OLYMPUS
Your Vision, Our Future

Issue 9

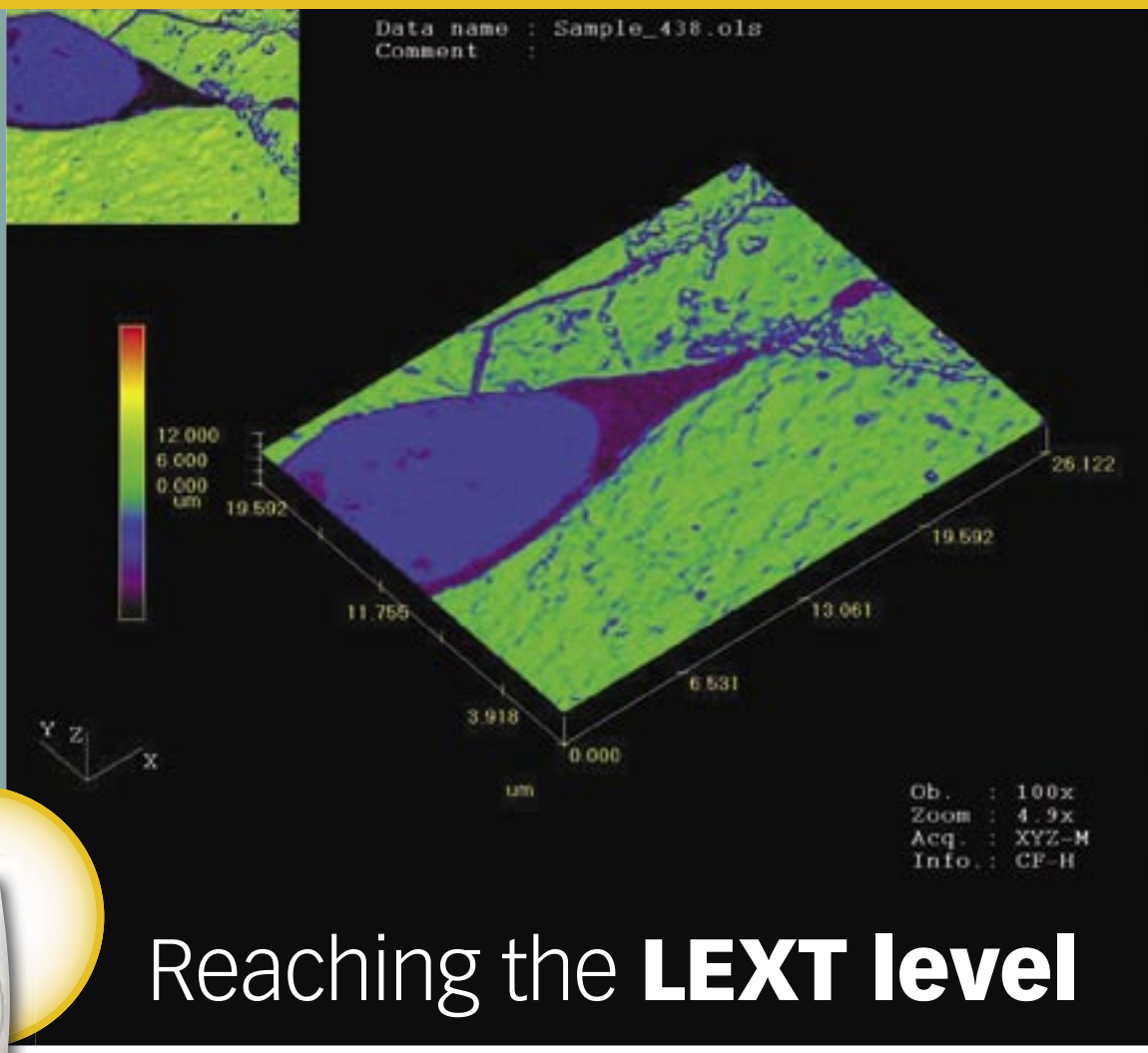
ILLUMIN8

The newsletter for microscope users

Welcome

This issue of Illumin8 focuses on industrial microscopy. For future issues we would like to know what you want to read about. Moreover if you are doing any interesting research, or have a great microscopy tip, then send an email to microscopy@olympus.uk.com or fill in the reply paid card. You can also use these to request your own copy of 'Illumin8' as well as the handy leaflet and poster series available. We hope you enjoy this issue and don't miss our competition to win an Olympus μ [mju:] 1000 digital camera.

IN THIS ISSUE



Reaching the **LEXT level**

Manganese sulphide particulate in a steel sample

Traditionally, undergraduate courses give students an excellent grounding in the basics of a broad subject area. Very rarely within the university setting though, do the students have any contact with the advanced equipment and instrumentation that is actually used at the cutting edge of their chosen subject. At the University of Plymouth however, the School of Engineering within the Faculty of Technology has recently purchased an Olympus LEXT confocal laser scanning microscope, which is specifically designed for advanced metrology and materials research.

The Plymouth Solution

Terry Richards, Materials Engineering Officer said, "The students on our engineering degree courses can choose a module on Materials Characterisation, which takes them through microstructure, fracture, surface and failure analysis as well as faults and inclusions etc. During this module they use microscopes to look at items more closely for the tell-tale signs of stress and fatigue, as well as to identify typical attributes of the most common engineering materials." Terry continued, "We took this teaching one step closer to what the students will be expected to do in the workplace, by investing in a microscope capable of higher resolution and better magnification than our present light microscopes - the LEXT metrology microscope. Importantly, the LEXT gives us a large number of analytical features such as surface roughness, volume, area and length and we are looking at adding further protocols." It is not just the engineering students that have seen the benefit of the system though, with one biological sciences student looking at shell growth in sea-based organisms.

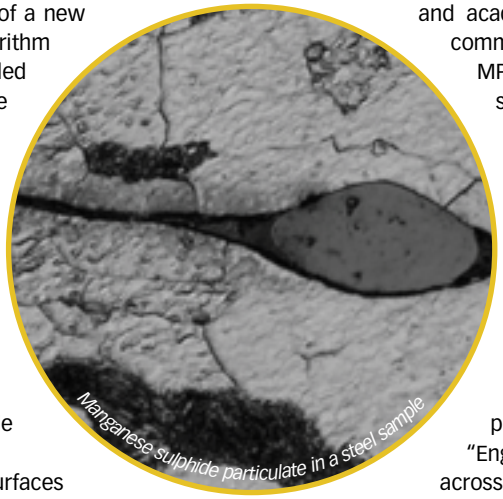
Why LEXT?

Before the LEXT was available, the students would use light microscopes (such as Olympus's BX range) and then spend some time on a scanning electron microscope, housed in a different school, to look

more closely at the objects. With the LEXT though, many of the functions only previously available on the SEM can be carried out in parallel to the standard microscopy, since the LEXT is designed to combine this with confocal laser scanning microscopy. This gives the LEXT a magnification range of 120x-14,400x. Moreover, there is little or no sample preparation required to view an object using the LEXT, since the stage has been specially designed to hold samples up to 10kg in weight and 100mm in height which therefore do not need to be cut up into small pieces or coated with a conductive surface.

Technically speaking

Standard laser confocal systems can achieve resolutions of about 200nm, but the technological advances in the LEXT allow it to reach as low as 120nm in the x/y direction. Moreover, resolution on the Z-axis is 10nm, due to the use of a new mathematical algorithm and the finely controlled movement of the nosepiece rather than the object stage. In addition, the LEXT uses a 408nm laser-diode with newly designed and calibrated optical components, which have excellent transmission across the entire visible spectrum.



Manganese sulphide particulate in a steel sample

With the majority of surfaces analysed for features with variations in height, special techniques need to be employed at high magnifications since there is very little depth of focus. The LEXT's confocal optics ensure that by using optical slices consisting only of in-focus pixels and by simply combining a stack of slices (Z-stack) into one image, a perfect 2D representation of the entire feature is formed. For many of the analyses carried out using LEXT though, it is important to see the object in 3D detail and therefore these same optical slices can easily be arranged into a highly accurate 3D image. Most confocal microscopes carry out these processes post-capture and therefore there is a delay between taking the images and seeing the result. Once the top and bottom of the stack has been set the LEXT does not have this delay since it uses a specialised MEMS-based scanning unit and advanced software providing real-time observation.

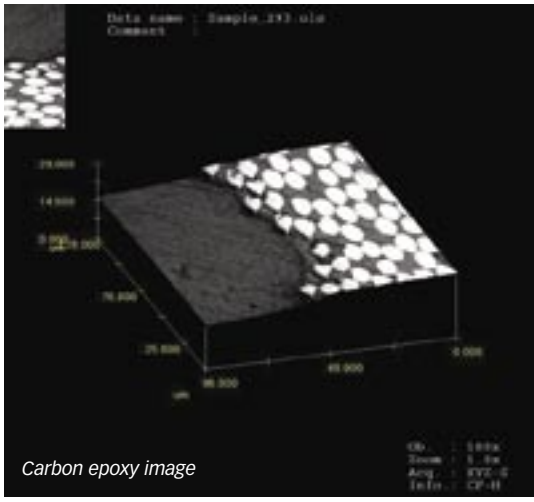
Investment dividend

The LEXT makes a perfect teaching tool since in the design, Olympus departed from the standard eyepiece setup, instead choosing to use a high resolution monitor to display the raw images as well as the overlays and analyses. This means that a number of students can watch and learn from a single instrument using the same samples.

The LEXT's heritage ensures that it also plays an important role in advanced degrees and academic research. Terry commented, "A number of MPhil and PhD project students use the LEXT on a regular basis, along with full-time research staff." The Faculty has also found that the LEXT is lauded by local engineering firms who contract time on the microscope and sponsor research projects, Terry said, "Engineering firms from across the region are using the LEXT, including high technology industries such as automotive and aerospace as well as those working with core materials such as steel and plastic."

Conclusion

The Olympus LEXT has provided students, researchers and engineering firms in Plymouth and the surrounding region, with an excellent metrology and materials analysis system. Professor Neil James, Dean of the Faculty of Technology commented, "The LEXT confocal laser scanning microscope has enabled a variety of metrology and surface characterisation and mapping work to be performed that would otherwise not have been possible, with resolutions lying between Talysurf and scanning electron microscope ranges. We are very pleased with the instrument and with its increasing application in undergraduate projects and Knowledge Transfer Partnerships."



Carbon epoxy image

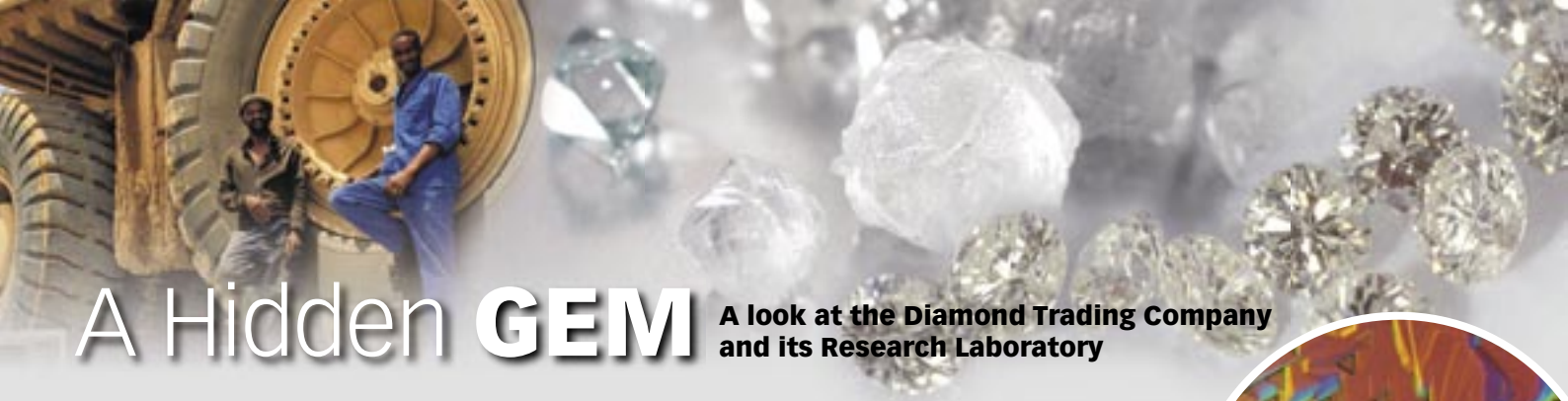
To find out more about the Olympus LEXT, please fill in the reply paid card or email **microscopy@olympus.uk.com**

University of Plymouth students using the Olympus LEXT

IPOT 2007 Stand D116

Olympus is exhibiting (Stand D116) at the IPOT (Imaging, Photonics and Optical Technology) exhibition at Birmingham's NEC from 14th-15th February 2007. On the stand will be the LEXT and the new SZX2 advanced stereo microscopes. This exhibition will also be the first UK show at which the novel Olympus DiscoveRING stand concept will be used, which, with its careful design will enhance each attendee's visit. Olympus personnel will be available for the entire two days to answer all your questions.

IPOT is co-located with the Machine Vision and Display Technology exhibitions, offering excellent value for attendees.



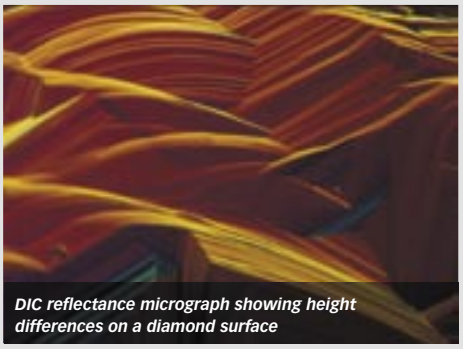
A Hidden GEM

A look at the Diamond Trading Company and its Research Laboratory

World leaders

The Diamond Trading Company (DTC) has a long and fascinating heritage. It was established in 1934 as the rough diamond sales arm of the De Beers group of companies. The DTC is the world's leading supplier of natural diamonds, guaranteeing the integrity of each one they supply for both gemmological and industrial uses. Moreover, they have developed principles designed to promote consumer confidence in natural diamonds.

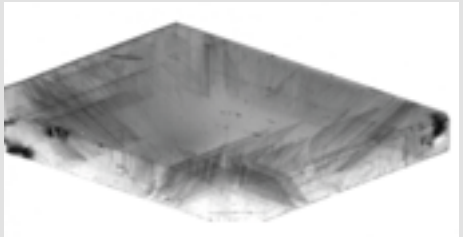
The DTC's clients are amongst the world's leading diamantaires, earning their status on the basis of their diamond and marketing expertise, and are known throughout the world as 'Sightholders'. The DTC constantly creates new ideas and designs that capture and express the deepest of emotions - in keeping with the "A Diamond is Forever" promise. To achieve this, the people of the DTC are passionate about preserving the integrity of a diamond through its journey: from the moment it leaves the earth to the point at which becomes a unique and prized piece of jewellery



DIC reflectance micrograph showing height differences on a diamond surface

Africa's Heartbeat

As a world-leader, the DTC is also a trend-setter and was fundamental in the establishment of the Kimberley Process Certification System - a UN-backed system that has virtually eliminated the trade in 'conflict diamonds' – diamonds traded to fund wars. Further to this, the DTC ensure that their mining and trading practices provide the maximum benefit for the countries where their diamonds are sourced: Nowhere is this more evident than in Africa. In fact, diamonds are driving economic growth and prosperity such that, as a direct result of the diamond industry, an estimated 5 million people have access to appropriate healthcare globally. Moreover, the revenue from diamonds is instrumental in the fight against the HIV/AIDS pandemic.



Micrograph of an x-ray topograph showing stacking faults and dislocations in a synthetic diamond

A Jewel in the Crown

For 25 years, the DTC Research Centre in Maidenhead, UK has been central to the development of the De Beers Group's expertise in gem diamond technologies. It is able to respond at short notice to any technical challenge associated with gem diamonds. Employing around 90 specialist scientists, engineers and support staff, the DTC Research Centre is also part of a network of key strategic laboratories within the De Beers Group working closely with other Group laboratories in Southern Africa, consultants and diamond research departments in universities world-wide.

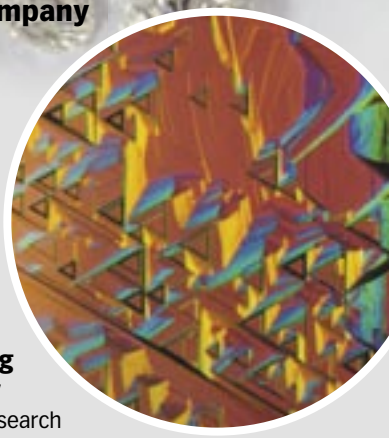
Automatic Weighing and Sorting

The DTC Research Centre has developed unparalleled experience in the design and manufacture of equipment for sorting and weighing diamonds. These machines, combined with the judgement of hundreds of highly skilled staff at the company's sorting operations in London and Southern Africa, sort and value the rough diamonds produced from the De Beers group mines into more than 14,000 categories of weight, shape, quality and colour, providing a consistent assortment to meet the needs of its clients - the Sightholders.

Consumer Confidence

It is essential that consumers have trust and confidence in the 'diamond-buying' experience. Anything that may affect confidence in a negative way could be damaging to both the De Beers group and the diamond industry as a whole. The main aim of the DTC's consumer confidence programme is to maintain and enhance consumer confidence in the mystique and integrity of diamond. At the DTC research centre, the technical research into synthetic diamond material, treated diamonds and simulants aid in providing the detection methods to differentiate these products from natural diamond.

From this fundamental research, development of detection equipment has also evolved and the DiamondSure™ and DiamondView™ instruments are now used daily in gemmological laboratories worldwide.



DIC reflectance micrograph showing triangular growth features ('trigons') on a rough diamond surface

Marking Technology

The DTC Research Centre also developed the groundbreaking technology behind the DTC Forevermark. This trustmark is inscribed on the table facet of a polished diamond to a depth of less than 50nm and incorporates a unique serial number. The Forevermark is currently available in Hong Kong, Japan and China, and launches are planned for 2007 in India, Italy and the Gulf.

Microscopic accuracy

In all these activities, optical microscopy of diamond plays a key role in the research underpinning the DTC Research Centre's expertise. The laboratory has an Olympus BX60 microscope equipped for reflected and transmitted illumination. A full range of techniques including Differential Interference Contrast are employed.

They also use the Olympus BX system as the basis for developing specialist OEM instrumentation. James Smith, senior scientist for the DTC Research Centre said, "The modular nature of the Olympus BX system has proved a flexible and cost effective platform for rapid development in a number of project areas."

Conclusion

Microscopes play an important role in the smooth running of one of the worlds most important industries. An industry that not only delivers the finest gems in the world, but also provides hope for many developing countries.

DIC reflectance micrograph of the DTC forevermark

Top image: 240 ton mining truck, Jwaneng mine, Botswana; Rough diamond crystals showing various shapes/morphology; A parcel of round-brilliant cut polished diamonds
All images Courtesy of the Diamond Trading Company

Try **Olympus**

Olympus is firmly established as one of the worlds leading optical companies, but they also offer so much more. Did you know that as well as the consumer products such as cameras and binoculars, and the microscope products such as the LEXT and SZX2 microscope series, Olympus also offers the world's most advanced endoscope and high speed camera investigation products as well as a large range of non-destructive testing instruments?

Olympus Industrial microscopes:
www.olympus.co.uk/microscopy/26.htm
Olympus Industrial endoscopes:
www.olympus-europa.com/industrial/
Olympus Non-destructive testing:
www.olympusndt.com/en/
For more information about any Olympus products, please fill in the reply paid card or email **microscopy@olympus.uk.com**

Competition time: Another chance to win an **Olympus µ [mju:]** 1000 digital camera

The new Olympus µ [mju:] 1000 digital camera pushes the very boundaries of technical achievement, without skimping on the style. It features a weatherproof metal body, beneath which lays a ten million pixel CCD and a 3x zoom lens, which together deliver razor-sharp results. Suited to low light photography, its light sensitivity can be boosted to an amazing 6400 ISO. To be in with a chance of winning one, you will need to answer the three questions below correctly on the reply paid card and return it to us by the 1st March 2007.

Question 1:
The DTC is an arm of which well known company?

Question 2:
Which Olympus Microscope provides advanced metrology analysis?

Question 3:
What is the name for the new Olympus exhibition stand concept?

Congratulations to Richard Han at the University of Edinburgh, Hospital for Small Animals, for winning the Olympus µ [mju:] 1000 digital camera from the last issue of Illumin8.

Tech perspective:

10 facts about **Diamonds**

Diamonds, whichever way you look at them, are unique. Here are ten of the many facts about diamonds that you may or may not have already known.

- Diamond is the hardest known substance on earth
- Diamond is the simplest of all gems in chemical terms; it is composed entirely of carbon
- The word "diamond" comes from the Greek word "adamas," meaning "unconquerable"
- Each diamond is unique, because each stone's complex internal characteristics cannot be duplicated
- The Republic of Botswana is the largest exporter of gemstone diamonds in the world
- Only 20% of all rough diamonds are suitable for gem cutting
- Most of the diamonds used in fine jewellery today are between 900 million and 3.3 billion years old
- The word "carat" for the measurement of a diamond's weight is derived from the carob seeds that were used to balance scales in ancient times
- Not all diamonds are white. Coloured diamonds, known as "fancies", are valued for their depth of colour, just as a white diamond is valued for its colourlessness
- The Cullinan Diamond, part of the British crown jewels, was the largest gem-quality rough diamond ever found (1905), at 3,106.75 carats

'Trilogy' Three stone diamond ring, Courtesy of the Diamond Trading Company

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To request further information:

Olympus UK Ltd
Microscopy Division
Dean Way
Great Western Industrial Park
Southall
Middlesex
UB2 4SB

Phone: 020 7250 0179
Fax: 020 7250 4677

Email: microscopy@olympus.uk.com
Web: www.olympus.co.uk

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My answers to the competition are:

(1) _____

(2) _____

(3) _____

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☐ Focus lock ☐ Koehler Illumination

☐ Phase Contrast ☐ Cleaning & Maintenance

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Olympus UK Ltd
Microscopy Division
Dean Way
Great Western Industrial Park
Southall
Middlesex
UB2 4BR

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Dean Way
Great Western Industrial Park
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