTOMER NEWS

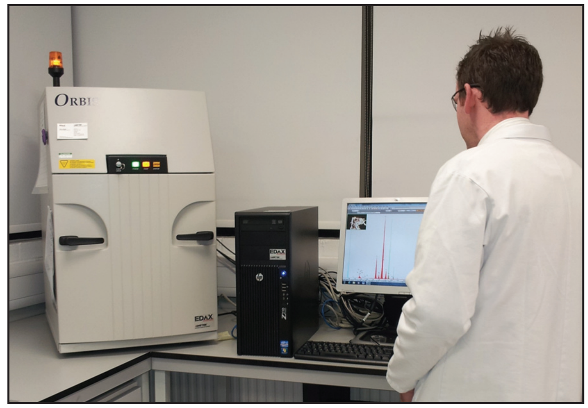
Reading Scientific Services Ltd (RSSL) Reading, UK

RSSL is a well-established global leader at the forefront of scientific analysis, consultancy, product development, and training. The company serves the food, drink, pharmaceutical, healthcare, biopharmaceutical, and consumer goods industries. A major expansion in its microscopy laboratory has been accompanied by investment in new analytical equipment, with an EDAX Orbis Micro-XRF Analyzer purchased in June 2012 to replace the 10 year-old EDAX Eagle system. The microscopy laboratory also has an EDAX TEAM™ EDS Analysis System equipped with an Apollo silicon drift detector fitted to a JSM 6480-LV scanning electron microscope.

RSSL operates contract analysis services, with investigative analysis being one of the key services provided by the microscopy laboratory. This is also utilised in RSSL's Emergency Response Service, which operates 24/7, 365 days a year for the rapid resolution of product emergencies such as serious customer complaints, manufacturing issues, and product tamper. The Orbis Micro-XRF Analyzer is an integral part of the multi-disciplinary analytical approach provided by the laboratory to deal with issues such as foreign material and contamination identification, including metal and glass identification and polymer and plastic investigation. Accurate determination of the chemical composition of any foreign material or contamination is critical in determining its original source.

All sixteen of the laboratory's scientists and technicians are trained to use the Orbis system. "We had a seamless transition to the Orbis system when it was installed, as it is easy to use and has a similar operating platform to the Eagle system it replaced, so everyone was familiar with it. The fact that everyone can use the Orbis system is crucial as the laboratory is required to process samples very quickly – especially when they come through the Emergency Response Service," says Tom Ray, Laboratory Manager.

The Orbis system contributes to many of the investigations carried out by the microscopy laboratory. Used in conjunction with the TEAM™ EDS Analysis System, a wide range of metals can be determined. Analysis can identify shards of swarf from production equipment and nuts, bolts, and wires dropped during routine maintenance which frequently arise as foreign bodies.



EDAX Orbis Micro-XRF Analyzer system

The laboratory has developed and established a rapid, routine procedure for investigating and identifying potential glass fragments. The Orbis system can help identify the type of glass, for example, domestic, container, window, lighting, lead crystal, heat resistant, and laboratory glass from a database including in excess of 800 different types of glass.

Polymers and plastics are a growing source of customer complaints because of their increased use in a wide range of applications. Fourier Transform-Infrared Spectroscopy is the principle technique RSSL uses to analyze a wide variety of plastic contaminants. The Orbis system is used as a complementary tool for element identification in polymer filler material, which can frequently be used to pinpoint the origin of the sample.

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